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Report to the Planning Inspectorate
APP/H9504/X/02/514182

Public Inquiry: Trawsfynydd Nuclear Power Station - Proposed ILW Store and Reduced-Height Safestore - Assessor's Report

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Report History

This document has been prepared by Dr. Daniel A. Galson of Galson Sciences Limited for the Planning Inspectorate under the terms of project APP/H9504/X/02/514182.

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1 Introduction

1. The National Assembly for Wales (NAW) and the Secretary of State for the Department of Trade and Industry (DTI) called in an application from Magnox Electric plc that consisted of the following proposals:

   i. Reduction in the height of the reactor buildings at the Trawsfynydd Nuclear Power Station from the existing 55 m to about 35 m to form a Safestore. This work would include recladding of the reactor buildings by removing existing concrete cladding and replacing this with local slate, stainless steel panels and glazing. It would also include reroofing of the reduced-height buildings in a new curved configuration.

   ii. Construction of a new store to hold intermediate-level radioactive waste (ILW) produced from the operation of the two nuclear reactors on the Trawsfynydd site. This store would replace the existing on-site ILW stores.

2. The NAW requested advice from the Inquiry Inspector on the following topics:

   i. The visual, environmental and access implications of the proposed development on the site and surrounding areas during construction and thereafter, including the effects on ecology and the aqueous environment.

   ii. Provisions to prevent the accidental release of radioactivity from the ILW store.

   iii. Alternative options for interim storage of ILW.

   iv. The impact of the use of explosives, if required for excavation works.

3. This report focuses on those parts of the application dealing with topics (2) and (3), but takes them in reverse order in the sections that follow. The report discusses a range of other technical issues that bear on the planning decision to be taken. It also includes consideration of issues that were discussed and that may be of wider interest to decision makers, but which are not necessarily determinative of the planning decision to be taken on the Applicant's proposals.

4. The Public Inquiry was held in the period 12-22 November and 10-12 December 2003. I was present at all of the Inquiry sitting days except the afternoon of 14

November and the morning of 15 November, when the Applicant presented evidence on planning and visual matters and was cross-examined on that evidence. In addition, I participated in a pre-Inquiry and a post-Inquiry site visit, on 11 November and 13 December 2003 respectively. During these visits I was able to observe the inside of the reactor buildings, the existing ILW storage areas, the site of the proposed ILW store, and the ongoing decommissioning work.

1.1 Background to Decommissioning

5. Decommissioning of Magnox power stations[1] can be considered to consist of three main stages:

   Stage 1 *Care and Maintenance Preparations*. During this stage, the spent fuel in the reactor core and in any on-site temporary store (cooling pools) is removed from the site and sent to Sellafield for further processing, and all necessary preparatory work is undertaken for the subsequent Care and Maintenance phase. At Trawsfynydd, the spent fuel has already been sent to Sellafield, but further preparatory work remains to be done before the site can enter the Care and Maintenance phase.

   Stage 2 *Care and Maintenance (Safestore)*. During this stage the reactor pressure vessel and biological shield, and any other radioactive waste stored on site, are maintained in a passively safe state until such time as all radioactive substances can be removed, and the site cleared. The duration of this stage depends on how long final dismantling of the reactor is delayed, and the availability of alternative, off-site long-term management options, such as an alternative disposal option.

   Stage 3 *Final Site Clearance*. During this stage, the reactor building and its contents are fully dismantled, the site is cleared of remaining radioactive substances, and the licensee must demonstrate that there is "no danger" from any residual materials remaining on site.

6. The timing and extent of work in each of these stages will need to be considered in detail on a site-by-site basis. The Planning Application concerns some of the further preparatory work within Stage 1 decommissioning at the Trawsfynydd site. This work is needed before placing the reactors in a period of extended Care and Maintenance (Stage 2).

7. Current Government policy on decommissioning is set out in the 1995 White Paper on radioactive waste management policy (Cm 2919, Document 20, para. 124):

[1] Although this description is specific to Magnox reactors, similar decommissioning stages are envisaged for other reactors in the UK.

> *"The Government believes that, in general, the process of decommissioning nuclear plants should be undertaken as soon as 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."*

8. The Nuclear Installations Inspectorate (NII) of the Health and Safety Executive (HSE) is responsible, in consultation with the Environment Agencies, for reviewing the decommissioning strategy of all nuclear operators on a quinquennial basis (Cm 2919, para. 126), and the NII has so far conducted two such rounds of quinquennial review.

9. Government policy on radioactive waste management is currently under review, through a national consultation led by the Department of the Environment, Food and Rural Affairs (DEFRA) (Document 24). This consultation is due to run until about 2006, at which time a new White Paper will be produced to replace Cm 2919.

10. The Government is also in the process of reorganising the management, funding and ownership of publicly held nuclear liabilities, as reported by the DTI in Cm 5552 (Document 25), which highlights the proposed establishment of a Liabilities Management Authority (LMA). Thus, the management and funding of Trawsfynydd decommissioning will be transferred in the next few years from British Nuclear Fuels plc (BNFL), the current owner of Magnox Electric plc, to the LMA.

11. A distinguishing feature of the Trawsfynydd site is its location in a National Park. Trawsfynydd is the only nuclear power station so sited. The site location has significantly influenced the Applicant's proposals on visual aspects of Stage 1 decommissioning and the ILW store.

1.2 Plan of the Report

12. This report consists of the following sections:

Section 2: A discussion of alternatives to the Applicant's proposals, and uncertainties associated with the Applicant's decision-making process.

Section 3: Implications for the Applicant's proposals of the uncertainties associated with establishment of a national repository for ILW.

Section 4: Implications for the Applicant's proposals of the uncertainties associated with the establishment of the LMA.

Section 5: Implications of the Applicant's proposals for future decommissioning strategy.

Section 6: Implications of the Applicant's proposals for risks to human health and the environment.

Section 7: Summary of conclusions concerning risks and benefits of the Applicant's proposals, and some thoughts on a possible Planning Condition providing for time-limited approval of the ILW store.

Section 8: References.

2 Alternatives for ILW Storage

13. The Applicant's proposals involve development of a new ILW store on site to take packaged ILW from reactor operations, and reduction in roof height of the two reactor buildings and placement of the contents – including the reactor pressure vessel and biological shield - into a so-called Safestore configuration:

    i. The ILW store would consist of a large building containing several thousand shielded waste packages of various types. The main function of the ILW store would be to ensure that the radioactive substances making up the operational ILW remain in a state of passive safety[2] until such time as a national repository or a centralised store is available. As each waste package, either by design (Type 1803 drums) or by its incorporation within a shielded overpack, largely has its own radiation shielding, the main function of the building envelope would be to provide weatherproofing, although some radiation protection would also be afforded.

    ii. The Safestore consists of the reactor pressure vessel, the biological shield, external items that have become contaminated during reactor operations (such as the gas ducts and boilers), and the reactor building itself. The main function of the reactor pressure vessel and biological shield is to ensure that they and the radioactive substances within are maintained in a state of passive safety3 until such time as the reactors are dismantled. The main function of the building during the Safestore period is to provide weatherproofing, although some further radiation protection is also provided for contaminated items external to the biological shield, such as the cooling systems.

14. Thus, common functions of the operational ILW store and the Safestores are to provide passive safety for the radioactive substances contained within for extended periods, at least until such time as a deep repository or centralised store becomes available. Any alternatives to the Applicant's proposals would have to provide the same functionality.

15. This section discusses the concept of the Best Practicable Environmental Option (BPEO) as applied to the Applicant's proposals (Section 2.1), and considers alternative options to the Applicant's proposals for operational ILW storage (Section 2.2) and decommissioning (Section 2.3).

[2] The evidence of the NII indicates that passive safety is achieved when radioactive wastes and materials have been immobilised in a form that is physically and chemically stable and stored in a manner that minimises the need for control and safety systems, maintenance, monitoring and human intervention. The wastes and materials should be stored in discrete packages that are resistant to degradation and hazards, and which can be inspected and retrieved for final disposal.

[3] The NII does not clearly define what passive safety means when referring to the reactor pressure vessel and biological shield. This is an area of ongoing discussion with nuclear operators.

2.1 BPEO

16. The Applicant argued that the BPEO process was not relevant to planning and, that in any event, the proposals had been demonstrated to be the BPEO. I consider these arguments to be erroneous.

17. The BPEO process has been defined by the Royal Commission on Environmental Pollution (RCEP) as "…the outcome of a systematic consultative and decision-making procedure which emphasises the protection of the environment across land, air and water. The BPEO procedure establishes, for a given set of objectives, the option that provides the most benefit or least damage to the environment as a whole, at acceptable cost, in the long as well as the short term." (RCEP 1988). The RCEP stressed the principles of openness, accountability, public involvement, and consultation in the BPEO process. The RCEP reinforced these principles a few years ago (RCEP 1998).

18. The concept of BPEO is relevant to planning decisions. The general thrust of evolving Government policy is increasingly to recognise the importance and value of the BPEO process in general waste management decisions, and the value of BPEO is recognised in planning documents. Furthermore, while the Government has not yet clearly defined the role of BPEO for radioactive waste management decisions, it is clear that exercise of the BPEO process as an adjunct to decision-making can help ensure that Government policy, as set out in Section 1.1 above (Cmd 2919, Document 20, para. 124), will be met. In my view, given the environmentally sensitive location of the Trawsfynydd site, the range of options potentially available, the costs, the long-term implications of planning approval, and not least the public interest in the Applicant's proposals, the BPEO process is particularly relevant to this application.

19. The Applicant has not produced a BPEO study to justify construction of the ILW store or the works to the reactor buildings. The Applicant did conduct a multi-attribute decision-aiding analysis (MADA) in 1998 to aid decision-making on **generic decommissioning strategy for Magnox reactors**. The MADA was limited in that it only involved internal deliberation, did not consider the principles of intergenerational equity and sustainability as attributes directly, and, because it was generic, did not consider National Park purposes explicitly. Thus, the MADA is not the same as a BPEO study, because the MADA does not meet the basic definition of BPEO, in particular the requirements for openness, public involvement and consultation. Also, the Applicant's MADA on decommissioning strategy was not specific to the Trawsfynydd site. In any event, although requested by several third parties, the Applicant withheld the MADA from the Inquiry on the grounds of commercial confidentiality. The Applicant did provide a summary of the MADA; this was insufficient to pass detailed judgement on its merits, but it was sufficient for the Inspector to determine during the Inquiry that access to the MADA was not necessary in order to make a decision on the Applicant's proposals.

20. With regard to the **ILW store**, any analysis of alternatives, such as there might have been, is even less transparent: the Applicant's evidence does not indicate that any similar generic or site-specific MADA procedure was followed.

21. Having said this, I consider that the lack of a BPEO for either the proposed reactor works or the ILW store should not preclude planning approval. The Inquiry was able to examine the Applicant's proposals at face value, and the information on alternatives provided by the Applicant in their evidence. A rigorous examination aimed at ensuring that the best practicable option was being pursued would, however, require more detailed examination of a site-specific MADA for site management, and possibly the conduct of a BPEO study by the Applicant. In this case, the reduced footprint options that the Applicant's evidence shows were discussed in the generic MADA for reactor decommissioning would particularly merit closer examination. These options would reduce significantly the bulk of the reactor buildings during the Care and Maintenance phase, compared to the Applicant's proposed option. I return to this in Section 2.3.

2.2 Alternatives to the Proposed Store for Operational ILW

22. The Applicant has presented only a single alternative - the fallback option - to construction of a new store for operational ILW in shielded overpacks. The fallback option involves the use of existing buildings, including the reactor buildings, to store operational ILW. However, the NII in its evidence strongly argued that the fallback option would not be acceptable, citing a range of safety concerns; the fallback option is therefore not a credible alternative, as it would not meet regulatory expectations. Credible alternatives must consist of alternative types of modern, purpose-built stores. Such options could include:

    i. *Construction of a store where the waste packages were themselves unshielded, and where most of the shielding was provided by the storage building itself (referred to as a shielded store below)*. There are few precedents in the UK or in other countries for the type of overpack ILW store proposed by the Applicant. Although such a store would appear to be capable of meeting regulatory requirements, the size of such a store would likely be larger than that required for a shielded store, for the same volume of raw (unpackaged) radioactive waste. Moreover, the use of a concept involving shielded waste packages generates more waste, in that the shielding materials themselves become contaminated, leading to greater volumes requiring disposal. It is possible that the life-cycle cost of a shielded store would be less than the cost of the proposed option, because of the ability to dispense with waste package shielding materials (e.g., overpacks) and the reduced disposal costs.

    There are many design alternatives to choose from if a shielded store is considered. Importantly, unshielded waste packages would occupy less volume and, because of the adverse radiation environment within the store, periodic inspection would be done largely by remote means (e.g., remotely operated camera), so that the waste packages could also be more tightly

spaced. Thus, a smaller building would be required than in the Applicant's proposed option, even assuming some of the store volume was used for already existing shielded waste packages.

ii. *Construction of a partially or largely underground store*. This would have the benefit of reducing visual impact even further, and could also *reduce* the risk of aircraft impact, but may not satisfy regulatory requirements for passive safety (for example, owing to the storage of waste below the water table).

iii. *Storage of Trawsfynydd ILW elsewhere*. This option is outwith the terms of reference of the Inquiry. It would not satisfy the proximity principle, and is currently not the Applicant's policy. However, this option would clear the site of operational ILW in the near-term, and could be considered to be the most consistent with National Park purposes.

The converse – that ILW from other nuclear sites might be stored at Trawsfynydd – was discussed at the Inquiry. There was general agreement that this would not be appropriate, and that any store at Trawsfynydd should be of a size that it could comfortably accommodate the operational ILW from Trawsfynydd, but no more. I agree with this sentiment. Furthermore, given the Applicant's proposed overpack design, the uncertainties in waste volume (Document 52), and the need for adequate monitoring and inspection room within the store, I am satisfied that the sizing of the store is acceptable.

23. The limited discussion of storage alternatives means that the Inquiry was really only presented with one credible option: the construction of the proposed store for ILW in shielded packages. The lack of a BPEO study or other credible examination of alternatives for the management of operational ILW means that the assessment of the Applicant's preferred option must be on face value. And on these grounds it must be preferable to the fallback option - not least because the fallback would not be acceptable to the regulator. It is unclear though, from the evidence presented to the Inquiry, how seriously the Applicant considered other storage options for the Trawsfynydd site.

2.3 Alternatives to the Proposed Reduced-Height Safestore

24. At the close of Stage 1 decommissioning, the reactor pressure vessel and biological shield consist of radioactive substances that would be classified as low-level radioactive waste (LLW) or ILW. With time and radioactive decay, radioactive substances that would be classified as ILW will become LLW, so that as Stage 3 decommissioning is delayed, the quantities of ILW from decommissioning will decrease and the quantities of LLW will increase. Although it may be possible to ship LLW generated during decommissioning to the Drigg disposal facility in Cumbria, in practice this could only be done for a portion of the waste owing to volume and inventory restrictions at Drigg. A new national LLW disposal facility will be required in order to clear reactors of all of the LLW that will be generated during decommissioning. Without a national facility for

ILW, the packaged ILW generated during decommissioning would also need to be stored on site. Thus, in practice, there are three main alternatives for Stage 3 decommissioning:

i. Retention of the radioactive materials *in situ*, at least until such time as the necessary national facilities are available, with a significant deferral of Stage 3 decommissioning (the Applicant's preferred option).

ii. Early Stage 3 decommissioning and development of new waste stores to accommodate the packaged LLW and ILW that would be produced. "Early" could mean any time prior to development of new national facilities for LLW and ILW. The Applicant has estimated that the stores required to hold decommissioning waste in packaged form would need to have a height of the same order as that of the proposed reduced-height Safestores (Document 51) - this assumes the use of shielded overpacks.

iii. Leaving the radioactive materials *in situ* indefinitely, with some type of engineered barrier system emplaced around the reactor pressure vessel and biological shield (also known as "Mounding"). Although the nuclear operators have considered this option in the past[4], both the Applicant and the NII have now discounted it.

25. The Applicant justifies its proposal to lower the roof height of the reactor buildings based largely on the desire to improve the visual appearance of the reactor buildings during an extended Safestore period (nominally 100 years). This justification takes specific notice of the location of the nuclear licensed site in a National Park.

26. The Applicant argued that the proposal bears no relation to overall decommissioning strategy, as long as it can be shown that no aspect of the proposal forecloses, technically or economically, earlier Stage 3 decommissioning. This argument is not entirely correct however. In particular, if the preferred decommissioning strategy were to change to favour immediate or very early Stage 3 decommissioning, then the case for reducing the roof height of the reactor buildings to improve visual appearance weakens, more so as the timetable for Stage 3 decommissioning is brought forward.

27. Important drivers for early Stage 3 decommissioning are the principles of sustainability and intergenerational equity: as a society, we should not be passing on problems to future generations. To the extent that it is practicable, we should also ensure that the generation that benefits from a practice (electricity from nuclear power generation) takes responsibility for paying for and dealing with the associated liabilities (appropriate management/disposal of the radioactive wastes generated). It is important that exercise of these principles is balanced against other factors, such as worker safety and cost.

[4] For example, Mounding the reactors was one of the three options considered during the 1994 public consultation on decommissioning Trawsfynydd and was also part of the 1998 MADA exercise.

28. Mr Woollam of Magnox Electric argued that while early or even immediate Stage 3 decommissioning is feasible and could be done safely, there are several reasons why reactor dismantling should be delayed. In practice, however, cost and repository availability appear to be significant drivers for delay (Document 21). The delay proposed by the Applicant for Trawsfynydd is about 100 years, although the Applicant's evidence notes that the generic MADA analysis suggested that a reasonable figure might be anywhere between 70 and 135 years.

29. It is unclear exactly what weight was given to visual impact in the Applicant's decision-making process. In particular, alternatives can be envisaged for the Safestore that would have a smaller footprint and smaller overall volume, and thereby might be considered to reduce visual intrusion further than in the Applicant's proposals. For example, the Applicant considered in the generic MADA the possibility of prompt dismantling of all active and inactive plant outside the biological shield, thereby significantly reducing the footprint and volume of the reactor building in the Care and Maintenance phase. For the reasons set out in Section 2.1 above, it is difficult to be sure about the relative weight given to various issues in the Applicant's decision-making process.

3 Establishment of a National Repository for ILW

30. In practice, until there is an alternative location available (either an alternative centralised storage site or a disposal site) for the Trawsfynydd ILW, the ILW must remain on site. The timing of the availability of a national facility is highly uncertain. Current industry planning is based on the assumption that current and new ILW stores should have a lifetime of at least 50 years (Document 24; Document 49).

31. In my view, it is likely that the DEFRA-led national consultation on radioactive waste management will confirm that deep disposal at a national repository should remain a central part of national policy, and that such disposal should occur as soon as reasonably practicable, accounting for an extended period of consultative site selection. Nirex has estimated that such a repository could be available by about 2040 (Document 49). However, as acknowledged by Nirex, there are large uncertainties around this date – which represents a delay of about 30 years beyond a date thought to be likely little more than seven years ago (Document 20).

32. Information on Nirex thinking provided to the Inquiry suggests that an earlier date might also be possible, perhaps as early as 2025 (Document 54).[5] Depending on the outcome of the DEFRA consultation process on managing radioactive waste safely, it may also be that new Government policy veers towards indefinite interim storage of ILW (possibly below ground), so that the deep repository project is deferred even beyond 2040[6].

33. This uncertainty on the timing of a deep repository contrasts with the then Government's position in 1995 (Cm 2919) that a deep repository for ILW should be developed as soon as reasonably practicable.[7] Because of the current large uncertainty on the timing of repository availability, the proposed developments should be considered as having the potential to become permanent features, and both planning and regulatory decisions should be taken accordingly, until such time as Government policy becomes clearer. While it seems likely that a national repository could be available around 2040 or even somewhat earlier, there is a distinct possibility that the repository may not be available until much later.

[5] While the inquiry was running, Nirex responded to a recent draft EC Directive calling for the establishment of deep geological disposal facilities for long-lived radioactive wastes in Member countries by 2018 (Document 60). Nirex indicated that, if pressed, a repository could be available as early as 2025. However, this would entail a significant change to current Government policy, which appears to emphasise the need for wide and extensive consultation to decide appropriate and acceptable options and sites (Document 24).

[6] A policy of long-term underground storage has been advocated by some, and such options are being considered within the DEFRA consultation. Moreover, Nirex's remit now includes consideration of long-term storage options.

[7] At the time previous Government policy was being established, a date of about 2010 was assumed for repository availability.

4 Establishment of the LMA

34. The Government has indicated its intention to establish the Liabilities Management Authority (LMA) within the next few years (Cm 5552, Document 25). One of the purposes of the LMA would be to accept responsibility for the cost and management of nuclear liabilities that are currently in the public sector (e.g., those of BNFL and UKAEA). Once established, the LMA will assume ownership of the Trawsfynydd site, and will become responsible for the costs of decommissioning. The necessary site management work will initially be contracted to the current nuclear site licensees. Eventually, however, the work is to be let by competitive tender.

35. Given the Government's intent that the LMA contracts site management work initially to the current nuclear site licensees, and the time needed to construct the proposed ILW store and to complete the proposed Stage 1 decommissioning work, the Applicant is likely to remain responsible for conducting much or all of the work, if the Applicant's proposals are approved. However, it is the LMA that will decide the timing of final dismantling of the reactors and that will be responsible for funding the work. Similarly, it is the LMA that will have responsibility for funding the operational ILW store, and any national repository development programme.

36. Given the major changes in ownership and funding entailed by the proposals set out by the Government in Cm 5552, the question arises as to whether decisions on the Applicant's proposals should be postponed, pending establishment of the LMA. The ILW store and the reactor buildings are dealt with separately below.

37. With regard to the proposed new store for operational ILW, there is no justification for postponing a decision until the LMA is established, as the need for a new store to contain potentially mobile radioactive material is pressing. Waste treatment and packaging is currently underway, and the ILW boxes and drums being produced are currently in store in several buildings around the site that were not built specifically for this purpose. Assuming that national policy remains to store waste at the point of generation until a national facility becomes available, a new purpose-built long-term store, where packaged waste can be kept in a state of passive safety until a national facility becomes available, is a clear requirement. The Applicant's fallback proposal for storage of this waste in existing buildings does not have regulatory backing, owing to safety concerns. Other on-site storage options may be possible - and may be preferable (BPEO) - but the Applicant's proposal has not been questioned on either technical or safety grounds. In any event, the Applicant's proposal will be subject to regulatory assessment by the NII, the Environment Agency (EA), and the Office for Civil Nuclear Security (OCNS).

38. With regard to the proposal to lower the roof height of the reactors, from a technical and safety point of view, there again is no reason to delay a decision. However, in this case, neither is there any strong reason other than visual amenity to proceed, as the fallback position would be acceptable on all other grounds. All

of the proposed work is subject to regulation by the NII under the nuclear site licence. The Applicant's fallback position envisages the need for recladding the reactor buildings whether or not their height is lowered. The work involved in recladding the existing reactor buildings, versus that involved in lowering the roof heights, reroofing, and recladding the reduced-height buildings, seems comparable on safety grounds. The reduction in roof height can also be seen as a small first step toward dismantling of the reactor buildings: if the work to lower the walls were not done today, it would still be needed in the future when Stage 3 decommissioning was undertaken. Mr Spooner of Magnox Electric indicated that the costs of work under the preferred proposals and under the fallback arrangements are of the same order (Document 56). Therefore, there seems no reason, on technical, safety or financial grounds to delay the decision.

5 Implications for Decommissioning

5.1 Proposed Reduction in the Roof Height of the Reactor Buildings

39. The discussion here assumes that national policy in the foreseeable future will remain for a significant deferral (at least 30 years) of Stage 3 decommissioning, with only the length of the deferral period subject to uncertainty. In this case, the most important question about decommissioning strategy is whether the Applicant's proposals to reduce the height of the reactor building roofs would significantly impede Stage 3 decommissioning, technically or financially, or otherwise reduce options.

40. Mr Richards of the Welsh Anti-Nuclear Alliance (WANA) argued that both necessary Care and Maintenance work and Stage 3 decommissioning would be significantly hampered, owing to the difficulty of gaining sufficient access given a reduced head height above the reactor charge face (a large crane may be needed for some of the work). In response, Mr Spooner of Magnox Electric indicated that the capping roof design allowed sufficient headroom for any necessary routine or emergency work during the Care and Maintenance phase, and that the proposals would not significantly impede future decommissioning - and Mr Weightman of the NII confirmed these views - as discussed below:

Mr Spooner noted that the issue of head height for Stage 3 decommissioning was more important above the reactor pile cap standpipes than elsewhere across the reactor charge face. The proposed new roof may allow sufficient head height to proceed with core removal. For example, removal of the initial layer of concrete at the reactor charge face would not be radiologically challenging and would immediately gain several extra metres of head room. Even where there was insufficient head room above the charge face, however, because the proposed capping roof would be constructed in sections, a relatively small portion of the outer roof could be removed, and a new temporary roof constructed using the existing trusses, to provide the necessary additional head room for the crane. Such a temporary opening would in any event only be necessary for a period of several months and the additional height needed would only be on the order of a few metres. None of this work was seen as technically difficult – although the NII is yet to consider safety cases for such work - and Mr Spooner confirmed that the need for such work was accounted for in current funding estimates.

ii. Mr Weightman noted that there would be some positive safety aspects for the Care and Maintenance phase if the roof height of the reactor buildings was reduced. These include a smaller area of cladding panels to maintain, reduced wind loading on the building, and a reduced loading on the foundations. However, none of these constitutes a reason singly or collectively to proceed with lowering of the roof; rather, they should be considered as positive attributes of a decision to reduce the roof height on visual grounds.

41. There seems no reason to dispute the evidence of Mr Spooner and Mr Weightman.

5.2 Proposed Use of High-Durability Cladding

42. Consideration was given in the Inquiry to the question of the appropriate approach to recladding of the reactor buildings. Such recladding will be needed whether or not approval is given to reduce the roof height of the reactor buildings so, in that sense, the answer is not directly relevant to the decision to be taken on the Applicant's proposals. But it is possible that a Planning Condition could be introduced on cladding approval, so the issue is summarised here.

43. Two options for recladding were discussed:

    i. The Applicant (Mr Spooner) and the NII (Mr Weightman) preferred a strategy in which the buildings were recladded using high-integrity materials with a lifetime on the order of 100 years, reflecting the assumed deferral period before commencement of Stage 3 decommissioning.

    ii. Third parties (WANA, Nuclear Free Local Authorities) questioned whether this was appropriate, considering the presumed uncertainty on the timescale for Stage 3 decommissioning. They argued that it would be more prudent financially to reclad the buildings with cheaper materials having a shorter lifetime, and then replace the cladding periodically if the Stage 3 decommissioning timescale turned out to be in accord with the Applicant's current projections. They argued that this option could save money if the Stage 3 decommissioning timetable were brought forward.

44. In my view, use of robust cladding materials does not in any way foreclose options for future dismantling, whereas use of cheaper materials would seem to have the potential (i) to pass on a burden unnecessarily to future generations to undertake remedial work to ensure that the Safestores remained in a passively safe state, and (ii) to cause unnecessary disruption within the National Park during periods of remedial work. For these reasons alone, the use of high-integrity cladding is to be preferred. However, proper safety inspection systems should be put in place to monitor the performance of the materials, to ensure their continued suitability and integrity.

5.3 Determination of Decommissioning Strategy

45. Under current arrangements, the NII, through the Quinquennial Review (QQR) process, has a lead role with nuclear site licensees in determining appropriate timescales for decommissioning. An important purpose of the QQR is for the NII to be assured that the site Licence Conditions will continue to be met, and that decommissioning strategy satisfies Government policy that decommissioning should be undertaken as soon as reasonably practicable.

46. The most recent NII QQRs were published in 2002 (e.g., Document 21). The NII was broadly supportive of the Applicant's generic proposals for decommissioning Magnox power stations, in particular the reduction in the delay to Stage 3 decommissioning of 135 years to about 100 years, although the NII also continued to press for consideration of even earlier Stage 3 decommissioning. At the next QQR, which will be based on information available in 2006, the NII will have at its disposal further information on the timing of repository availability, further information on the capabilities of remote dismantling techniques in use elsewhere, and a better understanding of the implications of the principle of intergenerational equity for decommissioning strategy.

47. There was discussion at the Inquiry about the appropriate timescale for decommissioning, particularly Stage 3 decommissioning. None of the parties to the Inquiry suggested that immediate Stage 3 decommissioning would be appropriate, but third parties (e.g., Mr Richards of WANA, Mr Stallard of Welsh Campaign for Nuclear Disarmament) questioned whether Stage 3 decommissioning, say 30 years from now, would be more appropriate than waiting until 2100 or so.

48. For example, one of the points considered at the Inquiry was whether worker dose rates inside the reactor pressure vessel 70-100 years after reactor shutdown would allow remote dismantling techniques to be largely dispensed with. Mr Woollam of Magnox Electric argued that the extra cost associated with the need to make greater use of remote dismantling techniques at earlier times was a primary reason to delay dismantling. Mr Woollam's evidence included curves of worker dose rate versus time to support his arguments. However, there are large uncertainties associated with the calculations that underlie these curves, as Mr Woollam acknowledged under cross-examination, and as confirmed by Mr Weightman of the NII. These uncertainties may be as much as an order of magnitude. In addition, Mr Weightman indicated that the NII is likely to require some use of remote dismantling techniques even at 70-100 years after shutdown, in part because use of such techniques would provide greater protection to workers in the event of unforeseen circumstances arising or accident conditions. Therefore, I consider that arguments based on worker dose rate alone do not provide sufficient rationale for a 100-year deferral period for Stage 3 decommissioning.

49. Although I do not consider that such discussions bear directly on the planning decision to be taken, several points do arise on decommissioning strategy that are relevant to the ongoing DEFRA-led national consultation on radioactive waste management and the planning that the LMA will have to do. As it was not the purpose of the inquiry to debate these points, they are reported here for the information of decision makers.

    i. The process that is currently in place to determine decommissioning strategy is working: the NII has published several QQRs since the 1995 White Paper calling for such reviews. These reviews have influenced the thinking of licensees, e.g., on the timing of Stage 3 decommissioning. However, there has

been no formal opportunity within the QQR process for other stakeholders to express a view, either to the licensee or to the NII. The process could be improved by provision of a period for public comment on licensees' submissions and/or a period of consultation on an initial draft report by the NII. This would help to clarify matters at future, similar public local inquiries.

ii. The evidence indicates that decommissioning policy in other countries having Magnox-type reactors, such as Japan and Italy, is for no deferral or for a much more limited deferral of Stage 3 decommissioning than that currently planned for Magnox reactors in the UK. This is part of a broader international trend favouring early Stage 3 decommissioning across all countries having nuclear power plants. Indeed, BNFL is involved in helping to plan the early Stage 3 decommissioning work in Italy, and has contributed to early Stage 3 decommissioning work in the United States. In its 2002 QQR of the Magnox Electric decommissioning strategy, the NII requested BNFL to examine whether decommissioning could reasonably be brought forward, as an input to the next QQR (Document 21). It is important for decision makers and the public to understand why strategy in other countries should favour significantly earlier decommissioning than in the UK.

iii. The principle of intergenerational equity is one support behind current Government policy that society should be looking to decommission shutdown reactors "…as soon as reasonably practicable" (Cm 2919, Document 20). Determination of what this means involves a weighing of risks and benefits. What is at issue is the proposed timing of Stage 3 decommissioning at Trawsfynydd (and by analogy, at other reactor sites). On this point there is a wide range of views – immediate, defer for 30 years, defer for 70 years, defer for 100 years (or never in the case of on-site Mounding). The Inquiry was not in a position to take a view on the relative merits of the different arguments, as these are largely unrelated to the Applicant's proposals – unless the assumption is made that Stage 3 decommissioning should not be deferred. However, it was clear from the discussions that the meaning of intergenerational equity as applied to reactor decommissioning, and the relative weight to be given to this issue need further strategic thinking and consultation as part of the development of national strategy on decommissioning.

iv. The required funds calculated for decommissioning have been based on an assumption that decommissioning will not occur sooner than 70 years after shutdown, and have been based on the use of a real growth rate for funds (2.5% post-tax) that, although modest, may not be achieved. The use of these assumptions appears to make it difficult to justify decommissioning on an earlier timescale, and places a burden on future generations to ensure that funds invested today grow at a sufficient rate. Furthermore, the lack of a segregated fund for decommissioning Magnox reactors, as at present, means that in practice, most of the required funding will likely be borne by taxpayers in the future. It is questionable whether the use of cost discounting and the

lack of segregated funds can be considered to satisfy the principles of intergenerational equity and sustainable development.

v. Nirex's current working assumption is that a deep repository for ILW and certain kinds of LLW is unlikely to be available prior to about 2040. The deep repository programme considered up to now has focused on ensuring sufficient capacity for operational ILW and Stage 1 decommissioning wastes, but not wastes from Stage 3 decommissioning. The repository was originally supposed to be operational much earlier, and was scheduled to operate for some 50 years, so that operations would be completed many decades before any presumed period of Stage 3 reactor decommissioning. However, as the repository programme is delayed and the timing of Stage 3 decommissioning is brought forward, so the need to resize the repository to consider Stage 3 decommissioning wastes and/or to consider reprioritisation of waste disposals become an issue. If a deep repository becomes available around 2040, and the first 30 or so years is used to fill it with operational ILW, then it could be filled by about 2070 (Document 49). This would approach, or even overlap, the time when the first reactors would be entering Stage 3 decommissioning under current policy. Furthermore, any policy changes are only likely to bring forward the timing of Stage 3 decommissioning. In addition, there is insufficient capacity at Drigg to accept the LLW arising from decommissioning. There is therefore a need to consider either a resizing of the deep repository to accept wastes arising from Stage 3 decommissioning and an extended operational period for the repository, or the development of further repositories for Stage 3 LLW and ILW. Furthermore, if a decision is made to begin Stage 3 decommissioning earlier, then these wastes may be stored in the existing on-site ILW stores as they are emptied, and/or earlier use made of the deep repository for decommissioning wastes in preference to operational wastes.

6 Environmental Implications of the Proposals

50. Evidence of the regulatory roles played by the NII (Mr L.G. Williams) and the EA (Dr C.R. Williams) was presented to the Inquiry. These regulators control radioactive releases to the environment, and doses to workers and the public, both under normal and accidental situations, from all parts of the nuclear licensed site. The environmental implications of the proposals are considered in more detail in Sections 6.1 (ILW store) and 6.2 (Safestores). Section 6.3 provides comment on the situation at Llyn Trawsfynydd, which was also discussed at the Inquiry.

6.1 ILW Store

51. The need for, and environmental benefits of, the proposed ILW store are widely accepted, and there was little discussion of potential adverse environmental implications. There is no reason to think that the proposed ILW store could not be constructed and managed in such a way as to prevent releases of radioactivity to the environment that would exceed regulatory limits. The radioactivity would be contained in solid form within robust waste packages having an extended design life, and approved by Nirex for eventual deep disposal. The only radioactivity that is likely to be released from the waste packages while they are in storage would be in gaseous form (Document 52). Gaseous releases from vented waste packages would need to be controlled and monitored. This is not technically difficult, and there are many decades of experience in doing so at other ILW stores in the UK and overseas.

52. One point that was raised during the Inquiry concerns the positioning of the ILW store such that its floor would be about 1 m below the level of Llyn Trawsfynydd. It was contended (e.g., by Mr Richards of WANA) that in the unlikely event of failure of the Gyfnys dam, the ILW store could be flooded. However, a site visit makes clear that the topography of the site is such that should the dam fail, the reservoir water would be channelled along a route below the position of the ILW store and the reactor buildings. Leaving aside the matter of the low probability of failure of the dam, the consequences of such an event would not appear to merit a refusal of the Applicant's proposals or a Condition on raising the base level of the ILW store.

6.2 Reactor Buildings

53. With regard to the Applicant's proposal to reduce the roof height of the reactor buildings, the environmental implications of doing this work or not doing it would be broadly similar, and will be subject to broadly the same types of nuclear and environmental consents. This is because there is in any event a need to refurbish the cladding of the buildings, including the roof, to ensure adequate weatherproofing of the reactor and its surrounds. There is no reason to think that the necessary recladding work, whether or not the roof is lowered, could not be

managed in such a way as to prevent releases of radioactivity to the environment that would exceed regulatory limits. Lowering of the roof will require cutting and movement of additional radioactively contaminated items inside the reactor buildings (the boilers and gas ducts), and worker exposures will need to be properly controlled and monitored. However, such work would anyway eventually be needed as part of Stage 3 decommissioning - although worker risk might be lower if this work were delayed to Stage 3.

54. The main environmental issue associated with the reactor buildings is whether the radioactive materials it contains (the boiler systems, the biological shield, the reactor pressure vessel) can be said to be in a passively safe state. This is an issue under discussion between the Applicant and the NII. The requirement for passive safety exists whether or not the roof is lowered. I consider that the works necessary to ensure passive safety of the reactor buildings and their contents is likely to be of the same type whether or not the roof height of the reactor buildings is reduced.

55. An ancillary question is whether reducing the roof height would make more difficult any necessary monitoring and maintenance of the reactor during the Care and Maintenance phase to ensure continued safety. Both the Applicant and the NII confirmed that the 5 m headroom above the reactor charge face allowed in the proposed design is sufficient to undertake any necessary operations. The NII has indicated that it has no difficulty with the proposal to lower the roof height and, indeed, can envisage some modest safety benefits. Although I accept these points, neither the Applicant nor the NII has fully documented the work that will be necessary during the Care and Maintenance phase.

56. I conclude that the need to demonstrate and to ensure passive safety of the reactors should not necessarily be a material consideration for the decision. However, I would recommend that the Applicant and the NII take account of the full range of construction uncertainties that can impact upon such a project - including construction delays and uncertainties in design implementation - and the full range of possible work needed during the Care and Maintenance phase - before finalising the approach.

6.3 Llyn Trawsfynydd

57. Llyn Trawsfynydd is a reservoir created in the 1920s for the purpose of hydroelectric power generation. Radioactive discharges to the reservoir have been authorised by the EA and its predecessors since start-up of the Trawsfynydd nuclear reactors. With time, there has been a gradual accumulation of radioactivity in the sediments at the bottom of the reservoir. Third parties (CANDO in particular) expressed concern at the potential level of radioactivity in the sediments, and expressed a desire for the Applicant to ensure that the contaminated sediments would be remediated. The contamination of the reservoir sediments bears little relationship to the Applicant's proposals, as these proposals do not specifically concern the reservoir, and the decision one way or the other

concerning the Applicant's proposals will therefore not affect the situation of the reservoir.

58. Radioactivity levels in and around the reservoir and in the reservoir sediments are subject to periodic monitoring by both the Applicant and the EA. The EA undertakes periodic assessments of the environmental effects of past and current discharges using a range of scenarios and assumptions. However, these assessments may not go far enough in meeting public concerns. For example, one possibility not considered up to now by the EA is that the reservoir could be drained in the future, either subsequent to dam failure or because a decision was made to use the land for other purposes. Mr Hardman of the EA stated that it would be unreasonable to consider such an event because the reservoir had a continuing use for hydroelectric power generation. Another possibility apparently not considered is that the sediments could become disturbed by other means even without the reservoir being drained, leading to an increase in dose to the receptors currently considered by the EA. The local population might be assured if a wider analysis of disruption scenarios was undertaken and demonstrated no undue radiological risks. Only if the resulting doses were relatively high would it then be necessary to consider the likelihood of the events. The results of such an analysis would also need to be considered in the light of possible risk management measures, and the relative costs and benefits of remediation.

7 Conclusions

59. This section summarises the main benefits and risks - insofar as my expertise is concerned - of giving planning approval to the proposed ILW store (Section 7.1) and the proposed reduction in roof height of the reactor buildings (Section 7.2). Section 7.3 outlines some relevant considerations concerning a possible Planning Condition for a time limit on the ILW store. Section 7.4 provides my overall conclusions on the planning application, and summarises recommendations.

7.1 Proposed ILW Store: Benefits and Risks

60. The main benefits of approving the proposed ILW store are as follows:

    i. The construction of a purpose-built structure is the best means of containing all of the site's operational ILW in a passively safe state for at least 50 years.

    ii. The existence of a new ILW store would eliminate the need to store packaged ILW in a range of buildings around the site not originally designed for this purpose.

    iii. Given the large uncertainties in current national policy on radioactive waste management, the country as a whole would benefit from the certainty that at least one small part of the radioactive waste management jigsaw was in place.

61. The main risks of approving the proposed ILW store are as follows:

    i. No BPEO was conducted. The proposed store may not represent the BPEO for a site in the National Park. For example, alternative options having less visual intrusion, producing less waste, and/or providing a higher level of long-term safety, may be possible.

    ii. If national radioactive waste management policy - currently under review - becomes underground long-term storage of ILW at the site of generation (e.g., to reduce the risks of terrorism), then a new store would need to be constructed.

7.2 Proposed Reduction in Roof Height of Reactor Buildings: Benefits and Risks

62. The main benefits of approving the proposal to reduce the roof height of the reactor buildings are as follows:

    i. Reduced roof height improves the appearance of the buildings in the Park, with similar cost and environmental and safety implications as the fallback option.

    ii. Reduced roof height brings modest long-term safety benefits during the Care and Maintenance phase (e.g., reduced loading of the walls and foundations, fewer panels to maintain).

    iii. Tearing down the upper parts of the walls in order to reduce roof height represents work that will anyway have to be done.

63. The main risks of approving the proposal to reduce the roof height of the reactor buildings are as follows:

    i. No BPEO was conducted. The proposed means of putting the reactors into Safestore may not represent the BPEO for a site in the National Park. Alternative options possibly having less visual intrusion than the Applicant's preferred option may be viable (e.g., the reduced footprint option considered by the Applicant in the generic MADA analysis).

    ii. Construction and operational uncertainties could lead to the reduced-height Safestores being more difficult to manage during the Care and Maintenance phase than would be the case if the roof height was not reduced.

    iii. If decommissioning strategy changes under the LMA to favour immediate or very early Stage 3 decommissioning, then the reduction in roof height would bring little worthwhile benefit. However, arguments by third parties that the reduction in roof height could make future decommissioning significantly more difficult on technical and/or financial grounds do not bear up under scrutiny.

7.3 Planning Conditions: Time-Limited Approval for the ILW Store

64. A time-limited approval for the proposed ILW store was one of a range of possible Planning Conditions discussed at the Inquiry[8]. Some comments on such a Condition are provided here.

65. There are two principal means of providing a time limit:

    i. The building could be approved for a fixed number of years after the receipt of planning approval (or, equally, until a specific date in the future).

    ii. The building could be approved until such time as a particular event occurs that would call into question the continued need for the building. This event would be some kind of nationally approved alternative means of long-term management of operational ILW, such as development of a repository or a centralised store within the UK, or the establishment of a suitable facility in another country[9].

66. A Condition with a time limit in the range 35-40 years (until about 2040) on the ILW store could be justified on several grounds:

    i. It would tie in with Nirex's projected date of repository availability and initial operation (Document 49).

    ii. The likely timetable for Stage 3 decommissioning - and the possible need to use or reuse the ILW store for Stage 3 decommissioning wastes - should be reasonably well known by then.

    iii. It is of the same order as time-limited approvals given for ILW stores at Sellafield by Copeland Borough Council (Document 105) and at Winfrith by Dorset County Council (Document 106).

67. However, the Condition could also allow for the eventuality that an alternative nationally approved means for the management of operational ILW is available sooner than this, so that review of the planning permission expires upon the earlier of the two events (time limit being reached, or alternative solution becoming available).

[8] A time-limited approval for the reactor Safestore was also discussed at the Inquiry (among several other possible Conditions), but it seems problematic to introduce a Planning Condition on a proposal whose main intent is to improve the visual appearance of an existing building.

[9] There have been several initiatives over the years to investigate the feasibility of developing international or regional repositories for long-lived radioactive wastes, on both commercial and non-commercial bases.

7.4 Overall Conclusions on the Planning Application

Main Judgements

68. *Planning approval*. On the basis of the evidence presented and discussed at the Public Inquiry, I consider that there are no compelling scientific or technical reasons why the planning application should not be approved. Although national radioactive waste management policy is currently in a state of turmoil, this decision is unlikely to undermine or run counter to national policy, and so is not premature.

69. *BPEO.* The Applicant has missed an opportunity in not conducting a BPEO in support of its decisions. The lack of a BPEO study hampered the Inquiry's consideration of the issues. Notwithstanding this, the Applicant's proposals are acceptable, but decision makers may not be satisfied that in the National Park, the most appropriate considerations and approach were pursued by the Applicant. For example, a different design for the ILW store may have emerged from a full BPEO.

70. *Planning Condition.* A time-*limited* approval for the proposed ILW store could provide the *local* planning authority a greater role than it would otherwise have in future decisions on clearance of waste from the site. Approval for a period of 35-40 years would seem appropriate

Supplemental Recommendations

71. I have made several additional recommendations based on the evidence presented and discussed at the Inquiry, which have implications beyond the Applicant's planning application. These are summarised here:

Decommissioning Strategy

i. The Applicant and, in due course, the LMA should consider the conduct of BPEO studies to advise future decision-making on decommissioning and waste storage strategy at the Trawsfynydd site and at other nuclear licensed sites.

ii. The QQR process could be improved by provision of a period for public comment on licensees' submissions and/or a period of consultation on an initial draft report by the NII.

iii. Further work is needed to define what is meant by passive safety for any extended Care and Maintenance phase, and what level of operator surveillance will be required. For example, proper safety inspection systems will need to be put in place to monitor the performance of reactor building cladding materials, to ensure their continued suitability and integrity, over what may be periods of up to 100 years or more.

iv. Better understanding is needed of why decommissioning strategy in other countries should favour significantly earlier decommissioning than in the UK.

v. The meaning of intergenerational equity as applied to reactor decommissioning, and the relative weight to be given to this issue need further strategic thinking and consultation as part of the development of national strategy on decommissioning.

vi. The use of cost discounting and the lack of segregated funds for funding public sector decommissioning liabilities need to be reconsidered in the light of the principles of intergenerational equity and sustainable development.

vii. National strategy on radioactive waste management and possible repository development needs to account for the projected arisings of LLW and ILW from decommissioning.

Llyn Trawsfynydd

viii. The EA should consider a wider range of scenarios than previously in evaluating the potential radiological impacts from authorised discharges to Llyn Trawsfynydd.

8 References

References for Inquiry Documents are contained in Appendix 2 to the Inspector's Report. Only two documents not forming part of the Inquiry Documents are listed here.

RCEP 1988 Best Practicable Environmental Option. Royal Commission on Environmental Pollution 12th Report.

RCEP 1999 Setting Environmental Standards. Royal Commission on Environmental Pollution 21st Report.