| | |
|---|---|
| **Title:** Amendment of regulation of nuclear sites in the final stages of decommissioning and clean-up<br>**IA No:**<br>**RPC Reference No:**<br>**Lead department or agency:** BEIS<br>**Other departments or agencies:** | **Impact Assessment (IA)**<br>**Date:** TBC<br>**Stage:** Consultation Response<br>**Source of intervention:** Domestic<br>**Type of measure:** Primary legislation<br>**Contact for enquiries:** Penny Dunbabin |

## Summary: Intervention and Options

**RPC Opinion:** Not Applicable

| Cost of Preferred (or more likely) Option | | | | |
|---|---|---|---|---|
| **Total Net Present Value** | **Business Net Present Value** | **Net cost to business per year** (EANDCB: 2016 prices; 2017 present value) | **One-In, Three-Out** | **Business Impact Target Status** |
| £392.8m | £387.9m | £-25.8m | N/A | Qualifying provision |

**What is the problem under consideration? Why is government intervention necessary?**

The Nuclear Installations Act 1965 (NIA65) provides the framework for licensing nuclear sites and for the third party nuclear liability regime in the UK, as required by international law. The UK has not yet adopted recent international recommendations that set out a procedure for excluding sites from the nuclear liability regime when hazards and risks fall below specified levels. Moreover, nuclear sites in the final stages of decommissioning and clean-up are currently subject to dual regulation by the Office for Nuclear Regulation (ONR) and the environment agencies. In our view, specialist nuclear regulation is excessive when nuclear hazards have been removed and the focus is on land remediation and conventional health and safety. Amending the regulatory framework requires legislative change.

**What are the policy objectives and the intended effects?**

The policy objectives are: (1) to align UK legislation with international standards on nuclear third party liability; (2) to ensure that nuclear sites are regulated by the most appropriate regulators during the final stages of nuclear decommissioning and clean-up; and (3) to enable a sustainable approach to waste management. The intended effects are: (a) to allow the ONR to concentrate its specialist nuclear safety and security resource on sites which require this expertise; (b) to allow site operators to work to a single set of land remediation standards rather than to two sets as they do at present; and (c) to avoid unnecessary remedial work, thereby reducing the generation of low and very low level radioactive waste (see point 12, main text), the costs of land remediation and pressure on the existing disposal facilities.

**What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)**

A non-legislative approach was considered in the consultation IA and was dismissed on the grounds that it would not provide sufficient certainty for regulators and the industry. It would require ONR guidance to re-interpret the existing "no danger" criterion in legislation (NIA65), which could be difficult, since the existing interpretation was taken following extensive consultation and legal advice. Moreover, some of the benefits of the selected policy option such as requiring site operators to apply to ONR to surrender their site licence and making the Health and Safety Executive (HSE) a statutory consultee for the decision on whether to accept the surrender, are only possible via amendment of primary legislation.

**Will the policy be reviewed?** It will not be reviewed. **If applicable, set review date:** Month/Year

| | | | | |
|---|---|---|---|---|
| Does implementation go beyond minimum EU requirements? | | N/A | | |
| Are any of these organisations in scope? | **Micro** Yes | **Small** Yes | **Medium** Yes | **Large** Yes |
| What is the $CO_2$ equivalent change in greenhouse gas emissions? (Million tonnes $CO_2$ equivalent, over the period 2021-2037 | | **Traded:** | **Non-traded:** -0.076 | |

***I have read the Impact Assessment and I am satisfied that, given the available evidence, it represents a reasonable view of the likely costs, benefits and impact of the leading options.***

Signed by the responsible Minister: _____ Date: _____

# Summary: Analysis & Evidence

Policy Option 1

**Description:** Amendment of the Nuclear Installations Act 1965 (NIA65)

**FULL ECONOMIC ASSESSMENT**

| Price Base Year 2016 | PV Base Year 2021 | Time Period Years 17 | Net Benefit (Present Value (PV)) (£m) | | |
|---|---|---|---|---|---|
| | | | Low: 251.5 | High:534.1 | Best Estimate: 392.8 |

| COSTS (£m) | Total Transition (Constant Price) | Years | Average Annual (excl. Transition) (Constant Price) | Total Cost (Present Value) |
|---|---|---|---|---|
| **Low** | 0 | | 0.1 | **1.2** |
| **High** | 0 | | 0.1 | **1.2** |
| **Best Estimate** | 0 | | 0.1 | **1.2** |

**Description and scale of key monetised costs by 'main affected groups'**

The Nuclear Decommissioning Authority (NDA), ONR, environmental regulators and HSE have confirmed that they will incur no additional costs **overall**. Additional environmental monitoring costs (paid by the NDA and site licence companies) are estimated as £1.2m (discounted). Familiarisation costs for the Site Licence Companies are expected to be low at around £7.7k as they are already required to familiarise themselves with periodic amendments to regulatory guidance.

**Other key non-monetised costs by 'main affected groups'**

Potentially fewer jobs would be needed to excavate sub-surface material and to transport and dispose of low and very-low level (LLW and VLLW) radioactive waste. However, the majority of waste is from surface material and jobs associated with its clean-up will not be affected.

| BENEFITS (£m) | Total Transition (Constant Price) | Years | Average Annual (excl. Transition) (Constant Price) | Total Benefit (Present Value) |
|---|---|---|---|---|
| **Low** | 0 | | 18.2 | **252.8** |
| **High** | 0 | | 38.3 | **535.3** |
| **Best Estimate** | 0 | | 28.3 | **394.0** |

**Description and scale of key monetised benefits by 'main affected groups'** Reductions in the remediation work required are expected to reduce excavation costs for the NDA and site licence companies by £154.2m (discounted) and to reduce the costs of transport and disposal of LLW and VLLW by £228.7m. There is a wide range between high and low estimates due to uncertainty over how much remediation work is avoided. The central estimate is the mid-point of the high and low estimates. Savings from ending dual regulation are £5.2m. We estimate greenhouse gas savings of £4.8m from the reduction in transport and waste disposal activities.

**Other key non-monetised benefits by 'main affected groups'** The key non-monetised benefits are difficult to quantify and/or small. They include: i) reduced pressure on disposal facilities for radioactive waste, due to a reduction in the amount of LLW and VLLW generated; ii) reduced risk to workers undertaking excavation (small and difficult to quantify) iii) reduced traffic (fewer lorries required to transport the waste to disposal facilities); iv) reduced risk of associated traffic accidents (small and difficult to quantify); v) also, subject to planning permission, potential earlier re-use of former nuclear sites.

**Key assumptions/sensitivities/risks** **Discount rate** 3.5%

Savings under these proposals are sensitive to the estimated amount of sub-surface structures that could be left in-situ, rather than excavated. Between 5 and 20% of the structures to be demolished are estimated to be sub-surface from architectural drawings. Total cost savings have been estimated by the NDA and its Site Licence Companies which we assume are proportional to "intensity of work" of decommissioning. The appraisal period (2021-2037) has been selected to cover the sites for which we have best information. Sellafield, the largest and most complex nuclear site, has not been included because the site characterisation is not sufficiently detailed to provide reliable estimates or to confirm when work might start. We know that these benefits will be large and anticipate that they will continue for around 100 years. Estimated savings are therefore conservative. The consultation did not produce further evidence on Sellafield.

**BUSINESS ASSESSMENT (Proposals)**

| Direct impact on business (Equivalent Annual) £m: | | | Score for Business Impact Target (qualifying provisions only) £m: |
|---|---|---|---|
| **Costs:** | **Benefits:** | **Net:** | |
| 0.1 | 29.7 | -29.6 | -129.1 |

# Introduction

1. In November 2016, BEIS published a discussion paper on the principles of amending the regulatory framework for nuclear sites in the final stages of decommissioning and clean-up. A more detailed consultation on our proposals was published in May 2018, alongside an impact assessment[1].

2. This impact assessment sets out the impacts of our proposed approach and takes into account information provided during the consultation. A final impact assessment will be written when legislation is taken forward.

# Evidence Base (for summary sheets)

## 1. The problem under consideration and rationale for intervention

3. All nuclear sites require a licence under the Nuclear Installations Act 1965 (NIA65) and are regulated by the Office for Nuclear Regulation (ONR). The NIA65 also provides the framework for nuclear third party liability, as required under international and UK law[2].

4. In 2014, the Steering Committee of the OECD Nuclear Energy Agency decided that nuclear sites in the final stages of decommissioning can be excluded from the nuclear third party liability regime if they meet certain conditions (referred to as the "Paris Convention Decommissioning Exclusion Criteria")[3]. The UK is a member of the OECD Nuclear Energy Agency and has a member on the Steering Committee. While there is no obligation on the UK to adopt decisions made by the Steering Committee, and thus doing so would be a domestic policy choice, aligning the NIA65 with these decisions would bring the UK into line with international best practice in this area and reduce liability cover costs.

5. Once the spent fuel and higher activity radioactive waste have been removed and securely stored elsewhere, radiological hazards on a reactor site fall by over 99%[4]. In the final stages of decommissioning and clean-up, the nature of the hazard associated with nuclear sites is broadly similar to that at non-nuclear industrial sites undergoing clean-up for radioactive contamination[5]. Such non-nuclear sites are regulated by the relevant environment agency and the Health and Safety Executive (HSE).

6. Under the current regulatory framework based on the NIA65, nuclear sites remain subject to nuclear regulation by the ONR in addition to regulation by the environment agencies. This dual regulation has drawbacks; in particular, the two sets of regulations differ in their approach to site clean-up and re-use leading to complexity for operators and higher regulatory costs of compliance.

7. Once nuclear matters have been resolved, we consider that continued nuclear regulation is unnecessary. Radiological protection would be more appropriately regulated by HSE, while land remediation is most appropriately regulated by the environment agencies under the Radioactive Substances Regulations (and other environmental protection legislation).

8. Finally, the existing regulatory framework makes it easier to construct disposal facilities for radioactive waste away from a nuclear site rather than within the site boundary. As a result, there is an over-incentive to construct such facilities off-site, potentially on greenfield land. For example, at Dounreay, there is planning permission for up to six vaults of low level waste disposal facilities

[1] https://www.gov.uk/government/consultations/the-regulation-of-nuclear-sites-in-the-final-stages-of-decommissioning-and-clean-up

[2] The Paris Convention 2004 Protocols: See summary https://www.oecd-nea.org/law/paris-convention.html "Protocol to amend the Convention on third party liability in the field of nuclear energy of 29 July 1960 as amended by the additional protocol of 28 January 1964 and by the protocol of 16 November 1982" 12/02/2004 https://www.oecd-nea.org/law/paris_convention_protocol.pdf

[3] A.2.12 "Decision and Recommendation of the Steering Committee Concerning the Application of the Paris Convention to Nuclear Installations in the Process of Being Decommissioned", OECD Nuclear Energy Agency, 30 November 2014. https://www.oecd-nea.org/law/decommissioning-exclusion.html

[4] http://ukinventory.nda.gov.uk/wp-content/uploads/sites/2/2014/01/Fact-sheet-decommissioning-of-nuclear-power-facilities.pdf

[5] For example, certain pharmaceutical or medical facilities.

located outside the nuclear site boundary[6]. The area of greenfield land affected is around six hectares, not including roads.

9. Simplifying the regulatory framework would produce a range of benefits:

- it would allow ONR to concentrate its specialist nuclear safety and security resource on sites that require its expertise;
- it would allow site operators to work to a single set of land remediation standards, rather than two sets, as at present;
- it would result in more sustainable clean-up and potentially, earlier re-use of sites (see sections 10-17); and
- it would remove barriers to constructing disposal facilities for radioactive waste on existing nuclear sites.

## Two approaches to site clean-up

10. As stated above, the nuclear and environmental regulations differ in their approach to site clean-up and re-use.

11. The NIA65 was drafted in 1965, when little consideration had been given to decommissioning. It requires that a nuclear site is returned to a state suitable for unrestricted use before it can be released from nuclear regulation. This requirement is referred to as the "no danger" criterion.

12. The "no danger" requirement was interpreted by the regulator[7] in 2005 following legal advice and extensive public consultation. Details of the reasoning are set out in Annex A.

13. Meeting this interpretation of the "no danger" criterion generally means removing virtually all the foundations and sub-structures from a site and transporting them to disposal facilities elsewhere. For a typical Magnox nuclear site, this can represent thousands of cubic metres of lightly radioactive waste, generally classed as low and very low level waste (LLW & VLLW)[8].

14. The excavation and transport of this waste for disposal elsewhere result in a number of impacts on people and the environment. In particular: risks to construction and demolition workers; traffic risks due to many movements of heavy lorries taking waste away and bringing fresh material in for filling voids; and the filling up of the limited capacity in specialised radioactive waste disposal facilities.

15. In some cases it may be optimal to leave structures in situ. The risks of leaving lightly contaminated substructures and soils in place where it is safe to do so may be lower than those of excavating, transporting and disposing or storing them elsewhere[9]. The current requirement to meet the "no danger" criterion is inflexible. It does not allow the site operator to weigh up the benefits of moving the lightly contaminated material against the wider environmental, social and economic impacts of leaving it in place.

16. We therefore consider that the "no danger" criterion may not be the most appropriate criterion for determining the degree of clean-up required on all sites. The Radioactive Substances Regulations,

[6] Two of these six vaults have already been constructed.

[7] HSE was the regulator at the time and the interpretation has been adopted by ONR.

[8] Low Level Waste (LLW) contains relatively low levels of radioactivity, not exceeding 4 gigabecquerel (GBq) per tonne of alpha activity, or 12 GBq per tonne of beta/gamma activity. The waste includes items such as scrap metal, paper and plastics. Very Low Level Waste (VLLW) is a sub-category of LLW with specific activity limits. Sites that produce VLLW can dispose of the waste with regular household or industrial waste at permitted landfill facilities. The major components of VLLW from nuclear sites are building rubble, soil and steel items. Low and very low level waste constitute around 0.002% of the radioactivity of the UK radioactive waste inventory, but around 90% of the volume of waste ("Radioactive Wastes in the UK: A Summary of the 2016 Inventory").

[9] Under the "Radioactive Substances Regulations", applied by the environment agencies, provide a robust framework for determining the overall impacts of in-situ disposal on a particular site. Under these regulations, the site operator is obliged to submit a peer-reviewed site-wide environmental safety case and waste management plan to the environment agency, which will determine whether or not an in-situ disposal can be permitted.

applied by the environment agencies, provide a robust mechanism for assessing the wider impacts of different clean-up proposals and identifying the best overall solution for the site.

17. Moreover, the Radioactive Substances Regulations allow the site to be re-used while still being regulated[10]. Government therefore considers that these regulations offer a more sustainable and flexible approach to clean-up work than the current "no danger" criterion.

### Timescales of nuclear decommissioning

18. **It is important to note that nuclear decommissioning takes place over a long period**. To date, few nuclear sites in the world have reached the final stages of decommissioning and clean-up.

19. Under the current regulatory framework, proposals for the clean-up of Magnox sites include a 30-40 year period of quiescence from around 2035 to around 2070, after which further work is scheduled to take place. The Sellafield clean-up programme is scheduled to last over 100 years.

## 2. Objectives and approach

20. The objectives of these proposals are two-fold:

- to ensure that the site is regulated by the most appropriate regulator in each phase of decommissioning; and
- to enable a more sustainable approach to waste management and site clean-up.

21. The UK Government formed a Working Group, comprised of representatives from ONR, Nuclear Decommissioning Authority (NDA), the environment agencies and HSE. This group explored a number of options for improving the regulatory regime. The principles adopted in formulating the proposals presented in the consultation are:

- there must be no relaxation of regulation for public protection; the proposals align with international standards and Public Health England guidance; and
- regulation should align with the statutory principles of good regulation, namely: proportionality, accountability, consistency, transparency and targeting.

## 3. Proposals

22. We propose to amend the regulatory arrangements such that:

- ONR will be able to allow a site to exit the requirement for nuclear third party liability once satisfied that it had met the "Paris Convention Decommissioning Exclusion" criteria. This would be an alternative to the "no danger" criterion described in sections 11-12;
- the licensee will lose the right to surrender the licence unconditionally and would be obliged to apply to ONR to do so. ONR will be able to accept this surrender once content that the requirement for nuclear third party liability had ended and that all nuclear safety and security matters had been resolved. ONR will be legally obliged to consult with HSE before accepting an application for licence surrender or variation[11];
- once a nuclear licence is surrendered, conventional health and safety, including radiological protection, the site will be regulated by HSE, instead of ONR. Environmental matters will continue

[10] In theory it is possible to use a site for other purposes while the nuclear licence is in place, however, in practice it is very difficult. The licensee must remain in control of the site, and also remains solely responsible for compliance with site licence conditions. Therefore the must ensure that any relevant requirements are also met by any tenants or other occupiers or users of the site. The additional security and insurance requirements associated with activities carried out on a nuclear site are also a deterrent to site re-use while the licence remains in place.

[11] ONR is already obliged to consult with the relevant environment agency before surrender or variation of a nuclear licence.

to be regulated by the relevant environment agency under existing legislation (including the Radioactive Substances Regulations).

23. Figure 1 shows the current and proposed regulatory regimes (top and bottom sets of four coloured bars respectively). The blue flags ("Decommissioning Exclusion", "No concerns re nuclear safety", "Site Reference State" and "No Danger") represent key points on the timeline of site clean-up. The yellow bar represents the third party liability regime. Once the site exits the nuclear third party liability regime, third party liability is covered by general UK law. The green bar represents the nuclear licence[12]. The blue bar represents the environmental regulation, which continues until the site meets the "Site Reference State"[13] in both the current and proposed frameworks. The red bar represents conventional health and safety regulation.

24. The consultation documents outlined two proposals to amend regulations concerning liability for disposal sites. The first will allow the ONR to exclude certain disposal facilities for radioactive waste from the nuclear site boundary if satisfied that there were no nuclear safety or security issues. As a result, the environment agencies would be responsible for determining the ending of the period of nuclear third party liability for engineered disposal facilities on nuclear sites, as they do for similar disposal facilities located elsewhere. The second amendment will be to adopt the OECD Steering Committee for Nuclear Energy recommendations on exempting certain kinds of Low Level Waste facilities from the nuclear third party liability regime, if they meet the appropriate criteria.

[12] Currently, under NIA65, the licensee can surrender the licence at any time, leaving ONR to regulate via "directions" until the end of the period of nuclear third party liability, but we propose to remove this option by requiring the licensee to apply to ONR as described in section 18.

[13] The Site Reference State is defined in the "Guidance on Requirements for the release of nuclear sites from the Radioactive Substances Regulations", consultation document February 2016, the Scottish Environment Protection Agency, the Environment Agency and Natural Resources Wales. Note that this state is similar to the "no danger" criterion in the NIA65.

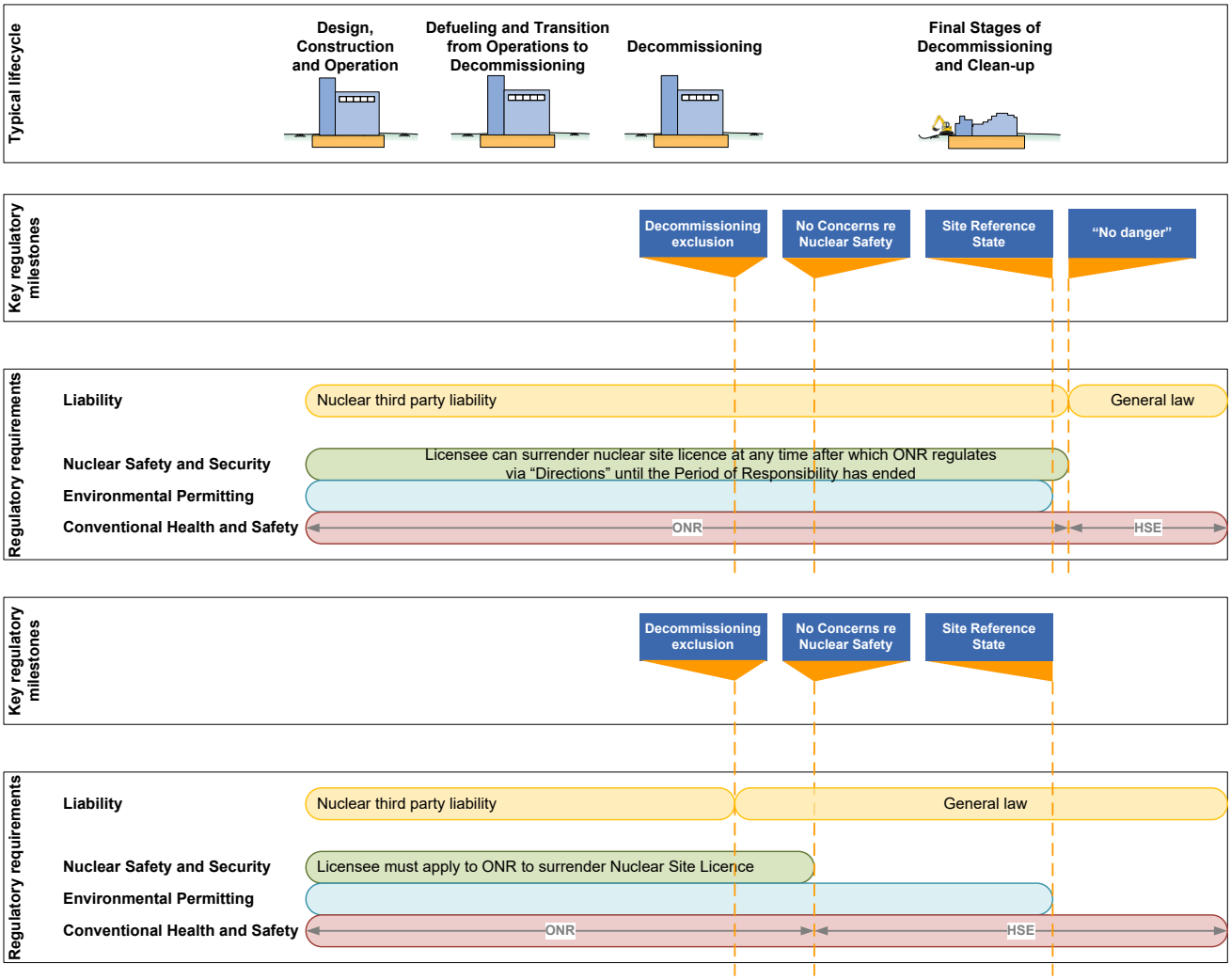


**Figure 1: The current and proposed regulatory regimes (current top, proposed lower)**

# 4. Proposals

### Amendments to NIA65

25. We propose to amend the NIA65 to adopt international recommendations on the procedure for exiting the nuclear third party liability regime and to introduce an amended licence surrender process. Additional minor amendments to the Environmental Permitting Regulations (England and Wales) 2016 and Regulatory Reform (Scotland) Act 2014 may be required.

26. **These proposals will not result in any increase in the risk to public health over the current baseline.** The Paris Convention Decommissioning Exclusion Criteria include a condition requiring that "under all reasonably conceivable conditions, including accidental occurrences and security events, and assuming that protective actions have not been taken" the annual effective radiological exposure for an off-site member of the public should not exceed 1 millisievert – the same as the international annual radiation dose limit for members of the public[14].

27. Under these proposals, ONR will be able to allow the site to exit the requirement for nuclear third party liability once content that the site has met the conditions established by the OECD Steering Committee on Nuclear Energy (the "Paris Convention Decommissioning Exclusion" Criteria). Further details are given in Annex A15. **Savings from costs to cover liability insurance would start from this point.**

28. We propose to change the arrangements for surrender of the nuclear site licence. Currently, the licensee can surrender the licence at any time, leaving ONR to regulate via "directions" until the "no danger" criterion is met. We propose that, after meeting the Paris Convention Decommissioning Exclusion criteria, the licensee will have to apply to ONR to surrender the nuclear licence. ONR will accept the application only when satisfied that all licensable activities had come to an end and there was no further need for a licence to regulate nuclear safety at the site[16]. **Savings on licence costs would start from this point. We propose to amend legislation so that HSE would become a statutory consultee when the nuclear licence is varied or surrendered[17].**

29. Following the surrender of the site nuclear licence, the site will be regulated by the relevant environment agency and HSE. **This would not result in any additional costs** (see paragraphs 85-86 for further information). Any remaining final site clean-up will be in accordance with the existing environmental regulatory framework.

30. **Based on data from the NDA and site licence companies, the largest savings from these proposals would come from reduced costs for land remediation, transport and disposal of waste. These savings are expected to accrue shortly after the introduction of a new regulatory framework[18]**. Furthermore, while the nuclear site licence is in place, it is extremely difficult to use the site for any other purpose. Once the nuclear licence is surrendered, the site operator may apply for planning permission to allow the site to be used for recreational, commercial or other purposes. **Thus a secondary benefit from this step is that it will allow former nuclear sites to be re-used earlier**.

31. If required, the licensee could apply for a licence variation to exclude part of the site, provided that the necessary conditions were met.

32. For a disposal facility located within a nuclear licensed site, we propose to amend the NIA65 to allow ONR to exclude disposal facilities from the nuclear site if satisfied that there are no nuclear safety or security issues. This would enable the relevant environment agency to determine the period of responsibility for nuclear third party liability for these facilities, as it does for disposal

[14] ICRP 103 2007 "The 2007 Recommendations of the International Commission on Radiological Protection", Ann ICRP 37 1-332.

[15] Note that we do not propose to re-interpret the "No danger" criterion, which would remain in place as an alternative option for determining the end of the period of responsibility. See Annex A for further discussion.

[16] ONR would consult with the HSE and the relevant environment agency prior to making a decision on a surrender application. ONR would retain the right to revoke a licence at any time in consultation with the HSE and the relevant environment agency.

[17] The relevant environment agency is already a statutory consultee.

[18] The savings for the Magnox sites, Dounreay and Winfrith would be expected to start shortly after the introduction of a new regulatory framework. We do not have clarity on when savings from Sellafield would start. Savings from the current EdF-E fleet would be expected to start sometime in the 2040s.

facilities located off nuclear sites. This proposal would encourage site operators to build disposal facilities on nuclear sites, rather than on other land, for example greenfield land adjacent to the nuclear site. **It has not been possible to monetise this benefit in this assessment.**

33. Low Level Waste (LLW) facilities that meet the criteria specified by the OECD Steering Committee for Nuclear Energy 2016 recommendations will be excluded from the nuclear third party liability regime. At present, there are only two LLW facilities in the UK. While we do not have information on the insurance premiums paid, **savings from this are expected to be minor so have not been monetised in this assessment.**

## Consideration of a non-legislative approach

34. BEIS convened a lawyers' group comprising members from the NDA, ONR, HSE, Natural Resources Wales, Scottish Environmental Protection Agency, the Environment Agency, Defra, DCLG and the Scottish and Welsh Governments to examine the viability of a non-legislative approach under which ONR would amend its guidance to reinterpret the "no danger" criterion in NIA65 to align with the Paris Decommissioning Exclusion criteria. This group concluded that a non-legislative approach would not be viable for the following reasons:

- the 2005 interpretation of the "no danger" criterion in NIA65 was taken following legal advice and extensive consultation, as described in Annex A;
- the "Paris Decommissioning Exclusion" document (footnote 3) does not explicitly use the term "no danger". Instead, it refers to risks being sufficiently low that the application of the nuclear third party liability regime is no longer necessary;
- this option would not deliver all the benefits of the proposals. Since licence surrender procedures are explicitly laid out in legislation, not guidance, the licensee would retain the right to surrender the licence unconditionally, leaving ONR to regulate via "directions" – something we propose to change;
- under this option, HSE would not become a statutory consultee when a nuclear site licence is varied or surrendered, see paragraph 27;
- BEIS published a discussion paper in November 2016[19], in which one of the questions asked for views on whether legislative change was necessary. The majority of responses were in favour of legislative change and none suggested alternative approaches.

35. **This option was therefore rejected in the consultation stage impact assessment and is not considered here.**

[19] https://www.gov.uk/government/publications/discussion-paper-on-the-regulation-of-nuclear-sites-in-the-final-stages-of-decommissioning-and-clean-up

## 4.1. Analytical Methodology

36. Our analytical approach combines a quantitative and qualitative assessment of the proposals relative to a "no change" baseline.

37. We assess the relative costs and benefits of each option against a range of impact categories:

    a) Familiarisation costs;

    b) Reduction in costs associated with excavation of sub-surface material;

    c) Reduction in costs associated with transport and processing of subsurface waste requiring disposal;

    d) Reduction in greenhouse gas emissions associated with transport and disposal of waste;

    e) Savings associated with exiting the nuclear third party liability regime and ending the nuclear licence;

    f) Costs associated with additional environmental monitoring;

    g) Reduction of the volume of low level waste (LLW) and very low level waste (VLLW) waste requiring disposal at a permitted radioactive disposal facilities and the associated preservation of capacity;

    h) Reduction in traffic associated with transport of waste and material to fill voids;

    i) Reduction in risks of accidents to workers excavating and removing waste and in risk of traffic accidents relating to transport of the material;

    j) Reduction in time to remediate and redevelop sites;

    k) Impact on employment.

38. The first six of these categories (a to f) fall under our quantitative assessment. The remaining impacts are relatively small, uncertain and/or inherently difficult to monetise and are therefore included with qualitative analysis.

39. In the consultation, which ran from 08/05/2018-03/07/2018, we asked for further evidence to inform the impact assessment. While we did not receive any numerical data, we did receive some qualitative information, which has been included below.

### Sites examined, assumptions and appraisal period

40. ONR currently regulates 36 nuclear sites in the UK. Of these, eight are operational nuclear power plants, one is a nuclear power plant in the process of construction. Seventeen sites are the responsibility of the NDA (of which 14 are in the process of decommissioning and three are operational nuclear sites[20]). Six of the sites are military, one is a small university research reactor, one an operational waste processor and two are healthcare sites operated by GE Healthcare. **Table 1** below summarises the sites included in this analysis:

[20] These are: Capenhurst (fuel processing), Springfields (fuel processing) and the Low Level Waste Repository at Drigg (waste management).

**Table 1: UK nuclear sites**

| Category | Number of sites | Description | Dates of decommissioning | Included in this IA |
|---|---|---|---|---|
| NDA - Magnox | 12 | 10 former nuclear power stations and two research reactors (Winfrith and Harwell) | Up until the 2080's under current plans | Yes, except Harwell, see point 46 |
| NDA - other | 5 | 2 large, complex sites (Sellafield & Dounreay), 2 fuel processing sites (Capenhurst, Springfields) and one Low Level Waste Repository | Dounreay – up to late 2030's<br>Sellafield – for the next 100 years<br>Capenhurst<br>Springfields<br>LLWR – not applicable, this is a disposal facility. | Yes<br>No – see point 47<br>No – see point 48<br>No – see point 48.<br>Not applicable |
| EdF | 8 | 8 operational power plants | Decommissioning expected to start in the 2020s-2030s | No – see point 49 |
| Hinkley C | 1 | In construction | Not known, expected in the 2100s | No |
| Military | 6 | Operational | Not known | No |
| GE Healthcare | 2 | 2 small healthcare sites | 1 to be completed by 2019, the other to decommission from 2019-mid 2020s | Yes – see point 50 |
| Cyclife | 1 | Metal recycling plant | No decommissioning plans | No – see point 51 |
| Imperial College | 1 | Small research reactor | Decommissioning until 2023 | No – see point 52 |

41. In order to simplify the reporting of this analysis the NDA's nuclear estate has been grouped as follows:

- Magnox nuclear power plants (10 sites[21]);
- Harwell;
- Winfrith;
- Sellafield; and
- Dounreay.

42. This grouping has been chosen because the Magnox sites are all of similar design and age, having been constructed between 1959 and 1970. Harwell and Winfrith were primarily research reactor sites, although of different sizes and so have been considered separately. Dounreay was the UK fast reactor research site and included a reprocessing plant. Sellafield is a particularly complex

[21] Berkeley, Bradwell, Chapelcross, Dungeness A, Hinkley Point A, Hunterston A, Oldbury, Sizewell A, Trawsfynydd, Wylfa.

site, including reactors, a reprocessing plant, and facilities for producing and storing plutonium for military and civil purposes.

43. We assume that putting in place legislative and regulatory amendments will take time, particularly due to current pressures on the Parliamentary timetable. Thus we have assumed that no savings are possible before 2021.

44. Annex B **Table 9** shows key dates for each site.

45. For Winfrith and Dounreay, we expect the benefits from not needing to excavate, transport and dispose of waste to accrue in the years up to 2029 and 2037 respectively. For the Magnox sites, we expect savings up to 2030, followed by a period of quiescence before further savings are realised in the 2070s.

46. Savings from Harwell are expected to be small and to cover the period 2050s-2060s.

47. Sellafield is the largest and most complex site and the process of decommissioning and clean-up is expected to take over 100 years. We have only been able to source high level estimates for the potential savings from these proposals over a 100 year timescale and the uncertainties on these estimates are much higher than those sources for other sites (for example, the estimates of savings from transport and disposal vary by more than a factor of 10). Further work is required to characterise the sub-surface structures before reliable estimates of the savings and the yearly profile of these savings can be calculated. **For this reason, we have elected to omit the savings from Sellafield in this impact assessment.**

48. Springfield and Capenhurst are part of the NDA estate but are operational fuel processing sites. Although some old facilities on these sites are being decommissioned, we do not expect these sites to be affected by the proposals in the consultation for the foreseeable future.

49. EdF Energy operates 8 nuclear sites in the UK[22]. Current proposals are to start decommissioning in the 2020s and 2030s but it is possible that further lifetime extensions may be granted. **Since the proposals in this consultation refer to the later stages of decommissioning, we would not expect significant savings before the 2040s**.

50. GE Healthcare operates two nuclear licensed sites, one of which (Cardiff) is expected to be delicensed in 2019 and therefore will not be affected by these proposals. The Amersham site will be affected by the proposals. Since the next use of this site is likely to be for housing or commercial buildings, GE Healthcare intends to remediate to the existing “no danger” criterion, which means that no excavation savings or waste transport savings will be made. However, under the proposals, this site will make liability cover savings from around 2025 to around 2035 and GE Healthcare has provided estimates of these savings, which we have included in the analysis.

51. The Cyclife metal recycling site could potentially be affected by the proposals. If so, savings would be limited to a reduction in liability costs, as there would be no excavation or transport savings. We do not have information on these potential liability savings, but expect them to be small compared to savings at the Magnox sites and have not included these in this impact assessment.

52. We do not expect that the proposals will result in any savings from the decommissioning of the small research reactor at Imperial College and note that it is in an advanced phase of decommissioning, with delicensing, under the current arrangements, due in 2023.

53. **In order to limit our analysis to the sites for which we have the most reliable information, we have selected an appraisal period of 2021-2037. Thus this analysis presents estimated savings from Winfrith, Dounreay, the 10 Magnox sites and the GE Amersham site only for this period.** Savings from Harwell and the EdF-Energy sites fall outside this period as do additional savings from the Magnox sites in the 2070s. However, we include analysis examining the sensitivity to different choices of appraisal period. Savings from Sellafield have not been included (see paragraphs 46 and 113 for further discussion).

54. Bradwell is the site for which the NDA has the greatest amount of detail on estimated waste from sub-structures and buildings. It has been assumed that Bradwell is typical of the Magnox sites, and costs and spend profiles developed for Bradwell have been scaled to the other Magnox sites. The installed capacities of the Magnox sites ranged from 240 megawatts (MW) (Chapelcross) to 980

[22] The Edf Energy sites are entirely separate from the NDA estate.

MW (Wylfa). Bradwell's capacity was at the lower end of this range at 242 MW. It is important to note that the amount of waste is not directly correlated with the capacity of the plant, and the NDA consider that Bradwell is still typical of the others because of the design of the sites.

55. The volume of waste from full excavation of the sub-surface components of the sites is estimated to be between 5% and 20% of the total volume of waste, depending on the component being considered (for example ponds, drain work, concrete, soils). The NDA has supplied estimates of the proportion of sub-surface waste for each site based on site design specifications.

# 5. Quantitative Assessment

56. This section presents a quantitative analysis of the proposals against the baseline scenario (current regulatory framework) **for the period 2021 to 2037.**

57. The key monetised impacts have been identified as:

a) Familiarisation costs;

b) Reduction in costs associated with excavating the sub-surface waste

c) Reduction in costs associated with transport and processing of subsurface waste

d) Reduction in greenhouse gas emissions associated with transport processing of sub-surface waste; and

e) Reduction in regulatory costs associated with exiting the nuclear third party liability regime and ending the nuclear licence;

f) Costs associated with additional environmental monitoring.

## 5.1. Familiarisation costs

58. The proposals will entail familiarisation costs when site operators spend time familiarising themselves with the new regulations. Guidance documents have not yet been prepared; however, ONR anticipates that there might be two documents, each around 40 pages long[23].

59. Using the Regulatory Appraisal Subgroup Methodology, we assume that the documents would be read by around 27 middle ranking managers[24] . We assume that the reader would need to read each document three times to understand the intricacies correctly. Assuming a reading speed of 200 words per minute, 500 words per page and wages from ONS's annual survey of hours and earnings (£824.1 gross per week, ASHE 2017) and 20.2% non-wage costs, we estimate familiarisation costs of around £7,700.

60. The regulation covers licenced nuclear site operators, which are large companies. Site Licence Companies (SLCs) are already required to respond to periodic updates to ONR's inspection and assessment guidance and safety assessment principles, and therefore have the necessary expertise to interpret regulatory updates in-house. Further familiarisation costs are expected to be negligible, as we expect managers to interpret the key elements of the guidance when instructing staff.

[23] Email from ONR 19-12-2017.

[24] ONR estimates 4 at Dounreay, 1 at Winfrith, one at each of the 10 Magnox sites and 4 at Magnox Ltd HQ, plus 8 people in the supply chain, making a total of 27 people for the 12 sites considered in this IA. [Source: e-mail from ONR, 19-12-2017]

## 5.2. Estimation of volumes of sub-surface material that might be left in situ

61. Estimates of the amount of sub-surface material that could potentially be left in situ are required to estimate excavation, transport and disposal costs savings. Sub-structures may include reactor bioshields[25], ponds and foundations.

62. The NDA 2013 Radioactive Waste Inventory[26] provides a snapshot of the radioactive waste that is likely to arise in the future. Based on architectural drawings, it has been assumed that between 5% and 20% of items such as reactor bioshields, ponds and other concrete structures are subsurface, and therefore candidates for leaving in situ. Applying these percentages to the waste inventory therefore yields a high and low estimate of the potential volumes of waste whose generation might be prevented if sub-surface material is left in situ under the proposals. Note that these are **packaged** waste volumes that include the effect of packaging for disposal.

63. **Table 10** in Annex C provides the NDA's estimates of volumes of LLW and VLLW from the excavation of sub-structures that might be left in place under the proposals. **These estimates are for the whole of the programme; for example, for the Magnox sites, they include estimates of waste expected to be removed in the 2070s**.

64. The NDA Strategy[27] shows roadmaps of "intensity of work" over time for the decommissioning programme at each site. These roadmaps have been combined with the overall estimates of waste for each site to produce annual estimates of waste generated as shown in Annex D, Figure D1. This figure shows the period of quiescence from the 2030s to 2070s for the Magnox sites, as mentioned in section 1.

## 5.3. Reduction in costs associated with excavating the sub-surface material

65. Substructures may lie 12 metres or more below ground. Excavating this material is complex engineering work requiring specialist equipment and skilled workers.

66. Winfrith will be the first complex UK nuclear site to reach its end state and is the site for which we have the most accurate estimates of potential savings. Magnox Ltd has carried out a detailed characterisation of the sub-structures and soils[28], and has calculated the costs of reaching the "no danger" criterion based on engineering feasibility studies and proprietary cost models. This study took account of the complexity of excavation (based on the depth, accessibility and volume of material being removed). It includes estimates of hire of equipment, employment of suitably qualified personnel (based on standard industry cost) and ground water pumping. The report also includes a safety case to establish which parts of the lightly contaminated sub-structures/soils could potentially be left in situ. The Site Licence Company's best estimate of the potential excavation savings is £28m.

67. Characterisation reports of sub-structures and soils at the other sites under consideration are also available, but detailed modelling of the costs of excavation at these sites has not yet been undertaken. Instead, the Site Licence Companies have provided approximate estimates based on the characterisation of each site and engineering judgement.

68. NDA has also provided approximate estimates of savings from sub-structure excavation. These are based the avoidance of excavation activity resulting in wage cost savings, which excludes non-wage cost and capital equipment rental savings. **Table 2** shows the savings by site based on the duration of the excavation, the estimated number of full-time equivalent employees engaged in this activity and an assumed average salary of £40,000[29]. Note that the figure for the Magnox sites is

[25] Specialised concrete shield around a nuclear reactor

[26] NDA. 2013 UK Radioactive Waste Inventory: Waste Quantities from all Sources. February 2014

[27] Nuclear Decommissioning Authority Strategy: Effective from April 2016. SG/2016/53 March 2016

[28] "Winfrith Interim End State Cost Model (for NDA Review).xls – spreadsheet received from Winfrith. The associated report "Site Decommissioning and Remediation: Stage B: Winfrith Site End State Determination" report ES(17)P154, Magnox Ltd does not separate out excavation and disposal costs.

[29] The median gross annual pay for employees in the treatment and disposal of hazardous waste is £39,791 (2017, ASHE Table 16).

the total for all ten sites together; the estimated excavation costs at each Magnox site are comparable to those at Winfrith.

69. The time profiles of savings are expected to follow the time profiles of waste generation shown in Figure D1 and mentioned in paragraph 64. Thus, for the 10 Magnox sites, only part of the total potential savings from the proposals would be realised in the appraisal period of 2021-2037. The remainder would be realised in the 2070s, after the period of quiescence. See **Table 2**.

**Table 2: Estimated savings from reductions in waste excavation (undiscounted)**

| Site | Excavation savings estimated by NDA | Excavation savings estimated by SLCs | Duration | Proportion of savings occurring in the period 2021-2037 | Estimated excavation savings for 2021-2037. |
|---|---|---|---|---|---|
| Winfrith | £32m | £28m | Until 2028 | 100% | **£28 – 32m** |
| Magnox (Total savings for all 10 sites together) | £400m | £240m – £400m | 2020s and 2070s. | 33% | **£80 – 133.5m** |
| Dounreay | £60m | £30m – £70m | Until 2037 | 100% | **£30 – 70m** |

## 5.4. Reductions in cost from reduced transport and disposal of LLW and VLLW

70. Reductions in the volume of LLW and VLLW generated from the excavation of subsurface material reduce the requirement to transport and dispose of this waste resulting in associated cost savings.

71. NDA guidance[30] provides estimates for the cost of disposing radioactive waste and is based on costs such as container purchase, transportation and disposal charges. These are given as:

- between £3,100 and £7,552 per $m^3$ of LLW; and
- £500 per $m^3$ of VLLW.

72. The NDA have calculated estimates of transport and disposal savings based on the estimates of volumes of waste to be transported (see Annex C and paragraphs 61-63) multiplied by the transport and disposal costs above (paragraph 71).

73. SLCs have also provided estimates of transport and disposal savings for the Magnox sites and Winfrith[31]. Both sets of estimates are shown in Annex E, **Table 11**.

74. Following discussions with the NDA these estimates have been combined to produce low and high estimates used in this impact assessment, presented in Annex E **Table 12** and in **Table 3**.

75. One respondent to the consultation noted that the impact assessment did not include cost savings from not needing to import rubble to fill voids left on site. Winfrith has confirmed that they expect to have sufficient rubble from demolished buildings to fill any voids. We anticipate that the same will apply at the other sites and therefore have not included this cost saving. Potential cost savings of not needing to purchase clay and topsoil have not been included in the analysis.

[30] Lifetime Cost Assumptions for LLW Activities (Rev2 April 2013)

[31] SLCs have not provided estimates of waste volumes but have provided the estimated costs of disposal, also based on the transport/disposal costs in section 56. It is not possible to work backwards from these costs to provide the SLCs' estimates of volumes of waste to be transported.

**Table 3: Estimated savings from reduced transport and disposal of waste (undiscounted)**

| Site | Transport and disposal savings for 2021-2120 (note: hundred year period) | | Duration | Proportion of savings occurring in the period 2021-2037 | Estimated transport and disposal savings for 2021-2037 (range in brackets). |
|---|---|---|---|---|---|
| | Low | High | | | |
| Winfrith | £10.9m | £55.0m | Until 2028 | 100% | **£32.9m (£10.9 - £55m)** |
| Magnox (total for all 10 sites) | £210.0m | £745.3m | 2020s and 2070s | 33.3% | **£159.4m (£70m - £248.8m)** |
| Dounreay | £78.1m | £93.5m | Until 2037 | 100% | **£85.8m (£78.1m - £93.5m)** |

## 5.5. Valuing greenhouse gas savings from the reduction in transport and processing of low level waste

76. Reductions in the volume of excavated waste are expected to reduce greenhouse gas emissions associated with its transport and disposal. We estimate that 0.076 MtCO2e would be saved from leaving subsurface material in situ over the appraisal period 2021-2037. Under central price estimates for non-traded carbon[32], this is valued at £4.8m (discounted). At high and low carbon prices the savings are £2.4m and £7.2m, respectively.

77. This is based on a combined total of around 72,000 tonnes of subsurface waste, converting the average of high and low subsurface volume estimates from NDA inventories to weight using a standard industry factor of 1.25 tonne/m3[33], and time profiled by site according to the annual profiles given in Annex D.

78. We assume no carbon recovery occurs through incineration or metals treatment in the baseline.

79. To estimate transport emissions savings we also assumed that all LLW would have been transported to the UK's LLW repository while all VLLW would have been transported to the nearest appropriate disposal facility. Note that the site facilities at Dounreay are adjacent to the site, and so the distance has been assumed to be zero in this case. Rigid HGV emissions for average loading are 0.11 kg CO2e per kilometre-tonne[34] and carbon factors for disposal were taken to be 1055 kg CO2e and 199 kg CO2e per tonne of LLW and VLLW respectively[35].

80. This estimate does not take account of any potential changes in carbon factors for transport or processing of waste that might occur over the assessment period, which may arise from, for example improved fuel efficiency of vehicles or variations to the methods of processing radioactive waste.

## 5.6. Reduction in regulatory costs associated with exiting the nuclear third party liability regime and ending the nuclear licence

81. There are two elements to the reduction in regulatory costs, the reduction in costs associated with exiting the nuclear third party liability regime and the reduction in costs through not requiring a licence. Different sites are scheduled to reach these points at different times, as shown in the table of key dates, Annex B, **Table 9**.

82. Insurance premium savings would start from the point at which the site meets the Paris Convention Decommissioning Exclusion Criteria. We do not have figures for annual insurance premiums for the third party liability regime. The liability levels are currently €1200million as set in law. However,

[32] https://www.gov.uk/government/publications/valuation-of-energy-use-and-greenhouse-gas-emissions-for-appraisal

[33] http://www.wrap.org.uk/sites/files/wrap/WRAP%20Waste%20Reporting%20Guidance%20Update%20-%20FINAL1.pdf

[34] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2017

[35] http://llwrsite.com/wp-content/uploads/2016/08/NWP_REP_083-Carbon-Emissions-Assessment-Issue-2-July-2016.pdf

Government has set out proposals to reduce nuclear liability for "intermediate risk prescribed sites" to €160million[36]. The proposals would apply to all the sites considered in this impact assessment[37].

83. The reduction in regulatory costs associated with nuclear regulation would start from the point at which ONR accepts the surrender of the licence, as shown for each site in Annex B Table 9. These have been termed as 'standstill' costs. The standstill costs have been based on data for nuclear sites such as Cyclife UK Limited[38], Chapelcross[39] and Dounreay and cover aspects such as regulatory charges, security requirements, maintenance of the nuclear staffing requirements, corporate management and assurance costs. The figures received ranged between approximately £1m and £3m per year. The analysis adopts a conservative figure of £1m per year for standstill costs for each site beyond the point of assumed de-licensing.

84. As described in paragraphs 44-53, we have elected to present the benefits for the period 2021-2037. This covers the entire period of clean-up work at Winfrith and Dounreay and the first phase of clean-up at the Magnox sites. **Only Winfrith is expected to reach the criteria for exiting the nuclear third party liability regime during the appraisal period and therefore is the only site in this appraisal for which benefits from insurance premium savings and regulatory savings accrue during the appraisal period.** No insurance premium savings or regulatory savings for Dounreay or the Magnox sites are expected within the appraisal period (see Annex B, Table 9). Following consultation, GE Healthcare stated that part of one of their sites would be expected to be affected by these proposals, with savings to insurance costs of around £140,000 per year for around 10 years from around 2025[40].

85. Under the proposals, HSE would assume regulatory responsibilities for conventional health and safety, including the protection of workers under the Ionising Radiations Regulations after the ending of the nuclear licence. HSE have confirmed that they do not charge an annual charge for regulation (unlike ONR); however, if a site is found to be in breach of regulations they charge fees to recover the costs of its interventions[41]. No additional costs arising from complying with these safety regulations are expected under HSE because the ONR already implements them – the regulator changes but not the underlying regulations.

86. Under the proposals, regulation by the relevant environment agency would continue when the nuclear licence is revoked. The Environment Agency, Scottish Environmental Protection Agency and Natural Resources Wales have confirmed that they do not expect their costs to increase.

## 5.7. Costs associated with additional environmental monitoring

87. Under both the current and the proposed frameworks, the site licence operator is expected to monitor radioactivity and contamination at various locations on the site to ensure that environmental safety requirements are met. At Winfrith, the duration of these measurements is expected to be different for the two different options; 5 years for the current framework and 30 years for the proposals, to verify the radioactive decay of material left in situ.

88. For Dounreay and the Magnox sites these costs fall outside the appraisal period. For Winfrith, however, the change in monitoring requirements under the proposals results in an estimated net increase in monitoring costs of £1.2m[42] over the appraisal period 2021-2037.

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[36] "Nuclear Third Party Liability: Defining Intermediate Risk Prescribed Sites – Consultation", BEIS, August 2017, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/636789/Intermediate_sites_consultation_paper_-_11_August_2017_v2.pdf

[37] The term "Intermediate Risk Sites" means sites which have been permanently defuelled and where the spent fuel has been stored in accordance with good practice.

[38] Formerly Studsvik-Lillyhall, a metal recycling facility.

[39] Chapelcross is thought to be typical of the Magnox sites in terms of the standstill costs.

[40] No other savings are expected for this site, as it will be cleaned to the "no danger" criterion, since its next planned use is likely to be for housing or commercial buildings.

[41] See http://www.hse.gov.uk/pubns/hse47.htm

[42] Site Decommissioning and Remediation: Stage B: Winfrith Site End State Determination" report ES(17)P154 estimates monitoring costs under the current framework as £2m (undiscounted) and spread over the period 2023-2028. Under the proposals, monitoring costs are £8m (undiscounted) and spread over the period 2023-2053. The discounted difference between these over the period 2021-2037 is £1.2m.

## 5.8. Summary of benefits

89. Table 4 shows a summary of the costs and benefits for the appraisal period 2021-2037, with costs shown as negative and savings as positive. Following discussions with the NDA, we combine their "high" and "low" estimates of excavation and transport/disposal savings with those estimated by SLCs, and take a best estimate as the average of the high and low values. The undiscounted savings are shown in **Table 4**. Figures in brackets show the low and high values. Discounted figures are shown in **Table 5**.

**Table 4: Estimated costs and savings for the period 2021-2037 (undiscounted £m)**

| | Winfrith | Magnox estate | Dounreay | GE site | Total |
|---|---|---|---|---|---|
| **Costs** | | | | | |
| **Familiarisation costs** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Monitoring costs** | 2.0 | n/a | n/a | n/a | 2.0 |
| **Savings** | | | | | |
| **Excavation savings** | 30.0 (28.0-32.0) | 106.8 (80.0-133.5) | 50.0 (30.0-70.0) | 0.0 | 186.8 (138.0-235.5) |
| **Transport/disposal savings** | 32.9 (10.9-55.0) | 159.4 (70.0-248.8) | 85.8 (78.1-93.5) | 0.0 | 278.1 (159.0-397.3) |
| **Greenhouse gas savings** | 0.4 (0.2-0.6) | 2.5 (1.3-3.8) | 3.1 (1.5-4.6) | 0.0 | 6.0 (3.0-9.0) |
| **Liability cover and regulatory savings** | 8.0[43] | 0 | 0 | 1.4 | 9.4 |
| **Total net savings** | **69.4** (45.1-93.6) | **268.7** (151.3-386.1) | **138.9** (109.6-168.1) | **1.4**[44] | **478.3** (307.4-649.2) |

**Table 5: Costs and benefits for the appraisal period 2021-2037 (discounted £m)**

| | Total savings for sites assessed | | |
|---|---|---|---|
| | **Low** | **High** | **Best Estimate** |
| **Costs** | | | |
| **Familiarisation costs** | 0 | 0 | **0.0** |
| **Monitoring costs** | 1.2 | 1.2 | **1.2** |
| **Savings** | | | |
| **Excavation savings** | 114.8 | 193.8 | **154.2** |
| **Transport/disposal savings** | 129.3 | 328.0 | **228.7** |
| **Greenhouse Gas savings** | 2.4 | 7.2 | **4.8** |
| **Liability cover and regulatory savings** | 6.3 | 6.3 | **6.3** |
| **Total net savings** | **251.5** | **534.1** | **392.8** |

90. Note the effect of rounding to the nearest £0.1m; familiarisation costs are estimated at around £7,700. Note also that costs are represented as negative in the tables above and savings as positive.

[43] See points 62 and 63. Winfrith and the NDA have not provided estimates of liability savings, as these are confidential.

[44] GE Healthcare's estimate is for liability savings only; they consider that, for their site, there will be negligible regulatory savings.

## 5.9. Business Impacts

91. Since the consultation stage impact assessment, the Business Impact Target has been set for this Parliament. The following analysis is carried out in accordance with the prescribed methodology. This is a qualifying measure. The analysis below is presented as 2016 prices in 2017 present values to be consistent with the calculation of the BIT score. **Table 6** shows the best estimate impact of the proposals.

92. Except for greenhouse gas savings, all monetised costs and benefits fall on organisations involved in the decommissioning and clean-up of nuclear sites and are included in the BIT analysis. The NDA and regulators are public bodies[45]. While SLCs receive their funds for decommissioning and clean-up from the NDA[46], they are private limited companies and are owned by large private sector consortia[47].

**Table 6: BIT analysis for the proposals**

| **Cost of Option (£m, 2016 prices, 2017 present value)** | | | |
|---|---|---|---|
| **Total Net Present Social Value** | **Business Net Present Value** | **Net direct cost to business per year** | **BIT Score** |
| 342.3 | 338.1 | -25.8 | -129.1 |
| **Appraisal Period (Years)** | 17 | | |

## 5.10. Sensitivity to appraisal period

93. The NPV of the proposals is sensitive to the appraisal period due the duration of decommissioning and clean-up activity that is covered within the estimates. Paragraph 53 explains our choice of appraisal period. **Table 7** presents the sensitivity of monetised savings over five different periods.

94. The different appraisal periods presented are: (a) 2021-2037 (17 years) (b) 2021-2030 (10 years) (c) 2021-2040 (20 years), (d) 2021-2050 (30 years) and (e) 2021-2101 (80 years). The last period includes the savings from excavations that would have been made at the Magnox sites in the 2070s and 80s and also includes savings from Harwell (in the 2050s and 2060s). Savings from Sellafield have not been included but as described in paragraph 46, these are expected to be large and to accrue in the hundred year period 2021-2120.

95. **Table 7** shows that the net present value increases from £347.0m to £403.1m as the appraisal period is increased from 10 to 30 years. The Magnox sites enter a period of quiescence in year 13 and thus do not contribute to savings between year 13 and year 30. However, this period of quiescence ends in around 2070 and additional savings accrue in the 2070s once the period of quiescence is over, resulting in a net present value over 80 years of £572.4m. The 80 year appraisal period also takes account of small savings from Harwell that are expected to accrue in the 2050s and 2060s.

[45] The NDA and the regulators receive funds from central Government and from commercial activities.

[46] For the avoidance of doubt, the decommissioning and clean-up contracts that NDA funds come from the public funds that the NDA receives.

[47] NDA has completed competitions for the ownership and management the above 4 Site Licence Companies (SLCs) to improve on-site performance. The winning bidder of each competition is called a Parent Body Organisation (PBO). A PBO owns the shares in an SLC for the period of the contract. Each PBO is a consortium of private sector organisations.
(from https://www.gov.uk/government/organisations/nuclear-decommissioning-authority/about#ndas-estate). NDA contracts for decommissioning and clean-up are typically on a 'target cost' basis. The NDA agrees a cost with the SLC; if the SLC comes in under that cost, then the two organisations share the savings. If the work is over cost, then the SLC contributes to any over-spend.

**Table 7: Sensitivity of benefits to the appraisal period**

| Appraisal period | Dates | Years | Sites included | Total net present value (£m) | Annual net impact on business (£m) |
|---|---|---|---|---|---|
| a | 2021-2037 | 17 | Magnox, Dounreay, Winfrith and GE Amersham | 392.8 | 23.6 |
| b | 2021-2030 | 10 | As above | 347.0 | 31.7 |
| c | 2021-2040 | 20 | As above | 395.6 | 21.2 |
| d | 2021-2050 | 30 | As above | 403.1 | 16.6 |
| e | 2021-2101 | 80 | As above + Harwell | 572.4 | 15.7 |

96. As discussed in paragraph 46, savings from the Sellafield site have not been included. These savings are likely to be large, but estimates are more uncertain than those for the other sites, due to the complexity of the Sellafield site. The NDA and the Site Licence Company (Sellafield Ltd.) have provided estimates of savings from transport and disposal of waste from Sellafield, over the next 100 years. These undiscounted figures are shown in Annex F and range from £900m-£7,200m, plus an estimated £46m of regulatory savings. Previous unpublished estimates of savings from Sellafield, Dounreay, the Magnox sites and Winfrith were £2bn (discounted) over 100 years, with a range from £500m-£3,600m. These did not include excavation savings, which are significant. Given the uncertainty of the estimates of savings at Sellafield, these estimates are considered to be less reliable than the ones presented in this impact assessment but illustrate the scale of the potential savings long term.

# 6. Qualitative Assessment

## 6.1. Reduction of the volume of low level waste (LLW) and very low level waste (VLLW) waste requiring disposal

97. The UK currently has 1.19 million cubic metres of capacity in permitted disposal facilities for radioactive substances[48]. From our estimation of greenhouse gas savings, we find that the proposals would allow around 57,850 cubic metres of LLW and VLLW to remain in situ. This would reduce the volume of LLW and VLLW waste produced, therefore reducing demand for storage space in waste repositories which have limited capacity. This would lead to further indirect savings, such as greenhouse gases and land use, from the avoidance of constructing additional waste facilities. Annex C, Table 10 shows the estimated reduction in the volumes of LLW and VLLW. Based on an unpublished study by Nuvia for the NDA[49], the cost of designing and building a new LLW facility is estimated as £400mn (undiscounted), and the most likely date for construction under the current framework would be in the 2040s, which is outside the appraisal period. The discounted savings would be expected to be around £170m.

## 6.2. Reduction in traffic associated with transport of wastes and material to fill voids

98. LLW and VLLW being removed from site and taken to waste repositories are most likely to be transported by road. Furthermore, equal amounts of material may be required to fill in the voids left from the excavation. Based on an assumed lorry load of 30 tonnes, there could be significant reductions in lorry traffic around 4,800 lorry journeys over the period 2021-2037 under the

[48] LLW Repository ltd. National Waste Programme. Low Activity Low Level Waste Capacity Assessment. NWP?REP/011 –Issue 3 – March 2013

[49] "A cost estimate for the successor to the Low Level Waste Repository", unpublished Nuvia report for NDA, 01/04/2009.

proposals, or an average of 284 per year. The reduction in traffic will lead to a reduction in associated air pollution.

### 6.3. Reduction in risk of accidents to workers excavating waste and risk of traffic accidents relating to transport of material to waste facilities

99. These proposals will reduce the risk of accident to workers and the public during nuclear site clean-up due to a reduction in land remediation and transport of waste. However, no UK nuclear sites have yet reached the final stages decommissioning and clean-up yet so it has not been possible to estimate the reduction in risk of accidents reliably. Fatal accidents in construction industry are rare. From HSE data, 0.4% of construction workers reportedly suffered non-fatal injuries[50]. Similarly, accidents involving pedestrian and HGVs are also infrequent with 0.018 accidents per million kilometres travelled[51].

### 6.4. Assessment of reduction in time to remediate and re-develop sites

100. In practice, it is extremely difficult to re-use sites while the nuclear site licence is in place. Under the proposals, ONR would be able to revoke the licence sooner than it can currently. The site would continue to be regulated by the relevant environment agency and the operator could **apply** to the local authority for planning permission for a new use while the environmental permit is in place[52]. Annex B **Table 9** shows the potential reduction in time to re-use or redevelop each site **subject to planning permission.**

### 6.5. Assessment of equalities impact

101. This deregulatory measure would not have adverse impacts on any of the groups with protected characteristics as defined in the 2010 Equalities Act. As mentioned in paragraph 26, these proposals would not result in any increase in the risk to public health over the current baseline. Reduced traffic impacts near former nuclear sites would be a benefit to all local residents, irrespective of protected characteristics.

### 6.6. Labour market impacts

102. The proposed regulatory change could reduce the number of jobs in the excavation and transport of LLW and VLLW but we do not expect there to be significant impacts on labour markets. This is because the majority of radioactive waste is not subsurface and will therefore be removed as at present.

103. There may, however, be local impacts, as nuclear sites are typically located in places with relatively high unemployment and jobs in the nuclear sector generally pay better than other comparable construction jobs. However, it is not possible to quantify these effects reliably. No impacts are expected in the initial years following policy change as the majority of radioactive waste will still require removal.

104. Under the proposals, sites are likely to be available for re-use earlier – in some cases, decades earlier than they might otherwise have been. Some sites will be used for recreational purposes, while site operators may apply for planning permission to redevelop others for commercial or industrial purposes. Since the nature of potential re-use is unknown and there is considerable uncertainty in forecasts of the labour markets in the 2030s and beyond, it is not possible to estimate the impact on jobs.

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[50] 2015/16r. http://www.hse.gov.uk/statistics/tables/index.htm#riddor

[51] 2016. Calculated from the number of accidents involving pedestrians and total vehicle kilometres of GB-registered vehicles. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/647872/ras10012.ods https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/626452/rfs0120.ods

[52] This permission would be subject to consultation between the relevant Planning Authority and the Environment Agency, as well as appropriate assessments of exposures to ionising radiation and control of any radioactive waste that might arise from new development.

## 6.7. Small and micro business assessment

105. No small and micro businesses are expected to be directly affected by the regulatory change. The regulation covers licenced nuclear site operators, which as previously mentioned are large companies. For example, Magnox Ltd employs 3,089 people and has a turnover of £648.2m[53].

106. **Table 8** shows the number of employees on a headcount basis at each decommissioning site we have considered. All the sites except Wylfa have finished defuelling. The headcount figures are based on surveys of the Nuclear Industry Association's membership to estimate number of employees engaged in the UK's civil nuclear industry. It shows that each site is large, employing more than 200 individuals, although these figures will include employment at businesses which have been contracted to supply services in addition to workers at the nuclear site operators.

**Table 8: Number of employees at each decommissioning site (2017)[54]**

| Decommissioning site | Headcount |
|---|---|
| Magnox Sites | |
| Berkeley | >230 |
| Bradwell | >230 |
| Chapelcross | >360 |
| Dungeness A | >290 |
| Hinkley Point A | >270 |
| Hunterston A | >260 |
| Oldbury | >600 |
| Sizewell A | >280 |
| Trawsfynydd | >400 |
| Wylfa | >530 |
| Harwell | >340 |
| Winfrifth | >250 |
| Dounreay | >600 |

107. We expect indirect impacts on small and micro businesses from the reduced volume of decommissioning and clean-up activity to be limited as they are unlikely to be suited to perform most of the complex tasks involved. In particular, excavation of substructures requires specialised equipment that small businesses are unlikely to have access to, as well as a skilled workforce with the requisite qualifications, and so we would not expect a significant number to contract for this work.

108. Small and micro businesses could potentially be impacted by the reduction in less technically demanding activity to support the clean-up activity. Small hauliers could bid for contracts to transport hazardous materials to low and very low level waste to disposal facilities since training to do so is not arduous and is readily available. Most of the approved hauliers for the Low Level Waste Repository are SMEs, though we expect that of these SMEs only a minority are small businesses. Therefore, since paragraph 98 estimates that the proposals could lead to around 284 fewer lorry journeys per year during the appraisal period – that is, around one journey a day spread between the various sites across different regions of the country – we expect any potential impact on small and micro businesses to be minimal.

[53] 2017 figures https://suite.endole.co.uk/insight/company/02264251-magnox-limited

[54] NIA Jobs Map 2017, https://www.niauk.org/wp-content/uploads/2017/06/NIA_Jobs_Map_FINAL1.pdf.

# 7. Summary and Preferred Option

109. BEIS has consulted on proposals to amend the regulatory framework for nuclear sites in the final stages of decommissioning and clean-up. Following consultation, we propose to amend the NIA65 to adopt international recommendations on the procedure for exiting the nuclear third party liability regime and to introduce an amended licence surrender process. We consider that these proposals will enable a more flexible and sustainable approach to site remediation.

110. The Steering Group considered a non-legislative change option in which ONR changes its guidance to include new criteria for exiting the period of responsibility for nuclear third party liability and introduces a new process for licence surrender but concluded that this option was not viable, for a range of reasons, as discussed in paragraphs 34-35.

111. The preferred option would be expected to result in net benefits of £392.8m over 17 years (range £251.5m – £534.1m) as well as non-monetised benefits such as a reduction in lorry traffic, reduced generation of low and very low level waste, reduced pressure on radioactive waste disposal facilities and a more streamlined regulatory framework for site operators, who would have to consider a single set of clean-up regulations, rather than two sets, as at present.

112. As discussed in paragraphs 44-53, the appraisal period selected (2021-2037) does not include:

    a) expected savings from the Magnox sites in the 2070s;

    b) savings in liability premiums from the dates of meeting the Paris Decommissioning Exclusion criteria (2029 onwards for Winfrith, 2037 for Dounreay, 2050 for the Magnox sites, see Annex B);

    c) savings from regulatory costs for Dounreay (from 2038) and for the Magnox sites (from 2050, see Annex B);

    d) savings from Sellafield, which is the largest and most complex site, but where assessment of sub-structures that could, potentially, be left on site is less well advanced than on the sites assessed here;

    e) savings from the EdF sites, which are scheduled to commence defueling in the 2020s and 2030s; or

    f) small savings from Harwell, in the 2050s

    g) savings from military sites (unknown, but unlikely to have any impact before the 2040s at the earliest).

113. The most significant savings are likely to be from Sellafield, but these are also the most uncertain, since Sellafield is a highly complex site. The NDA and Site Licence Companies have provided estimates of savings from transport and disposal of waste from Sellafield, over the next 100 years. These **undiscounted** figures are shown in Annex F and range from £900m-£7,200m, plus an estimated £46m of regulatory savings. Previous estimates of savings from Sellafield, Dounreay, the Magnox sites and Winfrith were £2bn (**discounted**) over 100 years, with a range from £500m-£3,600m. These did not include excavation savings, which are significant. Given the uncertainty of the estimates of savings at Sellafield, these estimates are considered to be less reliable than the ones presented in this impact assessment, but illustrate the scale of the potential savings long term.

## 7.1. Implementation Plan

114. Based on the analysis presented here, we propose to develop new criteria for exiting the period of responsibility under the NIA65 and introduce an amended licence surrender process. This would entail changes in primary legislation (the Nuclear Installations Act 1965).

115. If the proposed amendments to primary legislation are implemented, we will consider how to obtain data to assess the actual benefits (as opposed to the estimated benefits) of the programme.

116. We do not anticipate that any policy based on these proposals would require regular review; however, we suggest that lessons learned from the first sites to be decommissioned are shared with operators of other sites.

# Annex A: Background to the interpretation of the “no danger” criterion in the NIA65

117. The NIA65 states that the “period of responsibility” for nuclear third party liability can end “when the appropriate national authority gives notice in writing to the licensee that in the authority's opinion there has ceased to be any danger from ionising radiations from anything on the site or, as the case may be, on the part of it in question; the date when the appropriate national authority gives notice in writing to the licensee that in the authority's opinion there has ceased to be any danger from ionising radiations from anything on the site or, as the case may be, on the part of it in question.”

118. This criterion is known as the “no danger” criterion. It was interpreted in 2005 by the then regulator HSE and delicensing guidance was updated in 2008.

119. The delicensing criterion document of 2005 “attempts to achieve broad consistency with current scientific thinking, relevant guidance and other published material including the Radioactive Substances Act 1993 (and the exemption orders made under it), article 5 of the Basic Safety Standards Directive, and the International Atomic Energy Agency (IAEA) Safety Guide ‘Application of the Concepts of Exclusion, Exemption and Clearance’” (para. 2). It “forms a policy basis from which HSE can establish from its own assessment, from the licensee’s evidence, and through information from other regulatory bodies concerned with the site (e.g. the Environment Agency or the Scottish Environment Protection Agency), that any residual radioactivity on the site, above the average natural background, represents ‘no danger’” (para. 4). On the basis of existing, published guidance (for example, HSE’s “Tolerability of Risk” (TOR) and “Reducing Risks, Protecting People” (R2P2) publications), HSE considered that an additional risk of death to an individual of one in a million per year, was ‘broadly acceptable’ to society. Applying this to nuclear licensed sites, any residual radioactivity, above the average natural background, which can be satisfactorily demonstrated to pose a risk less than one in a million per year, would be ‘broadly acceptable’. For practical purposes, therefore, HSE used this criterion as the basis of what would be regarded as ‘no danger’ for the purposes of sections 3(6)(b) and 5(3)(a) of NIA65. Compliance with this criterion would normally mean that HSE could remove the site from regulatory control under NIA65 – i.e. allow the site to be delicensed (para. 10).

120. Paragraph 11 of the delicensing criterion document explained that legislation such as the Radioactive Substances Act 1993 (and the exemption orders made under it) and the Basic Safety Standards Directive (Euratom 96/29) that set standards for the protection of human health were also used to inform decisions on what constitutes ‘no danger’. Under the Radioactive Substances Act 1993, in line with government policy, regulators did not seek further reductions in discharges where exposures of members of the public were optimised and less than 20 microSieverts per year. Annex 1 of the Basic Safety Standards Directive (Euratom 96/29) allowed member states to exempt a practice where appropriate and without further consideration if doses to members of the public were of the order of 10 microSieverts or less per year. HSE was of the view that this dose limit broadly equates to the 1 in a million per year ‘no danger’ criterion as well as being consistent with other legislation and international advice relating to the radiological protection of the public.

121. Paragraph 1.4 of the 2008 delicensing guidance explained that the HSE policy was developed following extensive public consultation.

122. It **is important to note that we do not propose to re-interpret the “no danger” criterion in NIA65**. Instead, we propose to amend NIA65 so that there is an alternative route, based on internationally agreed criteria, to exit the requirement for nuclear third party liability and subsequently, to allow ONR to revoke the site licence if satisfied that nuclear safety and security matters have been resolved. The “no danger” route would remain as an option, for example, for sites which are not covered by the scope of the Paris Decommissioning Exclusion or for sites for which are not regulated by the relevant environment agency. For example, the Low Level Waste Repository at Drigg in Cumbria would not be in scope of the Paris Decommissioning Exclusion since it is not a nuclear site in the process of being decommissioned[55]. Sites which contain spent

[55] Furthermore, no matter how much the radiation levels had decayed, the site would never meet the criteria in the Low Level Waste Exclusion, since these apply to the radiation from the waste at the time at which it was first deposited in the facility. We therefore consider that the “no danger” route would be the most appropriate method for ending nuclear third party liability for these sites,

or unused fuel which is not classified as waste may not have an environmental permit under the Radioactive Substances Regulations and therefore it would be inappropriate to release these from all regulation once the Paris Decommissioning Exclusion criteria were met. In these cases, we propose to retain the existing “no danger” route to ending the period of responsibility for nuclear third party liability.

123. Under the proposals, radiological protection of workers would continue under the Ionising Radiations Regulations, which would be administered by HSE instead of ONR. These regulations were updated to align with the most recent version of the Basic Safety Standards Directive in 2017. Radiological protection of the public would be regulated under the Environmental Permitting Regulations 2016 (in England and Wales) and under the Regulatory Reform Act 2014 in Scotland.

# Annex B: Key dates for each site

124. **Table 9** shows three key dates for each site: the date at which the site meets the Paris Convention Decommissioning Criteria under the proposals (and therefore exits the nuclear liability regime), the point at which the site is de-licensed (under the proposals) and the point at which “no danger” would be reached (under the current framework).

l) The final row shows the reduction in time to re-use or re-develop the site under the proposals.

**Table 9: Key dates for each site**

| Site | Winfrith | Magnox | Dounreay | GE Healthcare Amersham |
|---|---|---|---|---|
| **Date at which "No danger" criterion met – under the current framework** | 2050 | 2090 | 2100 | 2023 |
| **Period during which excavation and transport of waste are required under the current framework but not under the proposals** | 2021-2029 | 2021-2030 and in the 2070’s | 2021-2037 | Not applicable |
| **Date at which Decommissioning Exclusion Criteria are met under the proposals** | 2029 | 2050 | 2038 | Not applicable |
| **Date at which site can be de-licenced (and assumed point when site can be reused in some way) under the proposals** | 2029 | 2050 | 2038 | 2023 |
| **Period for which regulatory savings can be made under the proposals** | 2030-2050 | 2050-2090 | 2039-2100 | Liability savings from 2025-2034. |
| **Reduction in time to develop/re-use the site (years) under the proposals** | 21 | 40 | 63 | Not applicable |

# Annex C: Estimates of avoided waste generation under the proposals

**Table 10: Estimates of avoided waste generation under the proposals from the NDA.**

| | Very Low Level Waste (VLLW) volume avoided | | Low Level Waste (LLW) volume avoided | | Proportion within the period 2021-2037, as calculated from the profiles in Annex C |
|---|---|---|---|---|---|
| | Volume – low estimate ($m^3$) | Volume - high estimate ($m^3$) | Volume - low estimate ($m^3$) | Volume - high estimate ($m^3$) | |
| Winfrith | - | - | 3,515 | 5,053 | 100% |
| Magnox estate | 6,400 | 6,400 | 44,255 | 98,265 | 33.3% |
| Dounreay | - | - | 25,180 | 30,169 | 100% |
| **Total** | **6,400** | **6,400** | **72,950** | **133,487** | |

125. These apply to the hundred-year period 2021-2120. The final column shows the proportion excavated under the current framework in the period 2021-2037. Thus, the total volume of waste whose generation might be prevented between 2021 and 2037 is estimated as being between 45,578- 70,107m3. We have assumed an approximate average figure of ~57,850m3.

# Annex D: Annual profiles of avoided waste generation under the proposals

126. The NDA strategy[56] shows roadmaps of "intensity of work" for the decommissioning programme at each site. These roadmaps have been combined with the average estimates of the amount of waste whose generation could be avoided under the proposals from **Table 10** to obtain annual profiles of avoided waste generation under the proposals as shown in Figure D1. Note that the profile of savings from the proposals would be expected to follow the profile of avoided waste generation.

127. As shown in the figure, site excavation under the current framework is expected to be completed by 2029 (Winfrith), 2037 (Dounreay) and 2095 (Magnox sites).

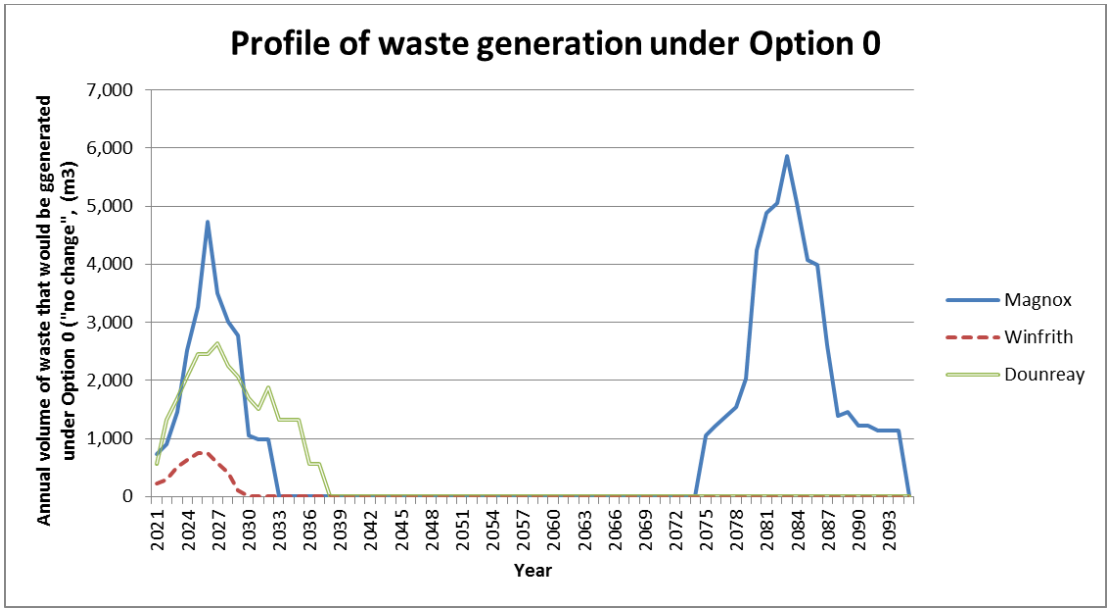


**Figure D1: Annual profile of waste generated under the current framework, Magnox sites, Winfrith and Dounreay**

[56] Nuclear Decommissioning Authority Strategy: Effective from April 2016. SG/2016/53 March 2016

# Annex E: Estimated savings from transport and disposal of material left in situ under the proposals

128. **Table 11** shows two sets of estimates of savings associated with not needing to transport and dispose of waste – one set from the NDA and one from the site licence companies. These apply to the hundred year period 2021-2120. The final column shows the proportion excavated under the current framework in the period 2021-2037.

**Table 11: Two sets of estimates of savings associated with not needing to transport and dispose of waste under the proposals (undiscounted)**

| Site | Estimated undiscounted savings for transport, processing and disposal £m 2021-2120 (**note: hundred year period**) | | | | Duration | Proportion of savings in the period 2021-2037 |
|---|---|---|---|---|---|---|
| | Estimated by NDA | | Estimated by Site Licence Companies | | | |
| | Low | High | Low | High | | |
| Winfrith | 10.9 | 37.5 | 55 | 55 | Savings occur up to 2028 | 100% |
| Magnox (10 sites) | 138.1 | 745.3 | 210 | 400 | Part of these savings occur in the 2070s. | 33% |
| Dounreay | 78.1 | 93.5 | No estimate | | Savings occur up to 2037 | 100% |

129. We have combined these estimates to produce a single high and low figure for each site. For Winfrith, we have selected the lowest of the "low" estimates and the highest of the "high" estimates. For the Magnox sites, however, we have selected the higher of the two "low" estimates, on the advice of the NDA, since the lower figure is calculated on the assumption that the sub-surface component is only 5% at all the sites and it is thought unlikely that this would apply at all the sites.

**Table 12: Combined set of estimates of transport/disposal savings for use in the cost-benefit analysis (undiscounted)**

| Site | Estimated savings for transport, processing and disposal £m, undiscounted 2021-2120 (**note: hundred year period**) | | Duration | Proportion of savings in the period 2021-2037 |
|---|---|---|---|---|
| | Low | High | | |
| Winfrith | 10.9 | 55 | Savings occur up to 2028 | 100% |
| Magnox (10 sites) | 210 | 745.3 | Part of these savings occur in the 2070s. | 33% |
| Dounreay | 78.1 | 93.5 | Savings occur up to 2037 | 100% |

# Annex F: Estimated savings from transport and disposal of material left in situ under the proposals at Sellafield and Harwell over the next 100 years

130. **Table 13** shows the undiscounted estimated savings due to reduced transport and disposal costs at Sellafield under the proposals. These estimates combine estimates from the NDA and estimates from the Site Licence Companies. They do not include excavation costs or estimates of savings due to reduced insurance liability premiums after parts of the site exit the nuclear third party liability regime. Characterisation of contaminated soils and sub-structures at Sellafield is less well advanced than at other sites, which explains the large degree of uncertainty in these figures. These figures have not been used in this impact assessment but are included to provide an estimate of the scale of potential savings from the proposals at Sellafield.

**Table 13: Undiscounted estimates of transport/disposal savings at Sellafield and Harwell over the next 100 years under the proposals**

| Site | Estimated savings for transport, processing and disposal £m 2021-2120 (**note: hundred year period**) | | Estimated regulatory savings (£m) |
|---|---|---|---|
| | Low | High | |
| Sellafield | 900 | 7200 | £46m |
| Harwell | 8 | 12 | £10 |