



Health & Safety Executive  
HM Nuclear Installations Inspectorate

# **UKAEA's strategy for the decommissioning of its nuclear licensed sites**

A review by HM Nuclear Installations Inspectorate

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## Foreword

This report sets out the findings of a review by the Health and Safety Executive's Nuclear Installations Inspectorate (NII), in consultation with the environment agencies, of the technical and some financial aspects of the decommissioning strategies for the nuclear sites operated by the United Kingdom Atomic Energy Authority (UKAEA). It has been undertaken in accordance with the Government White Paper, "Review of Radioactive Waste Management Policy: Final Conclusions" (Cm 2919) published in 1995. UKAEA's Decommissioning Strategy that was submitted to the NII for the quinquennial review can be seen at UKAEA's web site: <http://www.ukaea.org.uk/reports/dstrategy.htm>.

This report is focussed on the four sites for which UKAEA holds the nuclear site licence. These sites are Dounreay in Caithness, Windscale in Cumbria, Harwell in Oxfordshire and Winfrith in Dorset. UKAEA also has a site at Culham in Oxfordshire, at which it manages the UK fusion research programme and the operation of the Joint European Torus (JET) for Euratom. Although Culham is not a nuclear licensed site, there are interactions between the Culham and Harwell strategies that have been taken into account in the review.

The review compares UKAEA's strategy with national and international guidance, considers the underlying assumptions made and whether the plans are comprehensive and appropriate. The UKAEA's internal mechanisms to quantify the tasks and the necessary liability provisions are reviewed.

Our overall conclusion is that, based on current knowledge, the strategies proposed by UKAEA for the decommissioning and remediation of its highly diverse sites are generally appropriate. However, we shall review the situation again in five years time to ensure that UKAEA's strategies remain appropriate should new information change current assumptions. UKAEA has an objective of continuing improvement of the safety of its facilities, and we will continue to work with UKAEA as part of our routine regulatory work to ensure the improvement programme is delivered.

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# 1 INTRODUCTION

1 The White Paper (Cm 2919) (Ref 1) on radioactive waste management policy states in paragraph 124 that: “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 the 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 (in 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 cost of decommissioning nuclear facilities and concludes that segregated funds should be established for those parts of the industry that are privatised. In the case of UKAEA, the work that created the liabilities was mostly carried out for the Government, therefore the Government has agreed in principle to meet the cost of UKAEA’s liabilities (except for a small fraction which is attributable to other customers). Although the financial provision for state owned industry is not currently contained in segregated funds, NII expects state owned industry to describe the corresponding funding arrangements in their quinquennial review submission (Ref 2).

4 Licensees’ plans for decommissioning are subject to regular revision as knowledge and circumstances develop. Each licensee’s arrangements for decommissioning are reviewed once every five years and each review considers the technical adequacy of these plans as well as the costs associated with their implementation.

5 This report presents the outcome of NII’s quinquennial review of the decommissioning strategies of the United Kingdom Atomic Energy Authority (UKAEA) as described in documentation submitted to NII in September 2001 (Ref 3). It addresses all of UKAEA’s nuclear liabilities on its nuclear licensed sites, and also takes account of UKAEA’s nuclear liabilities on other licensees’ sites. This is consistent with the White Paper’s intention that the quinquennial review should be comprehensive.

6 The report is structured as follows:

- Section 2 provides background information to the review with a summary of the decommissioning strategy for each site;

- Section 3 provides the technical review in which general findings are presented followed by detailed findings for each site;
- Section 4 addresses financial aspects;
- Section 5 presents the overall conclusions.

## **2 BACKGROUND INFORMATION**

### **2.1 Work required of HSE**

7 The White Paper on radioactive waste management policy identifies two specific aspects of decommissioning for independent review. These are the 'strategy' (ie the overall approach and programme) for the work and 'provisioning' (ie the funding). HSE was given the task of reviewing the decommissioning strategies of each nuclear operator on a five-year cycle which, by inference, includes the arrangements for funding.

8 This review has been undertaken in consultation with the environment agencies. Although Cm 2919 does not specifically require publication of the outcome of quinquennial reviews such as this one, the document clearly envisaged that the findings would be reported.

9 The breadth, extent and detail of the review process are not specified in the White Paper. NII has interpreted this task in the manner described in the internal guidance for inspectors, which has been published on the HSE/NSD web site (Ref 2). This review has considered whether UKAEA's decommissioning strategy is:

- appropriate;
- plausible, realistic, technically practicable and appropriately timed;
- comprehensive; and
- appropriately costed.

10 NII has also considered whether appropriate arrangements are in place for funding, and whether appropriate review and revision procedures are in place.

11 NII has interpreted "decommissioning" as being "the set of actions taken at the end of a nuclear facility's operational life to take it permanently out of service with adequate regard for the health and safety of workers and the public and the protection of the environment. The ultimate aim of decommissioning is to make the site available for other purposes" (Ref 2). This review has therefore considered UKAEA's strategies for the decommissioning of its redundant nuclear facilities, the management of nuclear fuels and radioactive wastes, and the restoration of contaminated ground.

## 2.2 Legislative background

12 The main legislation governing the safety of nuclear installations in the UK is the Health and Safety at Work etc Act 1974 (HSWA 74) (Ref 4) and the associated relevant statutory provisions of the Nuclear Installations Act 1965 (as amended) (Ref 5). Under the Nuclear Installations Act (NIA 65), 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 NIA 65 and HSWA 74 on nuclear sites.

13 NIA 65 provides HSE with powers to attach conditions to the licence in respect of safety and in respect to the management of nuclear matter, which includes radioactive waste. HSWA 74 provides the regulatory powers to enforce these conditions. The standard licence conditions are reproduced in Ref 6. An additional licence condition introduced in 1999 addresses the control of a licensee's organisational change related to the management of safety.

14 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 HSWA 74 and hence has certain restrictions on disclosure.

15 In order for HSE to carry out the review required by Cm 2919, more detailed information to that contained in UKAEA's submission (Ref 3) was required. A suite of supporting information was made available at UKAEA's offices at Risley in Cheshire and, where necessary, this was supplemented with further data obtained from the UKAEA sites.

16 The routine regulation of licensees' decommissioning work by the NII relates generally to individual plants and 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 licensee by the conditions attached by the nuclear site licence. NII's expectation is that these arrangements would include:

- for any new plant, the preparation of an outline decommissioning plan which shows that the design of the plant will facilitate its safe decommissioning and dismantling;
- minimising the generation of waste and contamination of plant during the active commissioning, operational and decommissioning phases of the plant;

- plant operations to take due account of the need to decommission and to make and retain adequate plant records;
- prior to the end of the operational phase of the plant, the preparation of detailed decommissioning plans; and
- the undertaking of decommissioning work in accordance with an adequate safety case. If NII so specifies, consent is required before decommissioning work can be started.

17 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 (Ref 7). The management of nuclear matter (including radioactive waste) on nuclear licensed sites is regulated by the NII. Formal administrative arrangements (Refs 8 and 9) ensure that the NII and the environment agencies work closely together to ensure compliance with requirements.

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

- first, to consider the adequacy of the long term plans for the eventual removal of all the nuclear facilities from each licensed site;
- second, to consider whether UKAEA's liabilities on other licensees sites have been taken into account in the Liabilities Estimate; and
- third, to consider the arrangements for funding UKAEA's liabilities so that the work may proceed.

19 The Nuclear Installations Act 1965 places significant obligations and responsibilities on the licensee. Under current legislation, the licensee's period of responsibility does not end until the HSE is able to declare that there is no danger from ionising radiations from anything on the licensed site (Sections 3(6) and 5(3) of NIA 65). It is assumed that the licensee will ultimately wish to be relieved of these responsibilities after the useful life of the nuclear installation has ended and will plan the decommissioning of individual sites to achieve this.

20 The Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999 (EIADR 99) (Ref 10) require an Environmental Impact Assessment (EIA) to be carried out by the licensee before NII considers granting consent for a dismantling or decommissioning project for a nuclear reactor or nuclear power station to commence. NII must ensure that an adequate EIA is carried out. This it does by consulting relevant bodies and the public on an Environmental Statement provided by the licensee. It then takes the results of such consultation into account when considering consent. NII may attach conditions to any consent to start the decommissioning project as may appear desirable in the interests of limiting the impact of a project on the environment. A consent to decommission under these regulations does not imply that the requirements of other legislation have been satisfied. Decommissioning projects which were in progress when the regulations came into effect do not need an EIA to be provided, unless

there are changes or extensions to the projects which may have significant adverse environmental effects. NII is preparing guidance on the implementation of these Regulations.

## **2.3 Regulatory guidance**

21 NII has produced internal guidance for inspectors entitled “Decommissioning on Nuclear Licensed Sites” (Ref 2). The objectives of the guidance are to draw together those aspects of legislation, Government policy and international standards which are relevant to the work of NII in regulating decommissioning, and to provide a framework for the inspection and assessment of decommissioning on a consistent basis.

22 NII has four fundamental expectations for decommissioning, which should be met so far as is reasonably practicable. These expectations, which are consistent with current Government policy, are as follows:

- in general decommissioning should be carried out as soon as is reasonably practicable, taking account of all relevant factors;
- hazards associated with the plant or site should be reduced in a progressive and systematic manner;
- full use should be made of existing routes for the disposal of radioactive waste; and
- the remaining radioactive material and radioactive waste should be put into a passively safe state for interim storage pending future disposal or other long term solution.

23 NII has also produced internal guidance for inspectors entitled “Management of Radioactive Materials and Radioactive Waste on Nuclear Licensed Sites” (Ref 11) which complements the guidance on decommissioning.

24 NII has two additional fundamental expectations concerning the management of radioactive materials and radioactive waste on nuclear licensed sites, which should also be met so far as is reasonably practicable. These are:

- the production of radioactive waste should be avoided. Where radioactive waste is unavoidable, its production should be minimised;
- radioactive material and radioactive waste should be managed safely throughout its life cycle in a manner that is consistent with modern standards.

25 The HSE/NSD web site (Ref 12) has a more detailed discussion of these fundamental expectations and other topics. This review of UKAEA’s strategies has been undertaken in accordance with the NII guidance.

## 2.4 UKAEA sites

26 This report outlines the quinquennial review of the four sites for which UKAEA holds the nuclear site licence. These sites are Dounreay in Caithness, Windscale in Cumbria, Harwell in Oxfordshire and Winfrith in Dorset. UKAEA also has a site at Culham in Oxfordshire, at which it manages the UK fusion research programme and the operation of the Joint European Torus (JET) for Euratom. Although Culham is not a nuclear licensed site, there are interactions between the Culham and Harwell strategies which have been taken into account in the review.

27 UKAEA was established in 1954 to manage the development of both the UK's nuclear weapons and nuclear power programme, and its operations have left a legacy of nuclear liabilities across the four licensed sites. (The management of the nuclear weapons programme was transferred to the Ministry of Defence in 1973.) The range of UKAEA's past research and development operations means that there is a wide diversity of liabilities across its sites. These include numerous unique redundant nuclear facilities and nuclear matter in a variety of forms including fuels and radioactive wastes. Across the UKAEA sites, fuels are variously referred to as nuclear material, fuel material and nuclear fuel. At the present time, these fuels have not been declared as waste but this may change as the strategies develop.

28 Nearly all of these materials exist in a raw (unconditioned) form and they need to be retrieved from their present locations and treated so that they are in a state of passive safety. The technical challenges posed by these operations vary significantly depending on the facility concerned. The work ranges from relatively small-scale tasks using established techniques, to large-scale waste retrieval and decommissioning projects for which unique solutions will need to be developed.

29 The previous operations on the four licensed sites, and the nature of the legacies on each site, are described in more detail in the following paragraphs. UKAEA's Dounreay Division manages the Dounreay site in Scotland, whereas the Southern Division manages the sites at Harwell, Windscale and Winfrith in England.

### ***Dounreay***

30 Dounreay was the main UK centre for fast reactor development and houses the Prototype Fast Reactor, the Dounreay Fast Reactor and the Materials Test Reactor which are all at various stages of decommissioning. The site also fabricated and reprocessed fuels, and this is one of the main differences between Dounreay and the Southern Sites. There are significant quantities of different types of fuels and radioactive wastes on the site, and numerous facilities (such as reprocessing plants, waste stores, laboratories etc) which will need to be decommissioned, many of which are already shutdown. The Ministry of Defence (MoD) operates the Naval Reactor Test Establishment (VULCAN) on a leased part of the Dounreay site. MoD plans to operate this site for about 20 years in support of the nuclear submarine programme, after which the site will be decommissioned by MoD before handing back to UKAEA.

31 The decommissioning of the Dounreay site requires the construction of a significant number of new facilities to treat fuel and radioactive wastes. The scale of

the forward construction programme is another factor which distinguishes this site from the other UKAEA sites.

### ***Harwell***

32 Harwell was a research centre and housed a number of experimental and materials testing reactors and associated facilities, some of which have already been decommissioned. The reactors which remain are the two materials test reactors (DIDO and PLUTO) and the pile reactors (BEPO and GLEEP), all of which have undergone some decommissioning and are now in care and maintenance.

33 Other significant facilities on the Harwell site include research and development laboratories and post irradiation and examination facilities (which are still in operation), three operational accelerators (Tandem and Helios 1 and 2) and various facilities for the treatment and storage of waste. There are a variety of radioactive wastes stored at Harwell (mainly in the solid form) and some fuel, though in smaller quantities compared to Dounreay.

### ***Winfrith***

34 Winfrith was a site for reactor development and contains the redundant DRAGON, SGHWR and ZEBRA reactors all of which have undergone various amounts of decommissioning and which are now in care and maintenance. The site also contains a number of other facilities, most of which are redundant and which have also undergone some decommissioning. There are comparatively small quantities of radioactive waste and fuel on the Winfrith site. Some of this is planned to be transferred to Harwell in the next few years where it will be managed along with other similar materials.

### ***Windscale***

35 Windscale was a site for research and development into different types of fuel and housed two plutonium production reactors (Piles 1 & 2). The major facilities on the site are the two Piles and the Windscale Advanced Gas Cooled Reactor (WAGR). Pile 1 and WAGR are under decommissioning and Pile 2 is in care and maintenance. The other major plants on the site are post irradiation examination facilities, two of which are still operational. Windscale is an enclave within BNFL's Sellafield site and is leased from BNFL until 2070.

## **2.5 Financial liabilities and funding**

36 UKAEA has undergone several organisational changes since it was established in 1954. Parts of its original functions have been transferred to independent organisations in both the public and private sectors. The most significant restructuring in recent years took place in 1995 and 1996 when the facilities management and commercial functions were transferred respectively to separate bodies leaving the remaining organisation to concentrate on liabilities management. UKAEA's basic mission now is the restoration of its sites (although it does retain responsibility for fusion research at Culham). It is now classed as a Non-Departmental Public Body reporting to the Secretary of State for Trade and Industry. UKAEA is the owner of the sites and the liabilities.

37 UKAEA also has financial responsibility for some of the liabilities at BNFL sites. This is a result of former activities carried out by UKAEA or in support of it. The strategies for the management of these liabilities are not addressed in this report in any detail as they are covered by the strategies for the BNFL sites.

38 The Government, previous customers and tenants on the sites are the three main sources of UKAEA's funding. The work that created most of the liabilities was carried out for the Government, therefore the Government has agreed in principle to meet the cost of these liabilities. The main funding is provided by the Department of Trade and Industry (DTI) under the SAFER Programme Letter (SAFe Environmental Restoration). The funding also covers UKAEA's liabilities on BNFL sites.

39 The decommissioning of the two Windscale Piles is mostly funded by the Ministry of Defence (MoD). The small remaining liability on UKAEA sites not funded by DTI or MoD results from past work undertaken for external customers. This is met either through Letters of Comfort in which organisations agree to meet the cost as they occur, or through advance payments from customers.

40 UKAEA also receives income from tenants on its sites and from commercial arrangements. This helps to off-set costs for the fixed infrastructure, which would otherwise fall on decommissioning and waste management programmes.

41 UKAEA's nuclear liabilities were estimated in March 2001 at some £8.7 billion undiscounted. The 6% discounted value, which appears on the UKAEA Balance Sheet, is £3.3 billion, in 2000/1 money values and discounted to 31 March 2001.

42 UKAEA historic liabilities on BNFL sites amount to some £1.4 billion for work which will be implemented by BNFL. UKAEA's expected share of deep repository costs and other waste management activities off UKAEA sites amounts to a further £1.3 billion (all as of March 2001). The remaining £6.0 billion relates to spend on UKAEA-managed activities. The distribution of this £6.0 billion across the UKAEA sites is Dounreay (64%), Harwell (12%), Winfrith (11%), Windscale (10%), Culham (2%), with the remaining 1% for corporate activities.

## **2.6 Context of the review**

43 There have been several external developments since Cm 2919 (Ref 1) was issued in 1995 which have affected UKAEA's operations and liabilities, or have the potential to affect them in the future. Some of the most significant of these developments are discussed below.

### ***The Rock Characterisation Facility decision***

44 In 1997, the then Secretary of State for the Environment upheld Cumbria County Council's decision to refuse planning permission for an underground rock characterisation facility at Sellafield. Prior to that decision, it had been generally assumed in the nuclear industry that a future disposal facility for the category of radioactive waste termed 'Intermediate Level Waste' (ILW) would be operational around 2012. The decision effectively delayed the availability of a disposal facility and this initiated a review by NII of the storage of ILW in the UK which was published in 1998 (Ref 13).

45 One of the main conclusions of the NII review was that waste management strategies which defer the retrieval and conditioning of raw waste pending the early availability of a disposal facility may need to be reconsidered as they may no longer be tenable. UKAEA's assumptions concerning the availability of a long term management solution for ILW are discussed later in this report.

### ***Consultation Document "Managing Radioactive Wastes Safely"***

46 In September 2001, the UK Government and the Devolved Administrations published a consultation document entitled "Managing Radioactive Waste Safely" (Ref 14), the purpose of which was to launch a national debate leading to a decision on how to manage radioactive waste in the long term. The consultation document summarises the main options for the long term management of ILW and states that all options are being considered by the Government, except where they have been ruled out by international agreements or treaties. The document sets down a five stage programme of actions leading to a chosen option for radioactive waste management by 2006 followed up, if necessary, by legislation in 2007. Some of the issues raised by this consultation document are discussed later in this report in the context of UKAEA's strategies. The consultation period ended in March 2002.

### ***Liabilities Management Authority***

47 It is Government policy that the need for Executive Agencies and Non-Departmental Public Bodies (such as UKAEA) is reviewed at regular intervals. In line with this policy, the DTI has recently undertaken a quinquennial review of UKAEA. It must be stressed that this is a separate exercise to the HSE quinquennial review of UKAEA's decommissioning strategies which is the subject of this report. The objective of DTI's review was to conduct a forward-looking examination of the UKAEA to determine the best status and organisational options needed to meet Government objectives. The outcome of the review has been published on the DTI web site (Ref 15).

48 On 28 November 2001, Patricia Hewitt (the Secretary of State for Trade and Industry) announced the intention to establish a Liabilities Management Authority (LMA) to take on responsibility for strategic programming in relation to most of the public sector civil nuclear liabilities on behalf of the Government. This will include most of BNFL's liabilities and assets, as well as UKAEA's liabilities. The LMA will set the strategy for discharging the UK's civil nuclear liabilities, incentivise the arrangements and stimulate competition. The Government intends that the LMA will work in partnership with the site licensees, initially UKAEA and BNFL, and with the regulators.

49 These proposals for restructuring the nuclear industry will require primary legislation. The Government has stated its intention to bring forward a Bill for this purpose at the earliest opportunity and a White Paper was published (Ref 16) in July 2002 covering the Government's proposals.

50 HSE has been actively involved in discussions with DTI with regard to the regulators' requirements for the continuing regulation of LMA-funded site operators. Inter alia, these discussions have included arrangements for the development of

whole-of-life site remediation plans and the need for robust and transparent funding arrangements which can facilitate early and progressive reduction of hazards.

### ***NII/SEPA audit of Dounreay***

51 In June 1998, a team of inspectors from HSE and SEPA undertook an audit of safety management at Dounreay. The audit report was published in September of that year and made 143 recommendations (Ref 17). The general thrust of the audit report was that the decommissioning and waste management programmes needed to be speeded up.

52 One of the main findings was that UKAEA needed to develop a comprehensive strategy for dealing with existing and future radioactive wastes at Dounreay. The audit report also recommended that the radioactive waste management strategy should be integrated with the decommissioning strategy for the site as a whole. Recommendations were also made concerning the management strategies for dealing with individual waste streams and the decommissioning of specific facilities.

53 UKAEA responded to the main findings of the audit by producing the Dounreay Site Restoration Plan (DSRP) in which it proposed an accelerated decommissioning programme for the site. NII received the DSRP in October 2000 and it has been published on the UKAEA web site (Ref 18).

54 In January 2002, NII published the final report on UKAEA's response to the Dounreay audit (Ref 19), following the production of two interim progress reports. In the final report, NII views on the DSRP were presented and comments made, in particular, on the dates for those projects which were considered to be key elements of the overall Dounreay plan. Since an update of the full DSRP has not yet been received, the previously published assessment has formed the basis of the quinquennial review of the Dounreay strategy. (Volume 6 of the DSRP, which deals with the management of nuclear fuels, has been updated and has been taken into account in this review.)

### ***Cessation of reprocessing at Dounreay***

55 There has been no reprocessing at Dounreay since 1996, following the failure of the dissolver in the one of the site's reprocessing plants. In June 1998, the Government announced that Dounreay would take on no further reprocessing work and that reprocessing would end when the plant had completed reprocessing its own fuel, a small quantity of Highly Enriched Uranium from Georgia, and its existing commercial contracts.

56 A consultation exercise was then undertaken by DTI in April 2000 in relation to the options for managing the fuel from the Dounreay Prototype Fast Reactor (PFR) (Ref 20). Following this consultation, the Government announced in July 2001 that the refurbishment of the reprocessing facilities at Dounreay to deal with the remaining PFR fuel had been ruled out, and that UKAEA should consider the options for dealing with this fuel as part of the future development of the DSRP.

## **OSPAR**

57 In July 2002, the Government issued a strategy after consultation (Ref 21) which described how the UK will implement the agreements reached at the 1998 Ministerial meeting of the OSPAR Commission. One of the main aims of the strategy is that there will be progressive reductions in concentrations of radionuclides in the marine environment resulting from radioactive discharge, such that by 2020 they add close-to-zero to historic levels. The strategy includes proposals for discharge reductions from the research sector (ie UKAEA sites) and projected liquid effluent discharge profiles up to 2020. The Government intends to revise and reissue the strategy at periods of about 4 years.

### **2.7 The UKAEA submission**

58 This review has been based primarily on a two-volume submission entitled "UKAEA's Decommissioning Strategy" (Ref 3). Volume 1 contains general information on how UKAEA manages its nuclear liability, an overview of the decommissioning and waste management strategies for UKAEA's four licensed sites, and an outline of UKAEA's management and organisational structure. It also describes how UKAEA manages the development of the technology required to decommission its sites.

59 Volume 2 describes the decommissioning and waste management strategies for the Harwell, Winfrith and Windscale sites. Volume 2 does not include the strategy for Dounreay, although an overview of this strategy is given in Volume 1. The Dounreay strategy was not included in Volume 2 as it had been previously submitted to NII in the form of the Dounreay Site Restoration Plan (DSRP) as explained in para 53.

60 This is the second quinquennial review submission which NII has received from UKAEA, the first being issued in late 1997. However, the first submission was not assessed as it was overtaken by the outcome of the Dounreay audit which required UKAEA to produce the DSRP and to apply the lessons of the audit to its Southern Division Sites.

### **2.8 Overview of the site strategies**

61 The following paragraphs present an overview of the strategies for each of the UKAEA licensed sites, as at the time of the UKAEA submission, September 2001. This overview covers only the main features of each of the strategies and is included to place the issues raised later in this report into context. For a more detailed description of the site strategies, the reader is referred to the quinquennial review submission and the Dounreay Site Restoration Plan on the UKAEA web site (Refs 3 and 18 respectively). The programme dates quoted in this report are generally UKAEA's central estimates for planning purposes as used in the 2000/1 financial year.

62 UKAEA has described in Volume 1 Part 1 of its submission how the nomenclature devised by the International Atomic Energy Agency (IAEA) has been adapted to cover the decommissioning of its diverse range of facilities. In this report, the NII refers to the three stages of decommissioning in the context of UKAEA's

reactor decommissioning projects. In general terms, Stage 1 includes the removal of fuel and coolant from reactors, Stage 2 includes the dismantling of plant outside of the biological shield, and Stage 3 includes the removal of the remainder of the plant. Depending on the facility concerned, Stages 1, 2 and 3 may run continuously, or may be separated by periods of care and maintenance.

### ***The Winfrith strategy***

63 UKAEA's strategy for Winfrith is to decommission all the active facilities on the site by about 2012, with the exception of the DRAGON and SGHWR reactors, a conditioned waste store and the sea discharge pipeline. All ILW associated with the reactors will remain on site until there is an off-site facility available for the management of ILW but, by 2012, all fuel and (unconditioned) solid ILW will be removed.

64 Further significant decommissioning of the DRAGON and SGHWR reactors will be deferred until 2035 and 2025 respectively, when decommissioning Stages 2 and 3 will take place contiguously over a period of about ten years for each reactor. (UKAEA has recently reviewed these strategies as discussed in more detail in the section dealing with the findings, paras 171 to 178).

65 It is proposed that areas of the site will be progressively delicensed, broadly from east to west, as the decommissioning and contaminated land remediation programmes proceed. In fact, NII has recently delicensed a part of the site and an application to delicense another area is currently under consideration. The strategy assumes that decommissioning of the site should be complete by about 2050, though this timescale depends on the availability of off-site facilities for the management of ILW.

### ***The Harwell strategy***

66 UKAEA's strategy for Harwell is to decommission most of the active facilities on the site by about 2020, with the exception of the two materials test reactors PLUTO and DIDO, the BEPO reactor, the conditioned waste stores, and the waste handling facilities (which will be retained to allow retrieval and inspection of those wastes being stored on the site). UKAEA proposes that by about 2020, all stored radioactive waste will be recovered, repackaged and immobilised into a form suitable for long term passive storage using new facilities for which construction will start in the next few years. Completion of this task will mark the end of active operations on the site (apart from continued storage of conditioned waste) until decommissioning of the reactors recommences.

67 DIDO, PLUTO and BEPO have been decommissioned to Stage 2 and are currently under care and maintenance. Decommissioning of all three is currently programmed to resume at about 2040 and to take about 10 years to complete.

68 The remediation of the Western Storage Area, an area of land contaminated primarily with chemicals, should be complete by about 2004. The remediation of the Southern Storage Area, which is not part of the licensed site, is complete. UKAEA intends that the site will be progressively delicensed as facilities are dismantled and contaminated land is remediated. This will start with areas in the north-east end of

the site and move progressively to the south-west. Final delicensing depends on off-site facilities becoming available for the long term management of ILW which, for planning purposes, is assumed to be by 2040.

### ***The Windscale strategy***

69 Over the last ten years, work has concentrated on Pile 1 and WAGR. Pile 1 is in the development stage for Phase 2 of Stage 1 decommissioning, which is the removal of the fire-damaged core, fuel and remaining graphite. However, difficulties have been experienced which have prompted a fundamental review of the core dismantling strategy. This has resulted in delays to the decommissioning programme. Dismantling of the Pile 1 core was originally scheduled for completion by 2010. However, in recognition of the delays, the quinquennial review submission now quotes a date of 2020 for planning purposes. UKAEA intends to defer final dismantling of the Pile 1 concrete bioshield until 2042 to gain the benefit of radioactive decay. Final dismantling is programmed to be complete by 2046.

70 UKAEA intends to defer Stage 2 and 3 decommissioning of Pile 2 to 2044 to take advantage of radioactive decay. Final dismantling is programmed to be complete by about 2060.

71 WAGR is currently undergoing Stage 2 and partial Stage 3 decommissioning as a demonstration project. Dismantling of the core is programmed to be complete by 2007. The dismantling of the reactor building is being deferred until about 2040 to take advantage of radioactive decay.

72 There are three other significant facilities on the site: the B13 and B14 Post Irradiation and Examination (PIE) facilities and the B52 AGR Examination Caves. B14 is programmed to be decommissioned by the end of 2014, whereas the decommissioning of the other two facilities is scheduled to start around 2040, ie about the same time as the final decommissioning of the reactors.

73 UKAEA is planning a site contamination survey for Windscale. It does not believe that it is practicable for the site to be delicensed independently of BNFL's adjacent Sellafield site.

### ***The Dounreay strategy***

74 UKAEA's overall strategy for Dounreay is to retrieve and immobilise the majority of the radiological hazard within 25-30 years. During this period, fuels and wastes will be treated and decommissioning will be complete or well advanced for many facilities. The Dounreay Site Restoration Plan envisages that final dismantling and demolition will be complete in about 55-60 years, although conditioned waste will continue to be stored on the site until off-site facilities are available for the long term management of ILW.

75 There are three redundant reactors on the site, the Dounreay Fast Reactor (DFR), the Prototype Fast Reactor (PFR) and the Dounreay Materials Test Reactor (DMTR). Both DFR and PFR are currently undergoing decommissioning and this work will continue until decommissioning is complete around 2040.

76 DMTR is currently in care and maintenance, pending the establishment of a disposal route for decommissioning wastes. Final decommissioning is planned to be achieved around 2035. The retrieval of waste from the Shaft, which is the most challenging decommissioning project on the site, is currently programmed to commence in 2014.

77 There are a variety of other facilities on the site. Some of these are already being decommissioned whilst others will continue to have an operational role for a number of years to come. Decommissioning projects will be proceeding in parallel with the construction of a significant number of new facilities in the first 10-15 years of the programme.

78 The new facilities are essential for the delivery of the overall programme, as they are required to achieve the objective of converting nuclear materials into a state of passive safety within 25-30 years. The programme for decommissioning both the new and existing facilities takes account of interactions and linkages between different facilities.

79 The 55-60 year decommissioning phase will be followed by a care and surveillance phase lasting for about 300 years. This will provide an extended period of control of the site during which residual radioactive material and any waste disposal facilities can be monitored to ensure long term safety and to allow further radioactive decay to take place. During this phase, major areas of the site will be suitable for delicensing which will be completed at the end of the period.

### **3 THE TECHNICAL REVIEW**

#### **3.1 The review process**

80 The technical assessment has considered UKAEA's site strategies and supporting information in relation to NII's internal guidance for decommissioning and waste management (Refs 2 and 11). UKAEA's submission has been assessed by:

- consideration of UKAEA's general approach, in particular, with regard to the fundamental expectations set down in NII guidance;
- examination of the assumptions upon which the site strategies and Liabilities Estimate are based to determine their validity;
- review of the UKAEA methodology, to determine its overall adequacy to maintain acceptable strategies for the sites; and
- examination of UKAEA's detailed justification of the site strategies.

81 NII's assessment process included consideration of UKAEA's quinquennial review submission (Ref 3) in its entirety and targeted sampling of the considerable volume of supporting material at UKAEA Risley offices and the sites. The targeted sampling included consideration of aspects such as:

- corporate arrangements, for example, those for maintaining the site strategies and the Liabilities Estimate;

- UKAEA's management tools;
- detailed site decommissioning and waste management programmes;
- facility-specific documents such as optioneering studies; and
- data sheets, such as those for fuels and wastes.

82 The assessment process included visits to all of UKAEA's licensed sites to obtain further data and to visit ongoing decommissioning and waste management projects and facilities in care and maintenance. The NII technical assessment disciplines which took part in the review included specialists in radioactive waste management, decommissioning, fuels treatment, contaminated ground and delicensing, and civil engineering.

### **3.2 General findings**

83 This section discusses the findings of this review which are relevant to all (or most of) UKAEA's sites. There are a number of other findings, however, which are specific to individual sites or facilities. These specific findings are discussed in sections 3.3 to 3.6 which deal in turn with each of UKAEA's nuclear licensed sites.

#### ***Government policy issues***

84 A number of waste management issues of particular relevance to the UKAEA sites will be influenced by the outcome of the policy development work mentioned in para 46. These include the long term management of ILW, whether certain nuclear material such as plutonium and uranium should be regarded as wastes, and the management of the category of radioactive waste termed 'Low Level Waste' (LLW). These issues are particularly important to UKAEA as it is currently developing the design of several new facilities needed for the remediation of its sites. It is clear that future Government policy decisions could impact on UKAEA restoration activities. However, since it would not be desirable to wait 5 or more years for those policy issues to be clarified, UKAEA is basing its developing restoration programme on existing Government policy.

85 In June 2002, a report was published of a joint study by the Radioactive Waste Management Advisory Committee (RWMAC) and the Nuclear Safety Advisory Committee (NuSAC) (Ref 22). This study was concerned with current arrangements and requirements for the conditioning and storage of ILW. The report discussed the status of Government policy in some length and recommended that 'Government take the earliest possible opportunity to develop and state its policy for the conditioning, packaging and storage of ILW'. As part of its submission to the joint RWMAC/NuSAC study, NII commented on the need for policy clarification on issues such as the timescales over which conditioned radioactive waste may need to be stored on nuclear licensed sites. NII believes that the Government's commitment to clarification of policy will help to resolve some of the uncertainties surrounding the requirements for on-site storage, such as the waste package specifications and the longevity of buildings.

86 Nirex (an organisation set up by the nuclear industry to develop a disposal route for ILW and to provide advice on waste packaging) has considered whether existing waste packaging specifications would be significantly different if planned disposal was not pursued by the Government and other long term management strategies were adopted. Nirex's initial view, contained in its response (Ref 23) to the Consultation Document "Managing Radioactive Waste Safely," is that ILW packaged to Nirex specifications would not rule out the majority of waste management options. However, the option of long term surface storage (greater than 300 years) might require additional packaging and would require closely controlled environmental conditions. This has implications for new facilities which are being designed at the present time.

87 In its submission to the joint RWMAC/NuSAC study, UKAEA has expressed the view that 'For the longer-term, the uncertainty surrounding Government policy has introduced significant risk in the strategies for the conditioning, packaging and storage of wastes ... the reworking of wastes in the future, because of actions taken now in the absence of a clear Government policy, could result in significant costs to the public' (Ref 22).

88 NII's conclusion is that the timescale needed to develop Government policy on certain aspects of the management of radioactive waste introduces a significant uncertainty on UKAEA's restoration strategies and liabilities estimates. NII therefore concurs with the joint RWMAC/NuSAC view that the Government should take the earliest possible opportunity to develop and state its policy.

### ***Proposals for the Liabilities Management Authority***

89 Paras 47 to 50 outline the Government's intention to establish a Liabilities Management Authority (LMA) which will result in fundamental changes to the way in which public sector nuclear liabilities are managed in the future. The Government has also announced that the LMA will be tasked with developing an overall UK strategy for public sector nuclear liabilities. NII believes that this could be beneficial to the development of the UKAEA site strategies in a number of respects as discussed later. NII also recognises that the LMA may wish to review the existing UKAEA strategies, particularly with a view to seeking better synergies between waste treatment and storage facilities which either exist, or may need to be constructed, on BNFL and UKAEA's licensed sites.

### ***Maintenance of the site strategies and programmes***

90 UKAEA has a well documented management procedure for updating its site strategies and programmes on an annual basis, taking account of changes which have occurred in the previous year. The overall site plans, however, are developed from more detailed documentation covering individual facilities and liabilities (such as optioneering studies and facility-specific plans). During sampling of the documentation underpinning the overall site strategies, NII found examples where the lower tier documentation was not up-to-date, and did not support the overall site strategy.

91 NII considers that the maintenance of site strategies and programmes is key to the successful long term management of all nuclear licensed sites. As part of its

management arrangements for maintaining the site strategies, UKAEA therefore needs to develop and implement a procedure to ensure that facility-specific documentation (from which the site strategies are derived) is reviewed and, where necessary, revised at appropriate intervals. This issue is also discussed in para 249 in connection with cost estimates.

### ***Justification of the strategy***

92 UKAEA's stated aim is to ensure that there is a programme of progressive reduction of hazard on its sites, and to provide justification to defer the decommissioning of those facilities which will remain in the longer term. NII found that some elements of UKAEA's strategies were not adequately justified, in particular the deferral of the decommissioning of some major projects. Justification of the strategies needs to be properly addressed in the next quinquennial review submission.

### ***Site-wide decommissioning programmes***

93 The decommissioning schedules (bar charts) contained in UKAEA's quinquennial review are summary programmes which are underpinned by more detailed programmes. In the case of the Dounreay site, UKAEA has produced the site restoration programme which complements the Dounreay Site Restoration Plan (Ref 18). This is an overarching site-wide programme pulling together numerous individual work activities across the Dounreay site. (NII views on the Dounreay programme are discussed in the Dounreay audit close out report (Ref 19)). The Southern Sites have also produced more detailed site-wide programmes which are at various stages of development. NII would like to see these more detailed programmes developed further.

94 UKAEA has stated that it is committed to the continued development of these programmes. The Windscale programme in particular is at an early stage of development and the Head of that site has identified the need and obtained commitment for additional planning resource, specifically for the development of the that programme.

95 The development work for the site programmes will cover a number of aspects: updating the programme for changes to projects as work is completed; continuing to increase the level of detail in the programme as projects develop; incorporation of the results of risk assessments and, finally, reviewing the programme for consistency and integration. New data will be regularly incorporated throughout the annual planning cycle, subject to change management recording and management review. These programmes will then provide the basis for production of the annual updates in accordance with UKAEA procedures.

96 NII welcomes UKAEA's commitment to the continued development of their site programmes and will monitor progress as part of its routine regulatory work and its consideration of the next submission of the quinquennial review.

### ***Inter-site strategy interactions***

97 Notwithstanding para 96, NII would like to see further integration of decommissioning strategies between UKAEA sites, especially for the Southern Division. It is recognised that there is already some integration in that a number of the materials on UKAEA's sites, which have similar chemical, physical and/or radiological properties, are transferred and consolidated at a single UKAEA site prior to treatment. This strategy reduces the number of treatment facilities that need to be constructed and ultimately need to be decommissioned. However, these strategies depend on UKAEA obtaining the necessary authorisations and agreements for the inter-site movements. Other possible benefits of integration of strategies are in relation to maintenance and development of skills and in overall costs. NII is currently discussing this issue with UKAEA.

98 There are a number of interactions between the strategies for the UKAEA sites and the strategies for the BNFL sites, notably Sellafield. One important example is UKAEA's reference strategy for Plutonium Contaminated Material (PCM) which is to send the PCM to the Sellafield Waste Treatment Complex for supercompaction and conditioning, prior to interim storage at Sellafield. The success of UKAEA's PCM strategy, therefore, depends on the performance of the Sellafield plant and the ability of BNFL to accommodate the UKAEA's PCM within the Sellafield PCM strategy. UKAEA recognises that there are uncertainties associated with this strategy and that a fallback strategy may be needed if their current programmes are to be achieved. NII believes that these uncertainties would be more readily resolved if the strategy for PCM owned by the public sector was fully integrated. Recent developments in this area affecting the Harwell site are detailed in para 208.

99 There are other examples where UKAEA's strategies are dependent upon other licensees which consequently create uncertainties. NII suggests that these uncertainties would be more readily resolved if the strategy development for similar materials was undertaken at a national level, rather than at a site/licensee level. NII therefore welcomes the Government's decision that the Liabilities Management Authority will have specific remit to develop an overall UK strategy for the decommissioning and clean up of public sector liabilities.

100 There has been a recent initiative to identify the feasibility of a more integrated strategy for the management of 'exotic' fuels (see para 119). NII welcomes this initiative as it offers the opportunity for the industry to share resources, expertise and facilities in managing such material. NII recommends that consideration be given to extending this more integrated approach to other materials providing that delays in treatment are not introduced.

101 The Windscale site is adjacent to BNFL's much larger Sellafield site. There are several interactions between the Sellafield and Windscale sites (such as service supplies) and UKAEA Windscale uses some of BNFL's waste facilities. NII believes that there needs to be further integration of the Windscale and Sellafield strategies and management arrangements to facilitate decommissioning and waste transfers.

## ***The Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999***

102 These regulations do not require an Environmental Impact Assessment for reactor decommissioning projects which started before 1999; this is the case for the UKAEA reactors. However, if there is a change to the project which could have a significant adverse effect on the environment, then an Environmental Impact Assessment covering that aspect will be required. UKAEA is currently considering whether any changes or extensions to its reactor decommissioning projects might have significant adverse environmental effects.

### ***Article 37***

103 The Euratom Treaty (Article 37) requires Member States to submit to the European Commission any plans, including decommissioning plans, for the disposal of radioactive waste from nuclear facilities which may have an impact on other Member States. The UKAEA quinquennial review makes little reference to this Article. Late attention to this requirement may result in a delay to that aspect of the decommissioning programme as the submission requires significant input, involving considerable preparation, and the decision from the Commission can take a significant amount of time. UKAEA's plan for Article 37 submissions is that Dounreay will produce the first submission (as a pilot) and the other sites will follow, taking on the experience gained from the production of the Dounreay submission.

### ***Discount rate***

104 In the report on the Dounreay safety audit, it was noted that UKAEA uses a 6% discount rate when considering the options for decommissioning projects (see para 275). It was also noted that the use of such a discount rate makes the apparent net present cost much lower if decommissioning is done later, and that other licensees used a lower rate. In response to NII's recommendation, UKAEA consulted DTI on the possibility of using a lower discount rate. RWMAC has also expressed reservations about this high discount rate and has recommended that it should be reviewed (Ref 24).

105 The DTI is preparing revised guidance for the economic appraisal of decommissioning projects in the public sector which is likely to recommend a lower discount rate. As this will weaken economic arguments in favour of deferral, UKAEA will need to review the effect of changes to the discount rate on its optioneering studies and revise its strategies accordingly.

106 The subject of discounting is discussed in more detail in section 4.

### ***Timing of reactor decommissioning***

107 UKAEA has already fully decommissioned three of its redundant reactors (LIDO at Harwell, and NESTOR and DIMPLE at Winfrith). There are currently thirteen redundant reactors on UKAEA sites which have all undergone various degrees of decommissioning (see Appendix 1, Volume 1, Part 1 of UKAEA's submission). Three of these redundant reactors are at Dounreay and four are at Harwell. Windscale and Winfrith each have three.

108 The decommissioning strategies for the reactors at Dounreay have already been discussed in Ref 19 as part of NII's overall commentary on the Dounreay Site Restoration Plan. In summary, it is planned to complete the decommissioning of PFR and DFR by approximately 2040 and DMTR by 2035. In the case of the fast reactors, new plant for treating and disposing of the coolant is required as well as additional waste packaging plants. DFR still contains some breeder fuel which UKAEA plans to remove and send to Sellafield for reprocessing.

109 The following discussion is concerned with the decommissioning strategies for the reactors on the Southern Sites.

110 All of UKAEA's reactors have very different designs and operating histories, with the exception of DIDO and PLUTO at Harwell which are broadly similar. The reactors therefore have different decommissioning strategies. However, a feature of the strategies for most of the reactors is the inclusion of care and maintenance periods before decommissioning is completed. These care and maintenance periods are of varying duration of up to about 40 years.

111 The reactor optioneering studies have been examined during this review. For those strategies which include significant periods of care and maintenance, it is concluded that UKAEA has not provided sufficient justification for why the reactors cannot be decommissioned earlier. NII recognises that there are many factors which need to be considered in establishing the optimum timing for decommissioning. In particular, radioactive decay of nuclides is an important consideration in the timing of decommissioning, particularly with regard to core dismantling. However, NII believes that, in general, UKAEA's optioneering studies are too highly geared to assumptions about the timing of an assumed disposal facility for ILW, and do not give sufficient consideration to the practicality of decommissioning on earlier timescales.

112 It was also found that a number of these optioneering studies were performed some time ago and have not been updated in the light of more recent information (such as new data on the quantity of decommissioning waste in the various waste categories) which could change the balance of the argument for the timing of decommissioning. NII believes that, in general, UKAEA has not yet given sufficient consideration to how methods and procedures could be optimised to reduce the radiation dose resulting from decommissioning if it was undertaken at earlier times.

113 The current optioneering studies are not based on fully consistent methodologies, for example, the factors considered in the studies vary. In addition, some factors which NII believes to be relevant and which would favour earlier decommissioning, are not considered at all. These are the non-technical factors such as sustainable development, the precautionary principle and public perception. (NII notes, however, that UKAEA is undertaking work on sustainable development in the context of decommissioning and intends to incorporate this into its guidance when it becomes available.) Examples have also been found where fundamental underlying assumptions are inconsistent or have been overtaken by events.

114 It is therefore concluded that UKAEA needs to update its reactor optioneering studies and to provide a more robust justification for the timing of reactor decommissioning before the next quinquennial review. The optioneering studies

need to be based on consistent methodologies and assumptions, should take account of all relevant factors influencing timing, and any revised guidance from DTI.

115 The decommissioning strategies for individual reactors are discussed in more detail in sections 3.3 to 3.5.

### ***Fuels and nuclear materials***

116 There is a wide range of fuels and nuclear materials on UKAEA's licensed sites resulting from its diverse R&D activities and significant decisions still have to be taken on their management. In NII's view, UKAEA's quinquennial review submission does not give an accurate impression of the scale of the issue that has to be addressed and needs to give more prominence to the current uncertainties associated with the management of these materials.

117 Most of this material (about 109 tonnes) is held at Dounreay and the various categories are described in Volume 6 of the Dounreay Site Restoration Plan (Ref 18). The holdings on the Southern Sites are not insignificant and future versions of UKAEA's quinquennial review submission need to reflect this fact.

118 The Government decision not to sanction further reprocessing at Dounreay has had a major impact on that part of the strategy related to Dounreay. UKAEA is currently reconsidering the options for dealing with the fuels etc affected by this decision and is refining the reference strategies accordingly.

119 As mentioned in para 100, there has recently been an initiative to identify those "exotic" fuels (those materials whose management route is currently problematic) held by the major licensees in the UK, and to establish the feasibility of a more integrated strategy for their management. NII welcomes this initiative for the reasons given earlier, but believes that it is important that these developments do not result in unnecessary delays to the overall timescales declared in the DSRP and quinquennial review submission for the treatment of nuclear materials.

120 The management of the fuels and nuclear materials across the various sites will inevitably require new facilities to be provided and which may involve different processes to those identified in the reference strategies. The definition and selection of processes and facilities are major uncertainties that UKAEA has to address and resolve. UKAEA's current strategy indicates that the cost of managing the fuels inventory is small when compared to other costs (such as waste management and disposal). NII believes, however, that the costs of fuel management remains uncertain as a result of the current status of the management strategy.

121 In addition to UKAEA making provision for the management of fuels held on its own sites, a significant quantity of fuel (from SGHWR and WAGR) is also held by BNFL. UKAEA's quinquennial review does not specifically address the management of this fuel. Further revisions of the quinquennial review should address this issue and clarify responsibilities for management.

122 The reference strategy for some material is that it will be regarded as waste and conditioned for disposal. Some of the material has not been officially declared

as waste and there may be difficulties in making arguments to use disposal as a management method.

123 The reference strategies for some fuels depend on agreements with other operators which may, or may not, result in the timely management of the material. These options may entail the transfer of the fuel from UKAEA to another nuclear licensed site. Some discussions have taken place but it is not clear if any agreement has been reached to commit the material to these routes. This is an example of the uncertainties that are introduced when UKAEA's reference strategies depend on another licensee.

124 Because of the above, UKAEA's current quinquennial review submission cannot be expected to reflect the final treatment of fuels and other nuclear materials. However, by the next quinquennial review, it is hoped that decisions will have been taken to give direction to the management of these materials, options will have been selected and, in some cases, progress will have been made in implementing the preferred option. Any significant delays would ultimately impinge upon UKAEA's declared timescales for reduction of hazards and conversion of material into a state of passive safety.

***Assumptions concerning the availability of an off-site management route for ILW***

125 The assumption underlying UKAEA's site strategies is that a repository for ILW, and that LLW which cannot be disposed of to Drigg, will be available to receive waste by 2040. The strategies for Dounreay, Winfrith and Harwell recognise, however, that a repository may not be available by 2040 and include the provision for on-site storage of conditioned waste prior to disposal. The costs of these stores (ie construction and operational costs etc) are included in the Liabilities Estimate.

126 In contrast, the Windscale strategy refers only to a store "if needed" for the ILW that will be produced late in the programme (ie from Pile 2 and other deferred decommissioning projects) and the cost of this store is not included in the Liabilities Estimate. The Windscale strategy is not robust to changes to the timing of an assumed repository. NII believes that the UKAEA strategies should be based on consistent assumptions concerning the need for on-site storage and that the need for an additional store at Windscale (or another location) should be considered for inclusion in the Liabilities Estimate.

127 UKAEA has assumed in the Liabilities Estimate that all ILW (and LLW not suitable for Drigg) will be sent to a repository in the first 15 years after its opening (ie all disposals will occur between about 2040 and 2055) and that, once the stores are emptied, they will be decommissioned promptly. NII believes that licensees' strategies should be sufficiently flexible to allow for a significant period of on-site storage. UKAEA has stated that new stores for conditioned waste would be designed to be maintainable for 100 years (this is discussed later in paras 139-140). This is consistent with NII expectations.

### ***Assumptions concerning the availability of an off-site management route for LLW and VLRM***

128 UKAEA has different strategies for the management of LLW at its Southern Sites and at Dounreay. In the case of Dounreay, LLW has in the past been disposed of in an authorised on-site facility. However, the facility is almost full and current LLW arisings are being stored on-site pending the agreement of the long term management strategy. A study to identify the Best Practicable Environmental Option (BPEO) is currently being undertaken and one option under consideration is the construction of a new LLW disposal facility. In the meantime, an agreement in principle is being sought from BNFL to the transfer of Dounreay LLW which meets the current conditions for acceptance at the Drigg facility.

129 UKAEA's strategy for the management of LLW arising from its Southern Sites is to dispose of this waste at the UK LLW disposal facility at Drigg (operated by BNFL), as soon as reasonably practicable after its arising, in accordance with Government policy. When Drigg is full, which could be around 2050 (Ref 14), UKAEA proposes to store the LLW waste on site in a passively safe form (along with ILW) for disposal to a national repository. As UKAEA's submission shows that significant quantities of LLW are expected to arise after the assumed Drigg closure date, NII believes that UKAEA will need to review its planning assumption for the management of LLW in the longer term, once Government policy on this issue is clarified.

130 Because the activity concentration of the majority of LLW generated on UKAEA sites during decommissioning and land remediation falls at the lower end of the range in the definition of LLW, UKAEA has defined an additional category of waste termed Very Low Level Radioactive Material (VLRM). In the case of the Dounreay site, UKAEA is currently considering the options for managing this material as described in the final report on the Dounreay audit (Ref 19). The reference strategy for managing VLRM arising at the Southern Sites is to dispose of this material at Drigg. However, UKAEA is currently in discussion with the industry and the regulators concerning alternative options for the management of this waste. As the costs of the various options vary considerably, there is the potential for cost savings. This an emerging issue which NII considers significant. It is recognised, however, that this is largely a matter for resolution by the Government.

### ***Completeness of the strategies***

131 UKAEA's site strategies cover decommissioning, the management strategies for fuels and wastes (including existing and future arisings), new facilities for the management of fuels and wastes, the remediation of contaminated ground and delicensing. NII believes that the strategies are comprehensive in terms of the extent to which they address nuclear liabilities. However, some liabilities will need further characterisation and final decisions have yet to be taken on the management strategy for some materials (eg some fuels, nuclear materials, LLW and VLRM).

132 The UKAEA correctly concentrated on radioactive waste and contamination in its submission. NII believes that it would help inform the assessment and consultation process if more detail was provided on chemical waste and contamination in the next submission.

### ***Progress with systematic reduction of hazard and achievement of passive safety***

133 Two of NII's fundamental expectations with respect to decommissioning and waste management are firstly, that hazards associated with the plant or site should be reduced in a progressive and systematic manner and, secondly, that radioactive material and radioactive waste should be put into a passively safe state for interim storage pending future disposal or other long term solution. In 1999, NII published a review of the storage of ILW in the United Kingdom (Ref 13) in which it was noted that virtually all the ILW stored on UKAEA sites is in a raw (unconditioned) form and is not passively safe.

134 In general, the most significant reduction of hazard on UKAEA sites will occur when 'legacy' wastes and other nuclear materials are retrieved from their current storage locations, treated to render them passively safe, then transferred to appropriate interim stores until a long term management solution is available. UKAEA's declared timescales for the achievement of passive safety on its sites have been described earlier, and comments are made on these timescales later in this report.

135 The achievement of passive safety on UKAEA's sites depends on the timely provision of various new facilities such as retrieval and treatment plant for wastes and other nuclear materials, and associated stores. Most of these facilities are required for the Dounreay site, however, new facilities are also required for the Southern Sites. In view of the importance of these new facilities to the reduction of hazard and the achievement of passive safety, NII expects UKAEA to make all reasonable efforts to bring these plants into operation on time. The facilities concerned and their programme dates are discussed in more detail in sections 3.3 to 3.5.

### ***Safety cases***

136 The Nuclear Site Licence requires that the safety of any activity must be substantiated and, whenever possible, documented. Several of the standard Licence Conditions attached to all Nuclear Site Licences (given in Ref 6) relate to safety cases. Licence Condition 14 sets the primary requirement for a licensee to make and implement adequate arrangements for the production and assessment of safety cases to justify safety during all phases of the life of a nuclear facility. Licence Condition 23 requires that the licensee shall, in respect of any operation that may affect safety, produce a safety case to demonstrate the safety of that operation and to identify the conditions and limits necessary in the interests of safety. Other Licence Conditions require the licensee to provide documentation to substantiate the safety of proposals such as new plant (LC 19), modifications (LC 20 and 22) and commissioning (LC 21). Arrangements for the periodic review and assessment of safety cases are required by Licence Condition 15 and Licence Condition 35 is related to the safety aspects of decommissioning.

137 UKAEA is currently updating the safety cases for its facilities to bring them in line with current modern practice, to place greater emphasis on the deterministic analysis of the performance of the plant and to improve the demonstration of the

adequacy of the engineering. The updated safety cases will be produced over the next few years.

138 An implicit assumption underlying all of the site strategies is that UKAEA will continue to be able to produce acceptable safety cases for its facilities, up to the point at which they are fully decommissioned. This will be up to 50 years from now for some facilities, mainly those for which care and maintenance intervals are planned between periods of active decommissioning. NII expects licensees to produce robust safety cases for the planned periods of care and maintenance. These safety cases need to justify that the planned care and maintenance activities (including inspections) are of a suitable standard, rigour and periodicity. If it is not possible to produce an acceptable safety case for an individual facility in the future, then the decommissioning timescale for that facility may need to be brought forward.

139 UKAEA has stated in its submission that radioactive waste stores will be capable of being maintained for at least 100 years pending the availability of a long term management solution for wastes. A number of the stores are yet to be built, however, others are already in operation and were not originally designed for such long storage timescales. The revised safety cases for radioactive waste stores that NII has seen to date, present detailed safety justifications for the continued operation of the stores for the next ten years, but include no commentary on the safety of the facility over longer timescales.

140 NII believes that when a facility has a long term strategic function or cannot be readily shutdown or emptied, then the safety case should review the whole of the remaining projected lifetime (up to the point at which it is either decommissioned, or a replacement facility can be fully operational) to give confidence that there are no foreseeable circumstances that could threaten the ability to maintain safe operation in the future. UKAEA's safety cases for such facilities should therefore supplement the detailed 10-year 'forward look' with a safety review of the remaining projected lifetime, to provide a justification for the longevity assumptions made in the site decommissioning strategies. UKAEA has stated that its safety assessment handbook for the preparation of safety cases already includes a requirement for longevity issues to be addressed where appropriate, and it will ensure that this is given proper attention in future safety cases. NII welcomes this commitment.

### ***UKAEA's planning and management tools***

141 UKAEA has developed a range of techniques and computer-based tools to improve the planning and management of its decommissioning and waste liabilities. These are outlined in Volume 1 Part 3 of UKAEA's submission and include the Strategic Planning System (SPS), the Parametric Cost Estimating System (PRICE), the care and maintenance guidance document (AECF 1085) and its associated database (CARMEN). The tools have been developed over the last few years and UKAEA intends to develop them further to increase their functionality and usefulness, using feedback from project implementation. PRICE and SPS are discussed further in section 4 (paras 251 and 272), and AECF 1085 is discussed in the next paragraphs. NII believes that UKAEA has developed an appropriate range of management tools to assist with planning.

## ***Care and maintenance***

142 As described in Volume 1 Part 3 of its submission, UKAEA has developed a Code of Practice known as the Care and Maintenance Guidance Document (AECF 1085), the purpose of which is to assist UKAEA planners to develop the most appropriate care and maintenance strategy for redundant facilities. The system has a non-prescriptive, goal-setting approach and consists of standard principles together with an electronic workbook and questionnaire (CARMEN). In common with other AECF documents, its use is not mandatory.

143 The UKAEA facilities are diverse in terms of their original function, modification, radiological inventory, structural form etc. This diversity results in no single prescriptive approach being appropriate, however, a framework or strategy should be available which is sufficiently broad-ranging to allow its application to be tailored to each facility. The AECF 1085 plan approach does appear to offer a uniform methodology which can be adopted to a diverse range of buildings. It has been applied to a selection of the applicable facilities at Harwell, Winfrith, Windscale and Dounreay. NII would encourage the use of AECF 1085 for the remaining applicable facilities.

144 Sample inspections by NII have identified that some facilities have entered care and maintenance without any apparent baseline review or structured approach. These inspections revealed that degradation mechanisms exist which could undermine the overall integrity and are not being revealed by UKAEA's current inspection and maintenance activities. Whilst none of these appear life limiting at present, remedial measures and the current inspection regimes must be reviewed by UKAEA.

145 UKAEA should ensure that a consistent approach is used for all the facilities for which decommissioning is to be deferred with a period of care and maintenance. Whilst it may not be appropriate for AECF 1085 to become the sole standard, other methodologies should be at least as robust. Facilities already in care and maintenance which have not used a rigorous and structured approach should be re-evaluated without undue delay, and a stronger internal audit is required to ensure the necessary level of consistency.

## ***Progress with decommissioning***

146 The decommissioning of redundant facilities on all of UKAEA's licensed sites has now been underway for a number of years and UKAEA has outlined the progress made to date in Part 1 Volume 1 of its quinquennial review submission. In the case of Harwell and Winfrith, several facilities have already been completely decommissioned and progress has been made with the remediation of contaminated ground. At Windscale, good progress has been made with the decommissioning of WAGR but, on the other hand, technical difficulties have recently caused delays to the decommissioning of Pile 1 (this is discussed in more detail in paras 218 to 220).

147 In the case of Dounreay, concern was expressed in the 1998 audit report (Ref 17) about the lack of progress in general with decommissioning on that site. This situation will take some time to turn around. However, in the final report on the audit

(Ref 19), examples were reported of recent progress on certain decommissioning projects such as PFR Stage 1.

148 NII's overall conclusion concerning decommissioning progress to date is that it has been variable in terms of meeting programme dates and costs and in technical success. However, NII acknowledges that some of the latter problems have arisen as a result of the difficulties experienced in decommissioning and the need to develop new techniques and new applications of existing techniques.

### ***Management and organisation***

149 The findings of the Dounreay safety audit (Ref 17) required changes to UKAEA's arrangements and organisation for managing its liabilities. The audit highlighted a number of significant shortcomings at that time, such as weakened in-house management and technical expertise, and an over-reliance on contractors. The recommendations concerning management and organisation were generally concerned with corporate matters and so most were relevant to the Southern Sites as well as Dounreay. UKAEA's response to the audit was described in Ref 19, and UKAEA has outlined how it has responded to the main audit findings in Volume 1 Part 2 of its submission.

150 Table 1 of the final report on the audit (Ref 19) shows that most of the recommendations concerned with management organisation, human resources, training, safety management system and safety culture have already been closed out. However, some recommendations in these categories will take a number of years to be fully implemented and these have been placed in a medium term programme which will be monitored as part of NII's routine regulatory activities.

151 One of these medium term recommendations is concerned with records and UKAEA's quinquennial review outlines the work in progress to develop systems to maintain and preserve knowledge. Licence Conditions 6 and 15 of the standard nuclear licence require a licensee to make and preserve adequate records. These include records of the amount and location of all radioactive material and the operating history of nuclear plant. Decommissioning experience throughout the world has shown the importance of adequate records in supporting decommissioning projects. In addition to the requirement of the Nuclear Site Licence for making and preserving records, the same requirement is placed on UKAEA with respect to radioactive waste disposals, discharges and transfers under the Radioactive Substances Act 1993.

152 Since the publication of its quinquennial review submission, UKAEA has proposed the formation of a Major Projects and Engineering Division with responsibility for the major new facilities which will be required across its sites. In principle, NII welcomes this development which, properly implemented, should establish a focus for major projects within UKAEA and reinforce UKAEA's intelligent customer capability. Changes to a licensee's organisational structure or resources which may affect safety are subject to Licence Condition 36 (Control of Organisational Change) and NII is assessing the proposal. Other organisational changes within UKAEA could occur as a result of the formation of the LMA. These will also be considered under Licence Condition 36.

## **Resources**

153 In NII's Dounreay audit close out report (Ref 19), it was noted that the Dounreay Site Restoration Plan identified a vast programme of work, particularly in the first 10-15 years, when decommissioning projects will need to proceed in parallel with the construction of a significant number of new facilities. As described in more detail later, new facilities will also need to be constructed on the Southern Sites, although the scale of the work is less than at Dounreay. It was emphasised in the close out report, that the availability of suitably qualified and experienced personnel, and how they are managed, is an important issue for the implementation of the Dounreay programme. This also applies to the Southern Sites, and the steps that UKAEA was taking to identify and secure the required manpower resources for those sites were outlined. The overall conclusion in Ref 19 was that, although UKAEA had put in place processes to identify its resource needs and to recruit personnel, there was not yet solid evidence about the future effectiveness of these processes, particularly for Dounreay. This conclusion still stands. UKAEA should, therefore, continue to identify the resources and competencies which it needs to implement its strategies. UKAEA should also further develop its arrangements for ensuring the long-term availability of this resource. This issue is currently being monitored as part of NII's routine regulatory work.

## ***Delicensing and contaminated ground***

154 UKAEA includes contaminated ground in its liabilities and is committed to restoring the environment of its sites. Strategies for the management of contaminated ground have been developed for Dounreay and Harwell and are being developed for Winfrith and Windscale. The strategies generally involve a review of the history of the site and incident and monitoring records, and then targeted investigative site surveys to characterise the contamination. UKAEA is participating in the SAFEGROUNDS project (Ref 25) to develop guidance on best practices and options for the management of contaminated ground. More details of UKAEA's work on site remediation are given in paras 260 to 266.

155 For delicensing, the HSE has considered applications on a case by case basis applying the requirement that the land to be delicensed is indistinguishable radiologically from similar land in the vicinity of the site and that it will not be subject to any regulation following delicensing under, for example, the Radioactive Substances Act 1993. Additionally, HSE is developing policy guidance on the interpretation of "no danger" which is planned to be put to consultation in late 2002, and there is the prospect of regulations for radioactively contaminated land which were proposed in the White Paper Cm 2919 (Ref 1). Any standards applied to delicensing would need to take into account those applied to other sectors. An indication of the standards being considered by NII is given in Ref 26. A study carried out for NII on the approaches to delicensing in various OECD countries suggests that these are consistent with those proposed elsewhere (Ref 27).

156 For release of materials, which may apply to the management of contaminated ground, there are a number of guidance documents published by the IAEA and the European Commission relating to exemption and clearance (Refs 28 to 30). In addition, the IAEA is producing guidance on the release of solid radioactive material from regulatory control.

157 Although the standards are being developed, the approaches being taken by UKAEA in delicensing and contaminated ground appear to be reasonable and generally geared towards meeting the more restrictive of the endpoints in the various guidance documents. In view of this, it is unlikely that, in the short term, UKAEA will need to make significant changes to their proposals as the guidance becomes crystallised.

### ***Authorisations for discharges/disposals and OSPAR***

158 The Government has issued a strategy for radioactive waste discharges (Ref 21) which shows how the UK intends to meet its obligations under the OSPAR agreement. The objective is a progressive reduction in liquid discharges from UKAEA sites over the next 20 years. The Government has also stated that it will apply similar principles to aerial discharges in the future. It has also published draft statutory guidance to the Environment Agency on the interpretation of OSPAR in relation to the granting of discharge authorisations. The Scottish Executive is preparing guidance for SEPA.

159 There is a potential conflict between the objective of progressive reduction of discharges over the next 20 years and UKAEA's aim for a continuing and increasing programme of decommissioning and waste treatment on its sites in order to achieve a state of passive safety in the next 2-3 decades. In NII's view, there will need to be flexibility in the application of the Government objective to reduce discharges in relation to decommissioning and waste conditioning if UKAEA's current programmes are to be achieved. Highly restrictive discharge requirements could have implications on safety and costs by delaying the systematic reduction of hazard and by creating additional wastes requiring treatment and disposal.

160 As noted in para 17, the discharge and disposal of radioactive waste is regulated by the relevant environment agency under the Radioactive Substances Act 1993 (RSA93). In common with all operators of nuclear licensed sites, UKAEA will need to submit applications to discharge or dispose of radioactive waste. NII notes that UKAEA needs to be mindful of the appropriateness and availability of disposal routes in the future and that authorisation applications need to be submitted in good time, bearing in mind that the process is often not straightforward and is subject to the views of stakeholders. Failure to achieve, or delays in achieving, the required authorisation could present a threat to the decommissioning strategy and to the programme's timing.

161 It would help inform the consultation process if future UKAEA quinquennial review documents referred to the RSA93 and the requirement to produce documents explaining the compliance and implementation arrangements against the limits and conditions in the disposal authorisations.

### ***Research and development***

162 UKAEA will be required to carry out extensive R&D work for the challenging, wide ranging and sometimes unique decommissioning, waste management and site restoration activities that will be encountered across the various UKAEA sites. Much of the R&D work will be site or project-specific. However, there will be a significant

amount of this R&D work which will provide generic information for future UKAEA activities.

163 In addition to its own R&D activities, NII expects UKAEA to keep up-to-date with developments in best practices for waste conditioning, waste packaging, abatement technology, decommissioning technology and land remediation technology.

164 The coordination of the data arising from generic development work, and from information exchange both internally and with external organisations, is currently carried out centrally by the UKAEA Planning, Performance & Engineering Division (PPED). Although this division has already developed a number of systems to assist UKAEA to plan, monitor, control, and manage the required development work, it is evident that further initiatives and systems will need to be developed as UKAEA progresses with its expanding scope and range of project activities. However, UKAEA's recent decision to create a Major Projects and Engineering Division to manage the major decommissioning, waste management and site restoration activities across all sites should facilitate the coordination of generic development work and general information exchange.

165 UKAEA does not have sufficient and adequate resources to undertake the required future R&D programme itself and so the vast majority of the work will be carried out by contractors. UKAEA will need to act as an intelligent customer for this work and NII will monitor this as part of its routine inspection activity. (NII's expectations of an intelligent customer are described in Ref 31.) Furthermore, the adequate dissemination of the findings of R&D work, which may include material considered as proprietary information by a contractor, to other UKAEA projects being carried out by competitors is another aspect which UKAEA will need to manage and control.

166 Overall, NII believes that UKAEA still should demonstrate that it has the appropriate systems for the control and management of the required R&D and the dissemination of the findings throughout the organisation.

### ***Consultation with general public and interested parties***

167 UKAEA's quinquennial review states that constructive public involvement and debate is welcomed as an input to its policies and plans. Each site has a local liaison committee and specific consultation exercises are undertaken on major issues. A wide range of information is available on the web site including reports on health and safety and annual reports and accounts. These initiatives are encouraged by the regulators since it is believed that the involvement of stakeholders, especially the public, is essential to the long term success of decommissioning and waste management strategies. To support this, UKAEA should continue to make publicly available as much information as possible on decommissioning, subject to any disclosure restrictions on grounds of national security advised by the DTI's Office for Civil Nuclear Security.

### **3.3 Findings for Winfrith**

#### ***Fuels etc***

168 The only irradiated fuel on the Winfrith site is from the DRAGON reactor. This fuel has recently been repackaged into robust stainless steel containers and currently resides in the DRAGON fuel store. UKAEA has started to transfer this fuel to Harwell, scheduled for completion by 2004. The longer term strategy for dealing with the fuel is covered in the Harwell section of this report (section 3.4).

169 There are uncertainties about the strategies for some materials on the site. These include several tonnes of natural uranium, depleted uranium and thorium. These streams are not insignificant when considered collectively. The management options being considered could require changes to the existing decommissioning strategy which might include retention of existing storage facilities currently programmed for early decommissioning, or early construction of a new store for long term storage.

170 NII believes that UKAEA should press ahead to establish a firm strategy for these materials (and certainly before the Treated Radwaste Store (discussed further below) is commissioned. This is considered to be one of the main areas of uncertainty in the overall Winfrith strategy and progress needs to be made without undue delay.

#### ***Decommissioning***

171 The SGHWR and DRAGON reactors are the two major decommissioning tasks on the site. SGHWR was shutdown in 1990 and Stage 1 decommissioning (removal of fuel from the core) was completed in 1997. DRAGON was shut down in 1976 when Stage 1 decommissioning was completed. The reactors are currently in care and maintenance although minor decommissioning work is continuing in both facilities.

172 UKAEA's current strategy is that SGHWR should remain in care and maintenance, essentially in its current condition, until 2025. This is to allow radioactive decay to reduce the amount of material which must be sentenced as ILW and to reduce the dose rate to the decommissioning workforce. UKAEA's quinquennial review submission states, however, that the date of 2025 is under review.

173 UKAEA's current strategy for DRAGON is that further major decommissioning will be deferred until 2035, although this date is also under review. UKAEA's rationale for deferring further decommissioning of DRAGON is similar to SGHWR, although UKAEA's submission states that deferral will also allow some material that is presently LLW to decay to free release levels.

174 As stated previously, NII recognises that radioactive decay of nuclides is a central consideration in the justification of the deferral of decommissioning and the optimum time to dismantle reactors, particularly with regard to core dismantling. However, NII has reservations about UKAEA's current strategies for both SGHWR and DRAGON because, in principle, it should be reasonably practicable to undertake

some further decommissioning of both of these facilities much earlier than currently planned. This is because there is a significant amount of redundant equipment in both facilities which is neither significantly activated nor contaminated, and which could be decommissioned earlier without incurring significant worker dose or waste management implications.

175 UKAEA's current decommissioning strategies for SGHWR and DRAGON also appear to be inconsistent with the strategies which have been successfully implemented for its materials test reactors at Harwell, both of which have been decommissioned down to the biological shield (ie to Stage 2). During the course of this review, therefore, further information was sought from UKAEA on the status of its ongoing reviews of the strategies for both the SGHWR and DRAGON reactors.

176 UKAEA has recently commissioned studies to fully review the current strategies, to formulate and evaluate alternative strategies and to recommend an optimum strategy for the decommissioning of each reactor. NII has reservations about some of the details of these studies, such as the relative weightings given to the cost and safety criteria used in multi-attribute comparisons. However, the studies demonstrate that the arguments for the current decommissioning strategies for SGHWR and DRAGON are weak. In fact, the studies conclude that, for both reactors, the overall optimum approach is early decommissioning of the redundant equipment outside of the biological shield, and deferral of decommissioning of the activated reactor cores to take credit for the benefits of radioactive decay.

177 NII welcomes UKAEA's progress in this area, although both of the updated studies need further development. In particular, UKAEA needs to produce more robust justifications for the optimum timing of the eventual core dismantling for both reactors. NII also believes that the timing of core dismantling should not be linked to assumptions about direct disposal to an ILW repository, as this is not a robust assumption and is inconsistent with the overall site strategy.

178 UKAEA has indicated that if the revised strategies were sanctioned, then the intention would be to resume decommissioning of SGHWR and DRAGON when the A59 Active Handling Building and ZEBRA decommissioning projects are complete. This would have the benefit of maintaining suitably qualified and experienced decommissioning teams, and would allow advantage to be taken of the availability of staff with plant-specific knowledge. NII therefore believes that UKAEA should continue to develop the SGHWR and DRAGON strategies and should seek the necessary approval to resume decommissioning earlier than currently planned.

179 The third reactor at Winfrith is ZEBRA, a low power experimental reactor which was shut down in 1982. This is currently in care and maintenance and UKAEA plans to decommission it by 2008.

180 There are several other active facilities on the site (such as post-irradiation and examination facilities, various laboratories, waste stores, etc) which are all planned to be decommissioned by about 2012 (or refurbished for other uses, subject to confirmation that no residual activity remains). NII expects UKAEA to make every effort to achieve this timescale because a number of these facilities were shut down some time ago and because there are no safety or waste management reasons to defer their decommissioning. The most significant of these facilities is the A59

Active Handling Building which has already been partially decommissioned and is planned to be fully decommissioned by 2006.

181 As stated previously in para 169, a number of the buildings which are due to be decommissioned over the next few years still contain nuclear materials. Therefore, the achievement of their decommissioning dates depends on there being no significant delays in the emptying programme. However, the management strategies for some of the materials have not been defined and some of the options being considered could result in changes to the existing decommissioning strategy.

182 Some of the buildings due to be decommissioned in the next few years are currently leased to tenants, including AEA- Technology which provides a waste management service for customers (for example, the encapsulation of ion exchange resins to allow these to be converted into a form suitable for disposal as LLW at Drigg). The B45 complex of buildings which houses the waste treatment plants is scheduled to be decommissioned by 2012 which means that these facilities will not be available in a few years time. The customers will therefore need to establish alternative arrangements for the treatment of these wastes.

183 UKAEA's quinquennial review submission indicates that a number of facilities on the Winfrith site are currently in care and maintenance. In practice, a few of these facilities are still operational. UKAEA needs to ensure that future versions of the strategy accurately reflect the operational status of the buildings.

### ***Waste management***

184 UKAEA has an established management strategy for most waste streams at Winfrith. For a number of the wastes, the strategy is to transfer to Harwell for management with other similar wastes, subject to agreement by the Environment Agency. One example is Plutonium Contaminated Material (PCM) which is planned to be transferred by 2003. As stated in para 97, NII recognises the benefits in consolidating similar wastes on specific sites.

185 The current status of the strategies for a number of individual waste streams is discussed in the following paragraphs. Wastes which are transferred to Harwell are discussed further under the Harwell section of this report (section 3.4).

186 There are about 300 m<sup>3</sup> of ion exchange resin sludges which were produced from periodic primary circuit decontamination and water treatment in SGHWR. These wastes are stored in three concrete tanks adjacent to the reactor. On-site preparatory work has started for the construction of a new encapsulation facility adjacent to the tanks to treat these sludges. The construction of the new plant is scheduled to start in mid-2002, operations should start in 2004 and the sludges should be immobilized by 2009. As the sludges are not in a passively safe state, NII places particular importance on this project and expects UKAEA to make every effort to achieve the timescales.

187 The encapsulated sludge has not been accepted by BNFL for disposal at Drigg and, therefore, the waste will need to be stored pending a long term management solution for such wastes. UKAEA intends to store the waste in the Treated Radwaste Store which was constructed in 1990 but not commissioned. As

the construction of this store pre-dates the then Secretary of State's decision concerning the Nirex Rock Characterisation Facility, the design assumption was that waste would be stored for up to 25 years.

188 UKAEA now recognises the possibility that waste may need to be stored for considerably longer. UKAEA has produced a Preliminary Safety Report and Engineering Substantiation Report as part of the justification for the use of this store. Refurbishment and installation tasks have been identified that are needed to bring the facility up to modern standards. NII intends to examine UKAEA's proposals for this store.

189 UKAEA intends to rationalise the liquid effluent system over the next few years in view of the changing status of the site. UKAEA proposes that the active process drains will be removed as facilities are decommissioned, that a small liquid effluent system will be installed to treat any residual arisings and that other drains will be re-routed. UKAEA proposes to take the sea disposal pipeline out of service in about 2012 but it will be retained in case of further need until Stage 3 decommissioning of SGHWR is complete. NII believes that future arrangements for the management of active liquid effluents should be justified by means of a rigorous option study to ensure that options are not prematurely foreclosed.

### ***Contaminated land and delicensing***

190 UKAEA has undertaken a complete gamma radiation survey of the surface of the site using Groundhog<sup>1</sup>. This, when linked with the expected fingerprint of radionuclides from the operations that were carried out on the site, is a useful tool in determining the extent of ground contamination.

191 Currently, two areas of contamination are known. These are being monitored and remediation measures are being assessed. NII is content that UKAEA is making progress with the determination of contaminated land. The Groundhog technique is a maturing technology that gives a good indication of surface and shallow depth contamination for particular gamma emitters. The intent to carry out a three-dimensional survey where appropriate, with analysis of both radiochemical and chemical contamination, is welcomed. NII will be pressing UKAEA to establish plans for this work and to carry out the surveys as soon as reasonably practicable.

192 The UKAEA strategy is to progressively delicense the site to release land for use, free from the constraints of a nuclear licensing regime. This will be based on progressive decommissioning and remediation of the contaminated land in the areas identified for delicensing. UKAEA's quinquennial review submission states that two applications for delicensing areas have been submitted to HSE for consideration. Since its publication, NII (on behalf of HSE) has completed its assessment of the application to remove the areas known as A4(N) and B4(N) from the licensed site. NII considered the application to be an acceptable demonstration that no danger from ionising radiations remained on that part of the site and, in late 2001, signed a

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<sup>1</sup> Groundhog is a beta/gamma detection system linked to a Geographical Positioning System carried by the operator, with results displayed on a geographical information system producing a contour map of activity.

variation to the Winfrith Nuclear Site Licence removing these areas from regulatory control under the licence. The application for the delicensing of the area known as A6(N) and A7 has been received by NII and is under consideration.

193 NII was involved in discussions with UKAEA at the Winfrith site about its approach to delicensing of A4(N) and B4(N) from an early stage in the process. This allowed a dialogue to proceed and reach mutual agreement on information required in any submission to support a delicensing application and targets for the demonstration of 'no danger' required under the Nuclear Installations Act 1965 (as amended). The UKAEA demonstration that these targets had been met in terms of surveying and sampling was also closely monitored by NII. An independent survey was commissioned by NII to aid the assessment process of the final application. The cooperation between UKAEA and the NII in this area has led to confidence on the part of NII that UKAEA has in place at Winfrith both a process and teams that are capable of carrying out the required land quality assessment to support applications for delicensing. In this respect, it is considered that the proposed six-phase approach to the delicensing of the site, as proposed in Ref 3, is realistic.

### **3.4 Findings for Harwell**

#### ***Fuel***

194 DRAGON fuel is being transferred from Winfrith to Harwell over the next few years. UKAEA has not yet derived a long term strategy for this fuel and intends to retain the fuel in its current form until the national strategy for the management of ILW and HLW has been agreed. NII agrees to this approach. It is considered that there is no urgency for treatment into a passively safe condition because the fuel has recently been repackaged into robust stainless steel containers, it will be stored in a relatively modern facility, and it is relatively inert.

195 GLEEP fuel is currently stored in a relatively modern store on the Harwell site. UKAEA's reference strategy for this fuel is conditioning and disposal, and UKAEA already has a conceptual Letter of Comfort from Nirex for the packaging of this material for disposal.

#### ***Decommissioning***

196 There are four reactors remaining on the Harwell site which have yet to be fully decommissioned. DIDO and PLUTO are broadly similar and are materials test reactors which were constructed in 1956/7 and shutdown in 1990. BEPO is a graphite moderated reactor which was the forerunner of the Windscale Piles. It was constructed in 1947 and shutdown in 1968. GLEEP is a graphite, low energy experimental pile reactor which was constructed in 1946 and shutdown in 1990.

197 DIDO and PLUTO have both been decommissioned to Stage 2 and UKAEA proposes that further decommissioning should be deferred until about 2040 to take advantage of radioactive decay. Final decommissioning of the reactors would take about 10 years. NII recognises the benefit of delaying decommissioning to take advantage of radioactive decay but considers that UKAEA has not provided sufficient justification to demonstrate that it is not reasonably practicable to resume decommissioning of these reactors earlier than about 40 years from now. However,

NII does not regard the resumption of the decommissioning of these reactors as high priority projects on the site as they have already been decommissioned to Stage 2 and they are currently subject to a well managed care and maintenance regime. The treatment of wastes elsewhere on the site into a state of passive safety will give the greater contribution to the systematic reduction of hazard.

198 The BEPO reactor was decommissioned to Stage 2 about 30 years ago. The current strategy is to retain the reactor under care and maintenance until after 2040 when it would be decommissioned at about the same time as the materials test reactors. The building in which BEPO is contained (Hangar 10) is an ageing structure which needs to be demolished in the near term and replaced with an alternative protective structure. Deferral of BEPO decommissioning gives marginal benefit from radioactive decay and the justification for deferral is largely financial. UKAEA is currently reviewing the decommissioning timescale for BEPO. This will be reviewed by NII when it is available and will be discussed in the next quinquennial review report.

199 GLEEP has been decommissioned to Stage 2 and it is planned to be fully decommissioned by 2005. There is currently some uncertainty concerning the route for disposal of some of the very low active waste that will arise from decommissioning. This issue is under discussion between UKAEA and the regulators which is likely to result in changes to part of the strategy.

200 A significant number of facilities on the Harwell site have already been decommissioned over the last 10 years or so, and it is planned that most of the remaining radioactive facilities will be decommissioned within the next 15 years (with the exception of the reactors discussed above).

201 Other significant decommissioning liabilities on the site include the B220 Radiochemical Facility and the B393.6 and B459 Post Irradiation and Examination (PIE) Facilities. Much of B220 is leased to AEA- Technology, which has decided to withdraw from the building in early 2004. Decommissioning of B220 will be carried out when AEA- Technology vacates and the work is planned to be complete by about 2015. B393.6 is currently undergoing decommissioning with an expected completion date of 2003. Part of B459 is being used for waste repackaging and this work is expected to continue to about 2006, after which the facility is planned to be decommissioned by 2014.

202 There are a number of buildings on the site containing minor radioactive liabilities. Many of these will be decommissioned and the buildings demolished in the next six years. Decommissioning of many of these structures has been deferred in the past, but the condition of the facilities has become such that, for some, further delay is not acceptable.

### ***Waste management***

203 Due to the nature of UKAEA's past operations there is a wide range of nuclear materials and wastes at Harwell, mainly in the solid form. These materials are still in the untreated (raw) state and it is UKAEA's intention to convert them into a passively safe form by about 2020. The achievement of this objective is dependent on the provision of three new facilities. Firstly, the provision of a second machine for the

retrieval of unconditioned waste from underground tube stores in the B462 waste facility to supplement the existing machine which is being actively commissioned. UKAEA plans that this second waste retrieval machine will be fully operational by the beginning of 2008. Secondly, the provision of a flexible waste handling facility for those wastes which will require some form of additional treatment prior to conditioning. This facility is programmed to be fully operational by the beginning of 2014. Thirdly, the provision of a waste inspection facility and cement plant which is programmed to be fully operational by the beginning of 2012.

204 As these three new facilities are important to the reduction of hazard on the site, NII expects UKAEA to make every effort to achieve these dates and will be monitoring progress. The rate of retrieval of waste is the rate-determining step in the achievement of passive safety and, therefore, the availability and throughput of the waste retrieval machines are particularly important.

205 There is a total of about 100 m<sup>3</sup> of medium-active and low-active sludges and liquors stored in 14 tanks which has arisen from the treatment of aqueous effluents. This material is not passively safe and NII welcomes UKAEA's plans to immobilise the waste. A new facility is currently being installed and immobilisation of stored liquors and sludges is planned to be complete by the end of 2007. NII will be monitoring progress as part of its normal regulatory interaction.

206 There is a significant number of drums of waste stored on the Harwell site which were originally designed for sea disposal (sea disposal was discontinued by the UK in 1982). Many drums have already been removed from the site and those that remain have different owners which tends to complicate the strategy for their management. Work will continue over the next few years to open, sort the waste and repack the remaining ILW into more appropriate containers. However, the reference strategy for some of the drums is far from firm. The decision to establish the LMA introduces the possibility that the strategy for some drums could be revised in the future. The existing reference strategy for sea disposal drums means that they will either have been repackaged, transferred off site for management elsewhere, or disposed of as LLW. The drums containing beta/gamma waste will be treated within about 7 years. NII expects UKAEA to meet this timescale because although the drums are robust, they are not suitable for long term storage. The timescale for treatment of the drums containing PCM will be closely dependent on the developing PCM strategy (see para 208).

207 UKAEA is undertaking a review of the future requirements of existing facilities on the site, such as the B220.29 and B459 active handling facilities. This will allow UKAEA to assure itself that it already has, or has plans for, suitable active handling facilities to allow completion of the decommissioning and waste management programme before the existing facilities are decommissioned. NII believes that UKAEA should use existing facilities for the treatment of waste (where this is reasonably practicable and subject to a satisfactory safety case), rather than wait for the construction of the new waste facilities which will not come on stream for several years. This would be more consistent with the concept of systematic reduction of hazard.

208 UKAEA's strategy for PCM stored at Harwell depends on the ability of BNFL to accommodate the UKAEA PCM within its own strategy (as noted in para 98). The

original programme was to send the waste to Sellafield starting in 2006. However, because of BNFL's own commitments on the treatment plant, this cannot now take place until 2020 and UKAEA is investigating options for storage in the intervening period. The change to the PCM strategy could have an impact on the decommissioning strategy, however NII has not yet been advised of the outcome of UKAEA's consideration of this issue.

209 UKAEA proposes that the existing liquid effluent treatment plant will close around 2007 and a smaller, simpler plant will be provided to deal with the greatly reduced volume of effluent that is now arising. UKAEA's statement that an optioneering study is being undertaken to determine the most appropriate long term management arrangements is welcomed.

210 The internationally funded Joint European Torus (JET) project is located at UKAEA's Culham site. This is not a nuclear licensed site and the use of radioactive materials is regulated by the Environment Agency under the Radioactive Substances Act 1993. JET produces radioactive wastes in its normal activities, currently planned to continue until 2006, after which further radioactive wastes will be produced when it is decommissioned. UKAEA is presently undertaking option studies for the management of these wastes but the reference strategy is to dispose LLW to Drigg and to package ILW in Nirex approved containers at Culham and to store at Harwell until a disposal route becomes available. UKAEA estimates that storage provisions at Harwell will not be required until 2010. The removal of regulatory control at Culham is not discussed in the quinquennial review and UKAEA needs to explore this with the Environment Agency.

### ***Contaminated ground and delicensing***

211 UKAEA has produced a strategy document for the management of (potentially) contaminated land at Harwell, including the strategy for delicensing the site. UKAEA has also produced a document which gives the site survey and sampling strategy for land and buildings on the Harwell site.

212 Like Winfrith, the Harwell approach is one of progressive decommissioning and delicensing of the site. UKAEA and NII have been involved in a dialogue on the approach to delicensing for the Harwell site since late 1997. This resulted in the UKAEA producing a framework document for the delicensing safety cases required for the delicensing of the north-east area of the site. NII and UKAEA continued to discuss delicensing and the information that UKAEA would be required to provide to support an application. In 2001, this resulted in UKAEA making an application to remove a pilot area in the north-east area of the site from regulatory control under NIA 65. This pilot area represents a significant area of land, including buildings, and will require a substantial assessment from NII in reaching a decision. During the process, it will allow UKAEA and the regulator to test the assumptions in the framework document and refine the processes on each side, ideally leading to a more streamlined approach to the delicensing of the remainder of the north-east areas and the subsequent areas of the site.

213 NII recognises the work that UKAEA has put into developing an approach to presenting the applications for delicensing and welcomed the opportunity to have early dialogue. The cooperation between UKAEA and NII in this area has led to

confidence on the part of the NII that UKAEA has in place at Harwell processes and teams that are capable of carrying out the required land quality assessment to support applications for delicensing.

### **3.5 Findings for Windscale**

#### ***Fuel***

214 About 7% of the original inventory of fuel still resides in the fire-damaged core of Pile 1. This will be retrieved as part of the Phase 2, Stage 1 decommissioning project (see para 218).

215 There is a quantity of PIE remnants and fuel residues currently stored in the B13 caves which UKAEA intends to send to Sellafield over the next few years for treatment. UKAEA needs to produce and implement a programme for these transfers.

#### ***Decommissioning***

216 There are three reactors on the Windscale site which have yet to be decommissioned. These are the two Windscale Piles and WAGR. The Piles were operated between 1950-1957 and were shut down in 1957 when a fire occurred in Pile 1. Phase 1 decommissioning of Pile 1 is complete and this included various tasks such as sealing the bioshields, installation of ventilation and monitoring, removal of loose fuel from outside the core and the drain down of the water ducts. Pile 2 has been in care and maintenance since the late 1950s although there have been various modification and additions. All fuel has been removed from Pile 2.

217 WAGR operated from 1962 to 1981 and decommissioning started immediately after shutdown. Along with three other facilities in Europe, WAGR became part of a European Commission demonstration project to develop decommissioning techniques. To date, the fuel has been removed and the reactor vessel and internal structures have been partially dismantled. A major part of the project has been the design of remote equipment necessary for dismantling in the high radiation fields. At the present time, the graphite core is being dismantled.

218 The decommissioning of Pile 1 is the most challenging and important decommissioning project on the site. The project is in the development stage for Phase 2 of Stage 1, which is the removal of the fire-damaged core, fuel and remaining graphite. However, the project ran into contractual and technical problems which have resulted in significant delays to the planned completion date for core dismantling.

219 Dismantling of the Pile 1 core was originally scheduled for completion by 2010. However, UKAEA's submission now quotes a completion date of about 2020. This date is for planning purposes and has not been underpinned by a detailed analysis of project timescales. UKAEA is currently re-evaluating options for core dismantling and associated R&D requirements. NII has expressed concerns about the lack of overall progress in the Pile 1 decommissioning project and is pursuing the matter with UKAEA. UKAEA has not declared a revised cost for Phase 2, but NII understands that there is likely to be a very significant escalation.

220 UKAEA's submission states that it is the intention to defer final dismantling of the Pile 1 concrete bioshield to 2042 to gain benefit of radioactive decay. However, a relatively recent study states that the main driver for the timing of final decommissioning is the assumed availability of a repository for ILW, to which direct disposal is assumed in the decommissioning strategy. Also, a more recent study on the radiological composition of the waste arising from the decommissioning of Piles 1 and 2 concludes that little change in the waste characterisation occurs between 2001 and 2040.

221 As stated in para 126, the assumptions underlying the Windscale site strategy need to be consistent with those for Harwell and Winfrith and should include interim storage (for the waste produced later in the strategy). NII also believes that UKAEA needs to undertake further work to establish the optimum timing for final dismantling of Pile 1, taking account of all relevant factors, and decoupled from direct disposal assumptions.

222 Pile 2 has had all of its fuel removed and is currently in care and maintenance, although a limited amount of decommissioning is ongoing. In the context of the systematic reduction of hazard, Pile 2 is clearly a lower priority than Pile 1 core dismantling. UKAEA's current strategy for Pile 2 is to defer final decommissioning until 2044. The conclusions of this review in respect of the Pile 2 strategy are essentially the same as those given above for the final decommissioning of Pile 1.

223 Good progress has recently been made with decommissioning of WAGR and dismantling of the core is scheduled to be completed by 2007. UKAEA then proposes to maintain the reactor building in care and maintenance until 2040 at which time decommissioning would resume. There is not an auditable documentation trail to justify the deferral of the final decommissioning of the reactor until 2040. UKAEA intends to undertake an option review before the end of core dismantling in 2007.

224 The other major facilities on the Windscale site are the B13 and B14 Post Irradiation Examination Caves and the B52 AGR Examination Caves.

225 B13 is a post-irradiation examination facility leased to AEA- Technology plc until 2015. The decommissioning strategy is based on the assumption that post operational clean out (Stage 1) will start when the lease expires, and that this would be followed by a period of care and maintenance in the event that the plant is needed to support decommissioning operations on the Sellafield site. Final decommissioning is programmed to begin in 2040. However, it is now planned that the lease will be transferred to BNFL. The decommissioning strategy needs to be brought in line with BNFL's long term requirements for this facility.

226 The B14 post-irradiation examination facility is mostly redundant, although there are some operational parts which are leased to AEA- Technology plc. UKAEA intends to fully decommission the facility, starting soon after the current lease expires in 2005. Decommissioning is planned to be complete by the end of 2014.

227 B52 is undergoing post operational clean out, including the removal of ILW and LLW stored in the fuel carousel and elsewhere. Following the completion of this

work, UKAEA intends to defer further decommissioning until about 2040 to avoid the need for an early packaging plant and storage for decommissioning ILW. NII notes that UKAEA's decommissioning study has concluded that radiation levels will not fall significantly until well into the 22nd century, so radioactive decay arguments do not play a significant role in the case for deferral. NII believes that UKAEA needs to review the timing of the final decommissioning of B52, in conjunction with a review of the timing of final decommissioning of the reactors, and produce a robust justification that the timing is as soon as reasonably practicable, taking account of all relevant factors.

### ***Waste management***

228 Due to the nature of the operations on the site, Windscale does not have the diversity of waste types which exist on the other UKAEA sites. The wastes are generally those associated with decommissioning operations and relatively small volumes of material resulting from post-irradiation examination. The small volumes of liquid wastes that are generated are transferred to the Sellafield site, but are insignificant in the context of Sellafield's own arisings.

229 UKAEA's submission states that the site strategy is based on a dedicated waste facility for each of the three major reactor decommissioning projects, ie the WAGR box store, the Pile 1 box store and the Pile 2 box store. However, there is currently no provision in the Liabilities Estimate for the Pile 2 box store.

230 UKAEA has established a strategy for most existing wastes at Windscale and those that will arise in the future. However, for some wastes, the strategy has not been fully defined. These uncertainties need to be resolved well in advance of the next quinquennial review and may require a reconsideration of the design and planning conditions for the Pile 1 store.

231 There are various wastes stored in redundant facilities on the Windscale site. The storage conditions do not comply with modern standards and are not suitable in the longer term, in particular, when alternative options are available. UKAEA has indicated its intention to remove much of this waste in the next few years for either treatment, disposal or storage elsewhere. UKAEA needs to produce and implement a detailed programme for this work. Examples of the wastes concerned include: wastes stored within the building fabric on the B13 cave roof; about 60 redundant flasks housed in B12, B13 and B14; and a quantity of drummed graphite and fuel debris from the Phase 1 decommissioning of Pile 1 which needs to be processed through B13. The removal of some wastes has been delayed as a result of difficulties in obtaining the necessary administrative clearance for transfer to Sellafield facilities.

232 The overall conclusion concerning the Windscale decommissioning and waste management strategies is that they are less well developed than those for the other UKAEA sites. UKAEA's commitment to obtain additional planning resource specifically for the development of the Windscale strategy is, therefore, welcomed. This review has identified several interactions between the Sellafield and Windscale sites (such as service supplies) and UKAEA Windscale's use of some of BNFL's waste facilities. However, little evidence of integration of the Windscale and Sellafield strategies and arrangements has been found. NII believes that there

needs to be further integration of the Windscale and Sellafield strategies and management arrangements to facilitate decommissioning and waste transfers.

### ***Contaminated land and delicensing***

233 There are areas of contaminated land on the Windscale site resulting from past operations and UKAEA has confirmed that a targeted contamination investigation is planned. It is its intention that remediation of any contamination found will be to standards consistent with BNFL requirements. This is being achieved by UKAEA having representation on the BNFL Sites Remediation Stakeholder Group and its working groups. NII welcomes the commitment of UKAEA to carry out a survey of the site to establish the extent of ground contamination. However, it is noted that this process is just beginning and plans or programmes for the surveys have not been provided. NII will be pressing UKAEA to establish these plans and carry out the surveys. Although agreeing with the intent for UKAEA to meet the same standards as BNFL, NII will seek to ensure that any contamination identified from the surveys is properly managed in the short to medium term prior to any remediation actions being taken. The nuclear inspectors involved in the inspection of ground contamination at Sellafield and Windscale work together to ensure that a common approach is taken and that common standards of remediation are achieved.

234 The Windscale site is currently leased by UKAEA from BNFL and the lease expires in 2070. UKAEA's intention is to hand it back to BNFL by this date. The decommissioning objective is for UKAEA to return the site to a state where it is appropriate for hand back. UKAEA believes that it is not practicable to delicense the Windscale site independently of the adjacent BNFL Sellafield site. Given the intimate relationship between the sites, NII agrees with this view. The two licensees have similar types of liabilities and the influence of the BNFL site would make it unlikely that the current Windscale site would have any potential uses for which it would need to be released from the regulatory regime associated with licensing. NII expects the Liabilities Management Authority will have views on how the (shared) liabilities of the two sites are managed, and will seek to ensure that any proposals for change are properly regulated.

## **3.6 Findings for Dounreay**

235 As stated earlier, UKAEA has previously published the Dounreay Site Restoration Plan (DSRP) (Ref 18) which was prepared in response to the 1998 safety audit (Ref 17). NII published the final report on the audit in January 2001 (Ref 19) which discusses, in detail, UKAEA's response to the 143 audit recommendations.

236 As the DSRP was UKAEA's most important response to the audit, Ref 19 contains a fourteen-page section devoted to the assessment of the DSRP. UKAEA's response to the numerous audit recommendations that were concerned with fuels, decommissioning and waste management issues are discussed.

237 The NII's views on the DSRP are therefore not repeated here. However, it is appropriate to restate in the next 5 paragraphs the overall conclusions from Ref 19, which still remain valid.

238 “We welcome the production of the DSRP and recognise the good work which UKAEA has done to produce the integrated overarching plan within a demanding timescale. The plans will, however, need further development, integration and the incorporation of new data as and when this becomes available.

239 The project timescales in the DSRP programme are generally considered to form a credible programme for the Dounreay site. There are several important projects for which we would welcome a further acceleration of the timescales if reasonably practicable. These are: the Vitrification plant; shaft waste retrieval, the Waste Treatment Plant for solid ILW and the Ammonium Diuranate Floc conditioning facility.

240 The DSRP identifies a vast programme of work which will be particularly intensive in the first 10-15 years. We are aware that UKAEA’s funding for decommissioning at Dounreay was considerably increased by DTI in the last Whitehall Spending Round. For the DSRP to remain on track will require the long term commitment of financial resources to meet these Government-owned liabilities.

241 The DSRP remains dependent on a number of significant decisions which still have to be made, including those associated with the fuel treatment strategy. UKAEA will need to modify the DSRP and associated programmes once such decisions are made.

242 The DSRP is subject to a number of project risks, some of which are not wholly within UKAEA’s control, which may significantly change programme dates. We therefore welcome UKAEA’s intention that the DSRP will be a living document which will be reviewed and developed in the light of experience.”

## **4 THE FINANCIAL REVIEW**

### **4.1 Scope of the financial review**

243 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 licensee's Board in conjunction with its auditors and financial advisers. Consequently, HSE's assessment of the financial aspects of the licensee’s decommissioning strategy is limited to an assessment of whether or not:

- the licensee has 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;

- the 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.

244 This section of the report is structured as follows:

- Section 4.2 reviews the UKAEA's arrangements for establishing the costs of decommissioning and waste management;
- Section 4.3 describes how those costs are aggregated to create the Liabilities Estimate, reviews the approach to discounting reflected in UKAEA's accounts and establishes how the necessary funds are secured in practice;
- Section 4.4 sets the 'snapshot' of the UKAEA QQR submission, and the findings of this assessment, within the context of the Government's proposals for future management of civil nuclear liabilities.

## 4.2 Costing the liabilities

245 UKAEA's processes for establishing nuclear liabilities are considered in the context of the following two key characteristics which shape the organisation's approach to liabilities management, and which distinguish it from licensees in the nuclear power generation sector:

- UKAEA no longer operates commercially in the nuclear field and its primary focus is on decommissioning and site restoration. This is reflected in its mission statement;
- UKAEA has a large number of disparate facilities to deal with, ranging from prototype nuclear reactors through nuclear fuel production and processing facilities to 'unplanned' situations such as the need to remediate the Dounreay shaft. Each is unique and requires a bespoke approach to the planning of decommissioning, albeit within a systematised planning and costing framework.

246 UKAEA has in place a process for producing decommissioning studies for each of the significant facilities on its sites and cost estimation is a key output of this process. The studies are produced at one of three levels of detail through which the estimated timescales and cost can be progressively refined. These can be summarised as follows:

- Level 1:** Identify key drivers
- Define reference strategy
- Preliminary estimates of timescales, waste volumes and cost

**Level 2:** Detailed option studies, including costings

Selection of preferred strategy

**Level 3:** Detailed assessment of preferred option for project approval

247 At the time of this assessment the production of cost estimates was overseen and co-ordinated by the UKAEA Planning Performance and Engineering Directorate; following a reorganisation, the exercise is now co-ordinated by the Finance and Commercial Division. Preparation of decommissioning studies for individual facilities is managed at site level in accordance with detailed corporate guidance, though the studies themselves are usually undertaken by contractors. Whatever level of study is being undertaken, the liabilities are assessed within the following four main groupings:

Component	Type	Coverage
A	Assessment and Decommissioning Costs	Actual costs of planning for and undertaking dismantling, including procurement of related equipment and materials, training, health and safety support
B	Operational Charges	The avoidable costs representing the difference between an occupied and an empty building. This includes, for example, relevant staff, energy costs, plant maintenance, ongoing health physics support
C	Facility Charges	Non-avoidable costs such as accommodation charges, regulator levies, police and security
D	Waste Management	Cost of storage, transport and disposal

248 Components A and B are outputs from the detailed studies undertaken by contractors. Labour costs are a major element in most projects and are derived by breaking the project down into tasks, estimating the number of staff hours required to complete each task and then applying standardised unit costs provided by UKAEA. Central guidance also informs the estimation of component B and C costs, with component C costs being derived at site level as part of the preparation of site decommissioning plans. Overall, this approach ensures that the ongoing costs of putting facilities into a care and maintenance regime are properly recognised and weighed in the balance when evaluating decommissioning options.

### ***Currency of estimates***

249 It was noted during NII's assessment that there is some variation in the level and currency of the cost estimates. Level 2 studies have been produced within the last 3 years for all significant facilities at Dounreay as part of the process of developing the Dounreay Site Restoration Plan (DSRP) in response to the 1998 HSE/SEPA Dounreay Audit. For the Southern Sites, one of UKAEA's documents supporting its submission incorporates statements of the status of studies for each

facility. The costings for some significant facilities (for example, Harwell B466 and Windscale B13) rely on Level 1 studies and, in some cases, these are several years old. NII found no clear evidence of a corporate and co-ordinated approach to updating and upgrading facility studies, taking account of the scale, complexity and expected timing of decommissioning. This is also discussed in para 90. Confidence in the reliability of the Liabilities Estimate would be enhanced if UKAEA could demonstrate that it was following a proactive and proportionate programme.

250 UKAEA's arrangements are responsive to changes in decommissioning strategies for particular facilities. The annual updating of site decommissioning plans means that changes in projected costs arising from, for example, the decision not to refurbish D1206 at Dounreay, can readily be incorporated into the Liabilities Estimate.

### **PRICE**

251 The **Parametric Cost Estimating System (PRICE)** is featured prominently in the quinquennial review submission. UKAEA has developed PRICE to provide a computerised platform for the preparation, in a systematic and consistent manner, of cost estimates at Levels 1, 2 and 3. It is sufficiently powerful to support the modelling of complex projects. However UKAEA is reluctant to impose its use as a mandatory requirement on contractors undertaking decommissioning studies and consequently there is no clear pattern to its application.

### ***Allowing for financial risk and uncertainty***

252 In estimating for a particular project, all the identified cost elements are aggregated to produce a 'Base Estimate'. There will, however, be a spread of financial risks and uncertainties which will tend to result in an outturn higher than the Base Estimate. One of the outputs from a decommissioning study is the identification of project risks which could affect delivery of the project in terms of timescale and cost. The Base Estimate is adjusted by project risks to become the Project Estimate as explained in the next paragraph.

253 The best estimate of the cost of completing a project is known as the 'Project Estimate' and will be the figure used in the preparation of UKAEA's total Liabilities Estimate. Where a project has been subjected to a full probabilistic financial risk assessment, the Project Estimate will usually equate to the 50% confidence outturn. The contingency added to the Base Estimate to produce the Project Estimate is known as Standard Contingency.

254 For sanctioning purposes, the UKAEA's sanctioning authority, the Strategy and Investment Review Committee (SIRC), recognises that there may be financial risks outwith the control of project management which could result in a cost outturn above the Project Estimate. Consequently the project manager may be asked to identify these risks, gauge their likelihood and impact, and make a judgement on an upper figure which is unlikely to be exceeded. This is the Approval Estimate against which sanction for the project is sought. If using a statistical risk assessment approach, the Approval Estimate will equate to the 90% confidence level. In most cases, however, where risks are assessed more subjectively, the additional contingency will simply be a matter of judgement. It is known as Additional Risk

Contingency and will normally be held by the Site Director and released only on evidence of the additional risks being encountered. The Planning, Performance and Engineering Directorate monitors both the Project and Approval Estimate against actual project outturn; the data indicate a substantial degree of consistency between estimate and outturn.

### ***Waste management costs***

255 UKAEA found from experience that the 'unit cost per cubic metre' approach to estimating waste management costs as part of a facility study had drawbacks. In practice, the actual costs of managing waste are functions of its volume, waste route and timing. Since each waste facility has fixed costs, the cost per unit in any year will vary according to throughput. Consequently, calculating costs in stand-alone decommissioning studies could be misleading.

256 Another factor to be taken into account in modelling waste management costs is the potential effect of radioactive decay; programme delays or deferrals may result in the reclassification of wastes, with consequences for management route and disposal destinations. Additionally, assumptions on the projected costs of disposal to facilities such as Drigg and the Nirex repository are revised from time to time, which would require waste management unit costs to be reviewed.

257 For all of these reasons, the focus of the facility studies is to provide waste management information in terms of the composition and volumes of the wastes to be managed. This can then be modelled at corporate level through the Strategic Planning System (see para 272) so that a holistic view of volumes and waste routes can be derived as the basis for calculations using the latest cost information. This integrated approach to waste management can also identify any potential constraints due to peaks of demand, lack of capacity etc.

258 The projected costs of ultimate disposal are based on information provided by Nirex. The reference assumption is that a repository will be available in 2040 for ILW and in 2080 for HLW. Together with details of UKAEA's position as a Nirex shareholder and the latter's expected expenditure profile, this informs judgements about the rate at which the costs will be realised.

259 In practice, it is recognised that the repositories may not be available on the projected timescales and that, in consequence, it may be necessary to store waste on the sites beyond the reference assumptions. However, plans are already in hand to build stores to meet UKAEA's needs in the interim. The stores have a design life of 100 years providing margin to accommodate delays.

### ***Remediation of contaminated ground***

260 The depth of UKAEA's work on identifying contaminated ground and planning for and costing the necessary remedial work varies from site to site. The issue is given only limited attention in UKAEA's submission. The position for individual sites is summarised in the following paragraphs.

261 ***Dounreay:*** There are a number of ongoing programmes covering the management, monitoring and remediation of contaminated land as well as the

separate project covering particles investigation. There is also an allowance in the site infrastructure costs for site surveillance over the very long term.

262 **Harwell:** The Harwell Site Plan includes a budget for site surveying and delicensing, which has been carried forward to 2020 based on the current level of expenditure. The budget covers detailed physical and radiological surveys and remediation of areas as found. Historical records are also being searched for possible disposals on and off the licensed site which may now constitute contamination. The minor facilities decommissioning programme also covers some clean-up before the area will be handed over for site surveying. No significant area of contamination has been found to date; some low levels of contamination are expected to be found on decommissioning of the Liquid Effluent Treatment Plant and the B462 complex. Beyond 2020, the intention is that only the reactors and the B462 store area will remain, plus linking land, and any residual contamination will be cleared up as part of facility decommissioning.

263 **Windscale:** Work on assessing and defining the strategy for contaminated land at Windscale is at an early stage. There is currently a 2 year programme to define a programme of characterisation work, and to develop the strategy. The work is being done in conjunction with BNFL. BNFL intends to sink boreholes around the Windscale site and will be providing historical information. To cover the longer term costs beyond the 10 year period, UKAEA has included an allowance in the Liabilities Estimate reflecting a notional remediation cost per unit area (based on work done at Harwell). The work is timed to follow the actual decommissioning of individual facilities.

264 **Winfrith:** A programme covering surveying and remediation is included in the Liabilities Estimate running to 2019. Beyond 2019, the only facilities remaining will be the main store and the reactors and, as with Harwell, any residual contamination will be removed as part of final decommissioning.

265 In addition, to support the sites in developing their strategies for contaminated land management, there is a central team looking at standards, technology and management tools.

266 It is clear from the foregoing that this is very much an area of work in progress. There are uncertainties about the extent of any land remediation required, but this will be reduced when planned survey work is complete. Consequently, NII considers it essential that, in the period up to the next quinquennial review, UKAEA presses forward with the surveys and planning necessary to produce a robust estimate of liabilities in this area.

### **4.3 Liabilities Estimate and bidding for funds**

267 This section of the report examines how the costings derived through the processes described in the preceding section are aggregated with other nuclear liability streams to produce the total nuclear Liabilities Estimate for UKAEA, and how funding for decommissioning is secured in practice.

## **Accounting requirements**

268 UKAEA is a statutory corporation, not a Companies Act company. However, it prepares its accounts in accordance with a Treasury direction issued in 1996 in pursuance of section 4(3) of the Atomic Energy Act 1954. (The text of the Treasury direction is appended to UKAEA's Annual Report and Accounts in Ref 32.) The direction requires, inter alia, that the accounts should be prepared in accordance with the Companies Act 1985 and generally accepted accounting practice in the UK.

269 Requirements on accounting for provisions and contingencies are set out in Schedules 4 and 4A of the Companies Act 1985. 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.”*

270 In terms of current accounting standards, Financial Reporting Standard 12 (FRS12) (Ref 33) requires companies to make provision to cover liabilities which are of uncertain timing or amount, a description which encompasses nuclear decommissioning and waste management liabilities. The need to recognise a provision will arise if:

- there is a present obligation; and
- it is probable that a transfer of economic benefits will be required; and
- 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.

271 In addition, Schedule 2 of the Treasury direction mentioned above (which predated the introduction of FRS12) sets out specific disclosure requirements in relation to nuclear liabilities, as follows:

*“The UKAEA is responsible for decommissioning nuclear facilities, reprocessing irradiated fuel and disposing of nuclear wastes, the estimated costs of which shall be disclosed as a liability in the balance sheet. The amount of the liability shall be calculated after discounting the total estimated costs at a rate to be agreed with the Treasury. The notes to the accounts shall disclose:*

*(a) a brief description of the nature of liabilities and the period over which the costs are expected to be incurred;*

*(b) the undiscounted amount of the costs;*

*(c) changes year on year in the estimated costs of dealing with the liabilities, identifying the nature and extent of these changes;*

*(d) the ageing of liabilities over the following periods:*

*0-3 years (PES period)<sup>2</sup>*

*4-10 years (planning period)*

*> 10 years;*

*(e) details of how the costs of meeting the liabilities are to be funded and an analysis of the liabilities by source of funding."*

### ***Producing the Liabilities Estimate***

272 UKAEA uses a bespoke database, the Strategic Planning System (SPS), to produce the Liabilities Estimate. In effect SPS brings together:

- plant costings (derived as described in section 4.1 of this report);
- waste management costs, including storage, processing, transport and disposal (section 4.1) - (of which UKAEA's share of deep disposal costs amounts to approx. £1bn, undiscounted);
- the costs of dealing with UKAEA's historic liabilities on BNFL sites (these estimates are generated by BNFL, not UKAEA); and
- any other corporate costs which need to be taken into account.

There is a systematic approach to updating the SPS annually so that it reflects any movements in costs. All proposed changes are subject to scrutiny via a change management control procedure.

273 At 31 March 2001, UKAEA's liabilities for decommissioning and the treatment and disposal of nuclear waste stood at £8.7bn. This figure is quoted in Note 18 - Nuclear Liabilities - to UKAEA's accounts for 2000/01 (Ref 32).

### ***Discounting***

274 In line with standard accounting practice, the decommissioning cash flows established through the Liabilities Estimate are discounted back to the balance sheet date to produce the Net Present Cost (NPC). It is this figure which appears in UKAEA's balance sheet.

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<sup>2</sup> PES (Public Expenditure Surveys) have been superseded by a Comprehensive Spending Review process.

275 As a statutory corporation operating under the aegis of a Government department (DTI), UKAEA observes the approach to investment appraisal which is set out in the Treasury Green Book (Ref 34). Currently, the Green Book sets the discount rate at 6%, and this is linked to an assessment of the rate of time preference for public investment. The figure of £3.3bn which is given in the UKAEA balance sheet for 2000/01, is the NPC for the liability using the guideline 6%.

276 The 6% figure is significantly higher than discount rates used in the private sector which are linked to the cost of capital. For example, the BNFL Group currently uses a real discount rate of 2.5% in calculating the NPC of its nuclear liabilities.

277 The ability to fund the discharge of nuclear liabilities is bound to be a factor in shaping licensees' decommissioning strategies. In principle at least, the adoption of a relatively high rate is a matter of some concern, particularly when it is applied over the extended periods involved in nuclear decommissioning and site remediation. Application of a high discount rate over a long period will make it attractive to defer final dismantling for as long as possible, even though this may have drawbacks for health, safety and the environment. Unless this risk is recognised and mitigated in the optioneering process, it can overwhelm the other factors considered by the licensee in choosing a decommissioning strategy.

278 Over recent months, the Treasury has circulated to Government departments for comment the draft of a revised Treasury Green Book. The section on discounting has been updated to reflect recent thinking and proposes the introduction of lower discount rates for projects which have intergenerational implications or where the timescale of costs are substantially different from the timescale of benefits. As noted in para 275, the estimate of UKAEA's liabilities discounted at 6% is £3.3bn. The comparable figure using the proposed discount rates is £4.7bn.

279 NII has examined a sample of UKAEA's option studies. The factors considered in this process are essentially:

- compatibility with UKAEA's decommissioning strategy and objectives;
- effect on other projects;
- complexity; and
- finance and economic factors (including the effect of discounting).

280 One of NII's concerns in optioneering studies is that the weighting applied to financial and economic factors can bias the results towards deferral of decommissioning. UKAEA has acknowledged this risk but believes that its optioneering procedures are sufficiently balanced to ensure that discounting does not play a disproportionate role in the assessment of options. In fact, UKAEA argues that a realistic assessment of the infrastructure costs consequent upon deferral of decommissioning can largely offset the potential 'benefit' of discounting actual decommissioning costs over a longer timeframe.

281 In the optioneering studies examined by NII, the sensitivity to the effect of discounting has been addressed. This took the form of comparing the cashflows discounted at the Green Book rate of 6% against the same cashflows discounted at the proposed lower rates. In the cases reviewed, there was no evidence that the discount rate had been the determining factor in the selection of the preferred option.

### ***Audit arrangements***

282 UKAEA's Report and Accounts (Ref 32) for the period to 31 March 2001 were audited by the National Audit Office. In his report attaching to the accounts the Comptroller and Auditor General indicated that the basis of audit opinion included:

- examination, on a test basis, of evidence related to the amounts and disclosures in the accounts;
- assessment of the significant estimates and judgements made by the Directors in the preparation of the accounts; and
- assessment of whether the accounting policies were appropriate to the Authority's circumstances, consistently applied and adequately controlled.

NII understands that the auditors' examination of evidence included a significant sample of the studies underpinning the Liabilities Estimate.

283 The Comptroller and Auditor General indicated that in his opinion the financial statements gave a true and fair view of the state of affairs of the United Kingdom Atomic Energy Authority. The audit opinion was not qualified in any respect.

### ***Obtaining funding***

284 In the case of a commercial entity, the Liabilities Estimate would provide the basis for establishing a provision (see paras 269 and 270), possibly through some form of earmarked investment portfolio. However, for UKAEA there is a dichotomy. In accordance with the Treasury direction, UKAEA includes the statement of all foreseeable nuclear liabilities in its accounts. By a considerable margin, it is the largest item on UKAEA's balance sheet and it is consolidated into DTI's resource accounts (Ref 35). However the Liabilities Estimate does not drive the funding arrangements directly. Instead, because Government expenditure is funded in-year from current revenues, UKAEA secures the necessary moneys from DTI through a bidding process which has a much shorter timeframe.

285 According to UKAEA's accounts, £3.16bn of the discounted liability of £3.3bn is recoverable from the Department of Trade and Industry under a Letter of Understanding issued by the then Secretary of State for Energy in 1986 and reconfirmed by DTI in June 1996. This undertaking is reflected in DTI's own published accounts.

286 The remainder of the liability shown on UKAEA's balance sheet (£0.13bn<sup>3</sup>), is recoverable from other customers or financed from up-front payments received by

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<sup>3</sup> see Note 18 to UKAEA's accounts for 2001/02

UKAEA. It is understood that the bulk of these liabilities reside with the Ministry of Defence (MoD) and include, for example, the decommissioning of the Windscale Piles.

287 A debtor is included on UKAEA's balance sheet for contributions receivable from the DTI and from other customers. In practice, UKAEA's clean up activities are currently funded via grants and grant-in-aid from DTI and MoD. Budgets for these payments are determined every three years as part of the Government's spending review cycle and are based on a forward plan of UKAEA's activities discussed with its principal regulators. However, the dynamic nature of the situation means that there are arrangements between UKAEA and DTI for agreeing the funding required each year to meet an agreed programme of work.

288 The annual expenditure to discharge liabilities is currently running at about £200 m, which represents little more than 4% of DTI's annual expenditure of £4.7 bn (Ref 35). UKAEA asserts that DTI has never failed to provide it with the funds required to progress its operations safely. Theoretically, in a tight spending round, DTI as the budget holder could seek to defer decommissioning where there is no immediate adverse effect on safety, rather than to secure a progressive reduction of hazard. However, DTI Ministers have previously given public assurance that UKAEA will be provided with adequate resources to ensure safety at all of its sites.

### **Overview**

289 In summary, overall funding for decommissioning at UKAEA sites is underwritten by Government and so is secure. Arrangements are place for agreeing funding required each year to meet an agreed work programme.

## **4.4 Future developments**

290 It is in the nature of QQR submissions that they present a snapshot of the licensee's decommissioning strategy and its funding arrangements as at the date of submission to HSE. HSE's assessment, conducted on that basis, has highlighted some concerns including the application of a discount rate which is significantly higher than is used in the private sector, and funding arrangements which could theoretically inhibit early action on decommissioning projects. These concerns have, however, been recognised by the Government and this section is included in this report in order to give a balanced view and to indicate the way in which the situation might develop in the period to the next decommissioning QQR of the sites falling within the scope of this report.

### **Funding**

291 The Government's intention to create a Liabilities Management Authority (LMA) following the DTI's quinquennial review of the role and function of UKAEA was referred to in paras 47 to 50. The Government White Paper on the setting up of the LMA notes, at para 6.7, that:

*"Managing nuclear liabilities cost effectively requires financial flexibility and competent long term planning. There is some flexibility within the budgetary settlements agreed with funding departments as part of the Spending Review*

*process but three year settlements are, almost always, shorter than the timescale for major decommissioning projects. In the past, nuclear clean up has also been seen as a low priority for funding purposes relative to other programmes. Experience to date with UKAEA has therefore been that settlements have tended to be the minimum necessary to address safety and environmental needs and that limited funding has been available for other projects."*

This very much accords with HSE's perception of the drawbacks of the present funding arrangements.

292 Against this background, one of the key aims of the LMA will be to systematically and progressively drive forward the clean up of the nuclear legacy. The Government has taken the view that, in order to do this, the LMA will need funding arrangements which:

- underline the Government's commitment to nuclear clean up and help to build public confidence;
- enable the LMA to drive forward the clean up process with the flexibility required to facilitate optimal work programmes; and
- encourage the creation of an active market through giving contractors the confidence that funding will be available over a period of years.

The White Paper indicates that two main options are being considered in order to meet those requirements: a segregated fund or the on vote account as outlined in paras 293 and 294 respectively.

293 Segregated Fund: A segregated fund for clean up would broadly follow the concept of the decommissioning fund operated by British Energy, in that money paid into the fund would be invested and the accumulated assets used to meet future decommissioning and clean up costs. The statute setting up the fund would define its scope and purpose and prevent moneys within it being used for other purposes. Annual payments from Government into the fund would be set at a level which ensured that the value of the fund was maintained within defined limits reflecting the LMA's future spending projections. Detailed work is required on the value of the fund and the basis on which its assets would be invested. Currently, the Government sees no point in providing for 100% of the liabilities from the outset.

294 On-vote account: The on-vote account would effectively involve establishing a "savings pot" for clean up within the Consolidated Fund, the Government's 'current account' kept by the Treasury at the Bank of England. An on-vote account would be similar to a segregated fund but the funds would be notional. Payments into and out of the account would, in practice, be transfers within and payments out of the Consolidated Fund. A claim on the moneys in the account would be established in statute, which would also provide that moneys drawn from the account could only be used to fund the LMA's clean up programme and related expenditure. Like the segregated fund option, the on-vote account would be a rolling account. The Government would set aside sums of money which it would credit to the account on

an ongoing basis to replenish moneys withdrawn and ensure that the fund was maintained within defined limits reflecting the LMA's future spending projections.

### ***Discount rate***

295 The LMA will bring together the liabilities of UKAEA and the BNFL Group (including Magnox Electric). This will expose material differences in the way in which the two organisations cost, aggregate and discount their nuclear liabilities. It is anticipated that the LMA will want to impose a consistent framework across the liabilities within its ambit, and this will include the convergence of discount rates.

296 As noted in para 275, UKAEA employs the Treasury time preference rate for public investments, currently 6%, whilst the BNFL Group applies a commercial discount rate of 2.5% to its decommissioning cashflows. High discount rates can have a marked impact on the timing of decommissioning. It is assumed that the LMA (as a Non Departmental Public Body) will be required to adhere to the Treasury time-preference rate. If this is indeed the case, HSE believes it is highly desirable either that the Treasury implements its proposals to revise downwards the discount rate specified by the Green Book (see paras 277 and 278) or that the LMA secures Treasury approval to employ a more appropriate rate than the current 6%.

## **5 CONCLUSIONS**

297 This section draws together the issues identified in sections 3 and 4, discusses their significance in the context of UKAEA's current site strategies and the Liabilities Estimate, and draws overall conclusions.

298 NII considers that UKAEA's site strategies are comprehensive in terms of their scope, and it unlikely that there are any significant liabilities yet to be identified. Some liabilities, however, require further characterisation. All the sites have site decommissioning programmes at various levels of development and detail. All these programmes require further development and integration, in particular, the Windscale programme (which is the least well developed). In addition, results of project risk assessments need to be incorporated further. This tends to push project dates back, by an amount which can vary considerably depending on the project concerned, and could also increase operational durations.

299 UKAEA updates its Liabilities Estimate yearly but it is inevitable that the Liabilities Estimate lags behind the changes to the site strategies. The Liabilities Estimate in the quinquennial review submission is based on the pre-risk assessment version of the DSRP and on the Dounreay strategy for fuels (Ref 20), which has now been ruled out. NII believes that the final cost for the treatment of fuels is uncertain. It is also noted that a significant increase in the cost of the Pile 1 decommissioning project is likely, however, the Liabilities Estimate in the current quinquennial review does not yet take this into account. In accordance with its procedures, UKAEA will incorporate the revised costs, associated with the management of fuels and the decommissioning Pile 1 in the Liabilities Estimate in the year that new strategies are approved.

300 NII believes that UKAEA has appropriate tools for the production of the Liabilities Estimate, for example, the use of the computerised PRICE system for

estimating the decommissioning costs of individual facilities. This ensures a consistent approach to cost estimation. However, there is no systematic application of PRICE across all UKAEA's sites.

301 The procedures by which UKAEA produces cost estimates for decommissioning individual facilities are considered to be sufficiently detailed and robust and adaptable to changes. Generally, the level of detail in the estimates is appropriate to the time at which the facility is to be decommissioned. However, there are some significant facilities on the Southern Sites for which only preliminary cost estimates exist and these are several years old. UKAEA should review these estimates and adopt a systematic approach to updating estimates of liabilities.

302 UKAEA should review and, where necessary, revise its strategies in the light of DTI's updated guidance on the economic appraisal of decommissioning projects in the public sector. NII understands that this updated guidance is likely to recommend the use of a lower discount rate to that currently used in UKAEA's optioneering studies. In general, this would tend to weaken the economic argument in favour of deferral and could result in some projects being brought forward. However, in the optioneering studies sampled by NII for this review, it was apparent that the discount rate had not been the determining factor.

303 One of NII's fundamental expectations is that there should be a systematic reduction of hazard and one of the major contributions to this is the retrieval and treatment of waste and other nuclear materials into a state of passive safety. In the case of Dounreay, the project timescales in the DSRP are generally considered to be consistent with NII's expectation that decommissioning and waste retrieval should be undertaken as soon as reasonably practicable. However, there are several important projects for which a further acceleration of the timescales would be welcomed, if found to be reasonably practicable.

304 In the case of the Southern Sites, with the exception of those reactors for which further decommissioning is to be significantly deferred, in general, the timescales set down in UKAEA's programmes are considered to be as soon as reasonably practicable. On the other hand, UKAEA has not provided sufficient justification for the deferral periods proposed for some of the reactors on its Southern Sites and why it is not reasonably practicable to complete the decommissioning of these reactors earlier than currently proposed. The reactors in question are SGHWR and DRAGON at Winfrith, DIDO and PLUTO at Harwell, and Piles 1&2 and WAGR at Windscale. Furthermore, recent studies on the radioactive inventories of the structural materials of some reactors (eg Piles 1&2 and GLEEP) has shown that more waste will be produced in the higher waste categories than had previously been estimated. This has not yet been taken into account in the current strategies and has a potential impact on disposal routes and costs, and the rationale for the timing of decommissioning.

305 Due to the diverse nature of the facilities on UKAEA's sites, future decommissioning work ranges from relatively small-scale tasks, using established techniques, to large-scale waste retrieval and decommissioning projects for which unique solutions will need to be developed. The technical challenges posed by these operations therefore vary significantly depending on the facility concerned. For example, the decommissioning of the fire-damaged Pile 1 at Windscale and

retrieval of waste from the Dounreay Shaft, are arguably two of the most technically challenging decommissioning projects in the UK. These projects have not yet reached the implementation stage and the main technical challenges are, therefore, yet to come. Projects of this type have large project risks associated with them. However, as the implementation work progresses, the uncertainties associated with them should progressively decrease.

306 The achievement of UKAEA's proposed timescales to achieve a state of passive safety at its sites depends on several new facilities being constructed and brought into operation on time. NII expects UKAEA to meet these timescales. Most of these new facilities are at the early stage of the design and there is some uncertainty as to their final cost. Furthermore, some projects will not be implemented until several years into the future which introduces additional uncertainties.

307 UKAEA has developed strategies for most of the wastes on its sites but, for some wastes, final decisions have not yet been made on their treatment strategies. Some of the options being considered would result in consequential changes elsewhere in the strategies (for example, a possible additional ILW store at Winfrith) which could increase costs. NII also believes that UKAEA should plan for an additional store at Windscale. This would also increase costs.

308 The strategy for some materials depends on them being transferred to other sites, notably Sellafield, for treatment. There is a potential conflict between UKAEA's objective of achieving a state of passive safety on its sites in the next few decades and its reliance on another licensee's sites. This is because it has not yet been demonstrated with any certainty that the materials concerned will be removed from the UKAEA sites within the timescales assumed. This introduces risks to achieving parts of the UKAEA strategies which need to be resolved.

309 Disposals costs are a significant proportion of the Liabilities Estimate, as UKAEA's share of deep disposal costs is estimated to be about £1 billion compared to the total estimated costs of discharging UKAEA's liabilities which is £8.7 billion (undiscounted as of March 2001). Any significant increase in the cost of disposal, or the quantity of waste destined for disposal, would have an effect on the total Liabilities Estimate.

310 NII believes that a more widespread application of UKAEA's Care and Maintenance Guidance Document (AECF 1085) is required for redundant facilities. It is also noted that UKAEA is currently updating its facility safety cases to bring them in line with modern practice. If it was not possible to make an acceptable safety case for an individual facility in the future, and any remedial work to make the case was not economic, then the decommissioning timescale for that facility would need to be brought forward. At the current time, NII has no evidence to suggest that this may be necessary: however, the possibility cannot be ruled out.

311 As regards the detailed documentation of its strategies, NII's judgement is that UKAEA needs to produce a more robust justification of its strategies, in particular, the proposal to defer further decommissioning of some major facilities. In addition, the auditable trail from the top tier strategies down to the more detailed underlying

documentation needs to be improved and there were a number of examples where the underlying documentation had not been kept up-to-date.

312 Although the Windscale site is adjacent to the much larger Sellafield site, little evidence of integration of the Windscale and Sellafield strategies and arrangements was found. Examples were found where the removal of some material had been delayed as a result of difficulties in obtaining the necessary administrative clearance for transfer to Sellafield facilities.

313 There are several risks and uncertainties, that UKAEA recognises, which could impinge upon UKAEA's strategies and Liabilities Estimate in the future, a number of which are not wholly under UKAEA's control. A significant uncertainty is lack of clarity on certain aspects of Government policy for radioactive waste, such as the long term management option for ILW. Other risks and uncertainties include: possible planning inquiries; funding provisions; social factors; availability of suitably experienced personnel; changes resulting from the formation of the LMA; the implementation of the OSPAR agreement with respect to both liquid and aerial discharges; the disposal of VLRM; the management strategy for PCM and other interactions with BNFL; and the effect of the Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999.

314 NII's overall conclusion is that the strategies proposed by UKAEA for the decommissioning and remediation of its highly diverse sites are generally appropriate. The scope of the strategy for each site is believed to be comprehensive, although for some liabilities final decisions are yet to be made on the management strategy. The strategies are largely consistent with current Government policy (Cm 2919) and are generally sufficiently flexible to be adapted to take account of changing circumstances. The project timescales are generally considered to be consistent with NII's expectation that decommissioning and waste retrieval should be undertaken as soon as reasonably practicable, however there are a number of projects for which an acceleration of the timescales would be welcome, if found to be reasonably practicable. There are also a number of facilities for which UKAEA needs to produce more robust arguments for why they cannot be decommissioned earlier.

315 There are a number of areas where UKAEA needs to develop and update its site strategies and Liabilities Estimate before the next quinquennial review. NII will progress these issues with UKAEA as part of its routine regulatory work. In the longer term, there are significant risks and uncertainties associated with the site strategies and liabilities, a number of which are not wholly within UKAEA's control. A future increase in the Liabilities Estimate cannot be ruled out.

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