DEPARTMENT OF ENERGY & CLIMATE CHANGE

Appraisal of Sustainability of the draft Nuclear National Policy Statement: Main Report

Planning for new energy infrastructure

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Appraisal of Sustainability of the draft Nuclear National Policy Statement: Main Report

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Preface

Appraisal of Sustainability of the draft Nuclear National Policy Statement

The Appraisal of Sustainability (AoS), incorporating Strategic Environmental Assessment (SEA), of the draft Nuclear National Policy Statement (Nuclear NPS) has been undertaken at a strategic level. It considers the effects of the proposed policy at a national level and the sites to be assessed for their suitability for the deployment of new nuclear power stations by 2025. These strategic appraisals are part of an ongoing assessment process that started in March 2008 and, following completion of this AoS, will continue with project level assessments when developers make applications for development consent in relation to specific projects. Applications for development consents to the Infrastructure Planning Commission (IPC) will need to be accompanied by an Environmental Statement having been the subject of a detailed Environmental Impact Assessment (EIA).

The AoS Reports are presented in the following documents:

AoS Non-Technical Summary

Main AoS Report of draft Nuclear NPS

Introduction
Approach and Methods
Alternatives
Radioactive Waste
Findings
Summary of Sites
Technical Appendices

Annexes to Main AoS Report: Reports on Sites

Site AoS Reports
Technical Appendices

All documents are available on the website of the Department of Energy and Climate Change (DECC) at www.energynpsconsultation.decc.gov.uk

This document is the **Main Report** of the AoS of the draft Nuclear NPS and is subject to consultation alongside the draft Nuclear NPS.

This report has been produced by the Department of Energy and Climate Change (DECC) based on technical assessment undertaken by MWH UK Ltd with Enfusion Ltd, Nicholas Pearson Associates Ltd, Studsvik UK Ltd and Metoc plc.

Contents

Non-technical Summary

S.1 Introduction

S.1.1 This is a Non-Technical Summary (NTS) of the Appraisal of Sustainability (AoS) Report[1] undertaken to inform the preparation of the draft Nuclear National Policy Statement (NPS). The AoS Report is provided in three parts: this Non-Technical Summary; the Main AoS Report; and its Annexes (A-J) which report the individual appraisals for each of the potentially suitable sites included in the NPS. This Non-Technical Summary explains the following:

Background to the draft Nuclear NPS and AoS

- the new planning regime and the role of National Policy Statements;
- the objectives and structure of the draft Nuclear NPS;
- the main options considered for developing the draft Nuclear NPS;
- the overall approach to the AoS, and an outline of the methods and framework used in the appraisal process;
- an outline of the Strategic Siting Assessment (SSA) process;
- the challenges that were addressed in undertaking the appraisal;
- an outline of the consultation that took place during the development of the appraisal;
- an outline of the alternatives that have been considered in relation to 'Needs', 'Processes' and 'Locations';
- a summary of current situation in relation sustainability, and the likely future situation without a Nuclear NPS.

Key Findings of the AoS

- an overview of the draft Nuclear NPS findings as a whole;
- summaries of findings against the identified sustainable development themes;
- summaries of the appraisal findings for the sites listed in the draft Nuclear NPS;
- a summary of potential interactions and cumulative effects;
- key findings of the appraisal area, stated at the end of this Section.

Monitoring and Next Steps

- an outline of how the AoS informed the preparation of the draft Nuclear NPS;
- an outline of proposals for monitoring the predicted effects of the draft Nuclear NPS;
- discussion of next steps for the AoS and draft Nuclear NPS.

1 DECC 2009 EN-6: Appraisal of Sustainability of the draft Nuclear NPS Main report www.energynpsconsultation.decc.gov.uk

The Appraisal of Sustainability and the draft Nuclear National Policy Statement are subject to public consultation. For more information on this consultation and how you may give us your views, please see the Consultation Document (www.energynpsconsultation.decc.gov.uk)

S.2 Background to the National Policy Statements and Appraisal of Sustainability

The Planning Act 2008 and National Policy Statements (NPSs)

S.2.1 The Planning Act 2008 is intended to provide a more efficient, transparent and accessible planning system for nationally significant infrastructure projects for transport, energy, water, wastewater, and waste. A new independent Infrastructure Planning Commission (IPC) will take responsibility for considering and deciding on major infrastructure applications and, whilst allowing local factors to be taken into account, this will help speed up the planning process. The Government is producing National Policy Statements to provide clarity on the national need for the infrastructure and to set the policy and guidance framework for the IPC to use when making its planning decisions.

S.2.2 The Department of Energy and Climate Change (DECC) is responsible for preparing the NPSs that relate to energy infrastructure projects. DECC is proposing to publish a suite of six NPSs in relation to energy infrastructure projects. These will comprise an Overarching Energy NPS (EN-1) and five technology-specific NPSs. The Overarching NPS for Energy (EN-1) sets out the high level objectives, policy and regulatory framework for new energy infrastructure consistent with sustainable development and addressing climate change. The five technology specific NPSs are as follows:

- EN-2 Fossil Fuel Electricity Generating Infrastructure;
- EN-3 Renewable Energy Infrastructure;
- EN-4 Gas Supply Infrastructure and Gas and Oil Pipelines;
- EN-5 Electricity Networks Infrastructure;
- EN-6 Nuclear Power Generation.

S.2.3 These six NPSs set out Government's energy policy, the national need for energy infrastructure, and guidance to the IPC on how to assess the impacts of such infrastructure. Developers will need to ensure that their applications for development consent are consistent with the requirements of relevant NPSs. The IPC will also take into account local impact reports prepared by local authorities. The draft Nuclear NPS is different from the other energy NPSs because it includes a list of potentially suitable sites for new nuclear power stations. The draft Nuclear NPS with potentially suitable sites is the subject of this AoS.

S.2.4 Developers may submit applications for development consent on other sites not listed in the draft Nuclear NPS and these will be considered by the Secretary of State with an advisory role from the IPC.

What is the draft Nuclear NPS?

S.2.5 The main objective of the draft Nuclear NPS is to provide the primary basis for planning decisions by the IPC on applications for development consent for a new nuclear power station. It sets out the role of nuclear power and the key features of relevant planning policy in which applications for new nuclear power stations should be considered. It describes the nominations and the Strategic Siting Assessment (SSA) process and includes a list of sites that have been assessed to be potentially suitable for new nuclear power stations. This reduces the need for the IPC to consider alternative sites and helps make the decision making more efficient.

S.2.6 New nuclear power stations may have negative and positive impacts on the environment and local communities. The significance of these impacts depends upon the characteristics of the local area and the detailed design of the nuclear power station. Under the new planning regime, the promoters of new nuclear power stations will still need to provide an Environmental Statement to accompany their application for development consent. Any new nuclear power station will still be subject to a nuclear site licence and environmental discharge authorisations and the operator will have to comply with the safety, security and environmental conditions set by the regulators.

S.2.7 The draft Nuclear NPS sets out guidance for the IPC, including the general principles that should be applied in the assessment of impacts, and advises on the impacts from new nuclear power stations that are likely to have the most significant effect on sustainable development. It includes generic impacts that are applicable to energy infrastructure and are described in the Overarching Energy NPS (EN-1). Part 5 of the draft Nuclear NPS and sets out an analysis for each site with issues that need to be considered for development consent and site licensing. It indicates what detailed studies might be needed to evaluate their significance, and suggests possibilities for mitigating adverse effects. This will help scope the information that needs to be provided in the Environmental Statement and should speed up the decision-making process for building new nuclear power stations.

How has the Government developed the draft Nuclear NPS?

S.2.8 The 2008 Nuclear White Paper[2] set out the Government's belief that *"new nuclear power stations should have a role to play in this country's future energy mix alongside other low-carbon sources; that it would be in the public interest to allow energy companies the option of investing in new nuclear power stations; and that the Government should take active steps to facilitate this"*.

S.2.9 The Government considered a number of options for developing a draft Nuclear NPS commencing with assessment of high level options including whether we need a Nuclear NPS, and if we do, then how should it be developed. This hierarchy of options for the NPS was subject to consultation and this is described later in Section 6 of this Non-Technical Summary (NTS). The hierarchy of options considered the need for a draft Nuclear NPS, then the processes by which the draft Nuclear NPS should be developed, and finally the location of potentially suitable sites. These options, and the findings identified, are summarised in Section 7 of this NTS.

2 Meeting the Energy Challenge: A White Paper on Nuclear Power, CM 7296, January 2008 [page 7].

S.2.10 The draft Nuclear NPS sets out the Government policy on the role of new nuclear power in the energy mix, the Government's assessment of the arrangements for managing and disposing of radioactive waste from new nuclear power stations, and a list of sites which the Government considers to be potentially suitable for new nuclear power stations. The list of sites in the draft Nuclear NPS has been developed using a Strategic Siting Assessment (SSA) process with exclusionary and discretionary criteria to identify sites that are potentially suitable for the deployment of one or more new nuclear power stations by the end of 2025. Nominations for sites were invited and eleven nominations were received by the end of March 2009; these were taken forward for the SSA process. Sites that passed the exclusionary criteria were then subject to assessment using the discretionary criteria and were also appraised using the AoS and HRA processes. As a result of these assessments, the draft Nuclear NPS includes a list of ten sites that are considered to be potentially suitable for new nuclear power stations to be in operation by 2025. The following figure shows the location of the ten sites included in the draft Nuclear NPS.

Figure S.2.1 Potentially Suitable Sites

S.2.11 A key characteristic of nuclear power generation is the requirement to safely manage the radioactive waste that is produced by the nuclear power stations. The Government believes that it is technically possible and desirable to dispose of new higher-activity radioactive waste in a geological disposal facility and this would be a viable solution and the right approach for managing waste from new nuclear power stations. The Government also considers that waste can and should be stored in safe and secure interim storage facilities until a geological disposal facility (GDF) becomes available.

S.2.12 This AoS has considered the arrangements for the management of radioactive waste. The findings of this appraisal have helped inform DECC's assessment of waste management and disposal arrangements for the draft Nuclear NPS.

S.3 Appraisal of Sustainability (AoS) and Other Assessments

S.3.1 The Planning Act 2008[3] requires that an AoS must be carried out before a National Policy Statement can be designated. The main purpose of an AoS is to examine the likely social, economic and environmental effects of designing the NPS. If potential significant adverse effects are identified, the AoS recommends options for avoiding or mitigating such effects. In this way the AoS helps inform the preparation of the NPS to promote sustainable development.

S.3.2 The appraisal of the draft Nuclear NPS incorporates an assessment in accordance with the requirements of the European Directive[4] on Strategic Environmental Assessment (SEA) which aims for a high level of environmental protection and to promote sustainable development. It applies to certain plans that are likely to have a significant effect on the environment and particularly those that set the framework for development consent. The AoS considers socio-economic effects in the same way as environmental effects are required to be assessed by the SEA Directive. The AoS has appraised the draft Nuclear NPS, including those generic impacts of energy infrastructure described in the draft Overarching Energy NPS (EN-1).

S.3.3 An SEA helps inform strategic decisions to inform the preparation of plans by identifying and assessing their potential significant effects and informing strategic decision-making. The environmental assessment process continues with project level Environmental Impact Assessment[5] (EIA). Under the new planning regime, developers will still have to submit an Environmental Statement reporting the EIA with their application for a new nuclear power station to the IPC for development consent. EIA is a process that provides information to planners, other regulators, and the public about certain proposed developments and their likely effects on the environment. By integrating the EIA process and the emerging design of a development as early as possible, potential adverse impacts can be best mitigated and opportunities for environmental enhancement optimised. An SEA sets the strategic context for future development and this then makes the subsequent project level EIAs more effective.

3 The Planning Act 2008 http://www.opsi.gov.uk/acts/acts2008/ukpga_20080029_en_1

4 Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment.

5 Directive 85/337/EEC as amended by 07/11/EC, 03/35/EC the assessment of effects of certain public and private projects on the environment.

S.3.4 The draft Nuclear NPS has also been assessed in accordance with the European Habitats Directive[6]. The main aim of the Habitats Directive is to promote the maintenance of biodiversity for those habitats and species of European importance. The findings of the Habitats Regulations Assessments (HRAs) are reported separately[7] and have been incorporated into the appraisal of biodiversity within the AoS report.

S.3.5 In a similar way to SEA, HRA is a process that progresses from strategic to project level assessments. Project level HRA is informed more precisely by the nature, scale or location of a development and thus its potential adverse effects. In order to avoid adverse effects on the integrity of sites of European importance, avoidance and mitigation measures would be proposed and these could be refinements to the nature and/or scale and/or location of the proposed development.

S.4 Our Approach and Methods for the AoS

AoS Process

S.4.1 Our approach to the AoS was modelled on the Government's guidance[8] for preparing SEAs and Sustainability Appraisals, as there is no guidance yet on preparing an AoS. This is a staged approach as outlined in the following figure:

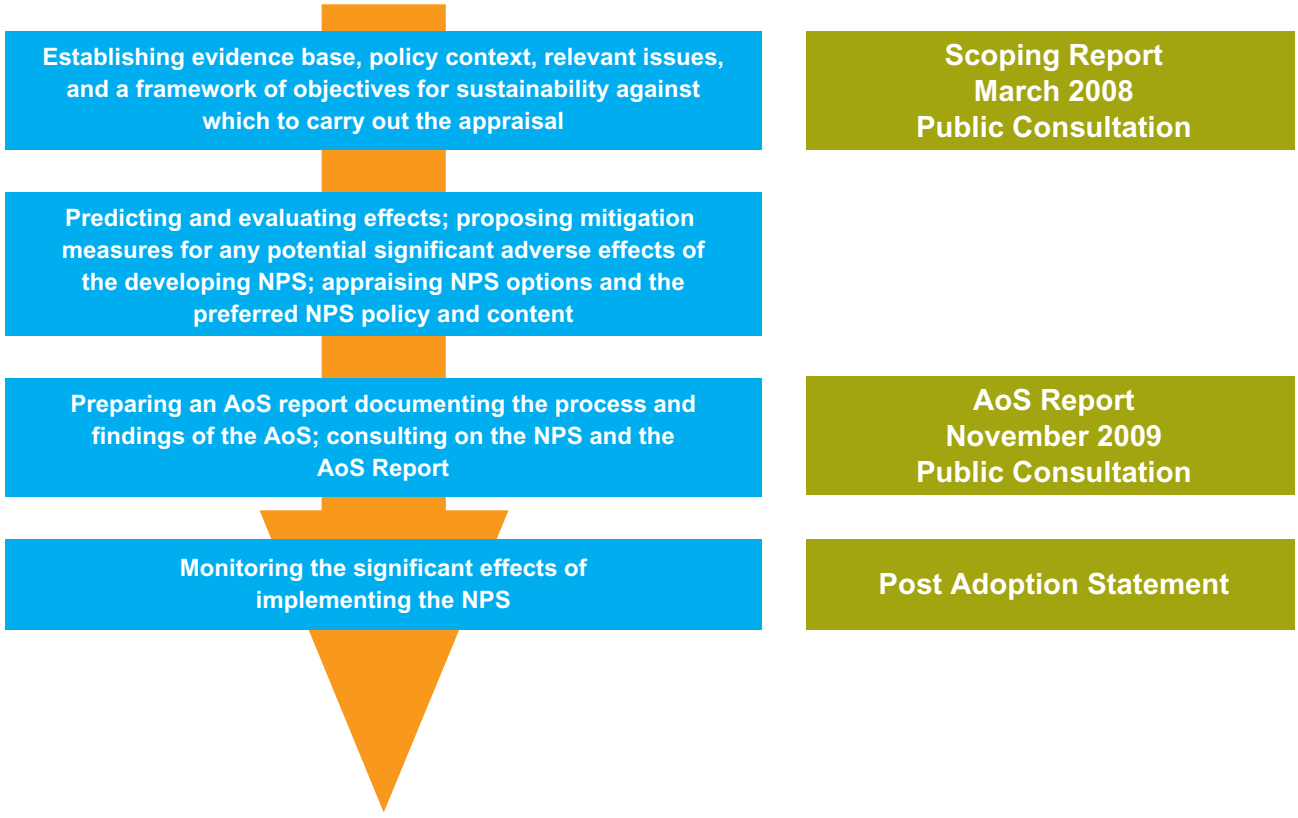

Figure S.4.1 Government's guidance for preparing SEAs and Sustainability Appraisals

6 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora.
7 DECC 2009 EN-6: Habitats Regulations Assessments of the draft Nuclear NPS.
8 ODPM 2005 A practical guide to the Strategic Environmental Assessment Directive and ODPM 2005 Sustainability Appraisal of Regional Spatial Strategies and Local Development Documents.

Appraisal Framework

S.4.2 The scope of this AoS was identified through analysis of relevant baseline information, the policy context, the relevance to the developing draft Nuclear NPS, and responses to the scoping consultation carried out in March 2008. The appraisal itself was carried out using a set of sustainability objectives as a way of identifying and evaluating the potential significant effects of the draft Nuclear NPS on communities and the environment.

S.4.3 The SEA Directive suggests a range of topics for assessing a plan including biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage, landscape and the inter-relationships between these factors. All these topics were considered to be variously relevant to appraising the developing draft Nuclear NPS and the AoS objectives for these topics were grouped into Sustainable Development (SD) themes to help with appraising different aspects of the draft NPS.

S.4.4 The AoS objectives used were as follows:

Table S.4.1 Sustainable Development Theme and AoS Objectives

Sustainable Development (SD) Theme and AoS Objectives (numbers in brackets refer to the numbers listed for the AoS Objectives in the Scoping Report March 2008)
SD Theme: Climate Change (Mitigation)
to minimise greenhouse gas emissions (13)
SD Theme: Biodiversity and Ecosystems
to avoid adverse impacts on the integrity of wildlife sites of international and national importance (1)
to avoid adverse impacts on valuable ecological networks and ecosystem functionality (2)
to avoid adverse impacts on Priority Habitats and Species including European Protected Species (3)
SD Theme: Communities – population, employment, and viability
to create employment opportunities (4)
to encourage the development of sustainable communities (5)
to avoid adverse impacts on property and land values and avoid planning blight (10)
SD Theme: Communities – supporting infrastructure
to avoid adverse impacts on the function and efficiency of the strategic transport infrastructure (8)
to avoid disruption to basic services and infrastructure (9)
SD Theme: Human Health and Well-Being
to avoid adverse impacts on physical health (6)
to avoid adverse impacts on mental health (7)
to avoid the loss of access and recreational opportunities, their quality and user convenience (11)

Sustainable Development (SD) Theme and AoS Objectives (numbers in brackets refer to the numbers listed for the AoS Objectives in the Scoping Report March 2008)
SD Theme: Cultural Heritage
to avoid adverse impacts on the internationally and nationally important features of the historic environment (22)
to avoid adverse impacts on the setting and quality of built heritage, archaeology and historic landscapes (23)
SD Theme: Landscape
to avoid adverse impacts on nationally important landscapes (24)
to avoid adverse impacts on landscape character, quality and tranquillity, diversity and distinctiveness (25)
SD Theme: Air Quality
to avoid adverse impacts on air quality (12)
SD Theme: Soils, Geology, Land Use
to avoid damage to geological resources (19)
to avoid the use of greenfield land and encourage the re-use of brownfield sites (20)
to avoid the contamination of soils and adverse impacts on soil functions (21)
to avoid damage to geological resources (24)
SD Theme: Water Quality and Resources
to avoid adverse impacts on surface water hydrology and channel geomorphology (including coastal geomorphology) (15)
to avoid adverse impacts on surface water quality (including coastal and marine water quality) and assist achievement of Water Framework Directive objectives (16)
to avoid adverse impacts on the supply of water resources (17)
to avoid adverse impacts on groundwater quality, distribution and flow and assist achievement of Water Framework Directive objectives (18)
SD Theme: Flood Risk
to avoid increased flood risk (including coastal flood risk) and seek to reduce risks where possible (14)
Climate Change (Adaptation) is cross-cutting and has the potential to affect several of the above objectives for sustainable development, in particular biodiversity and flood risk.
Radioactive and associated hazardous waste is cross-cutting and has the potential to affect many of the above objectives for sustainable development. As this topic is unique to new nuclear power stations, consideration of the likely significant effects is dealt with as a separate chapter in the AoS.

S.4.5 Often topics are inter-related, for example, new flood defences may change movements of sediments and thus affect the ecology of a nearby wetland. Therefore, a number of sub-objectives or guide questions were identified through the scoping process for each of the AoS objectives to structure the appraisal.

S.4.6 The potential effects of the draft Nuclear NPS may be positive or negative and where potential significant adverse effects were identified, mitigation measures have been suggested. Each topic was appraised using the professional judgment of the report contributors and available information. Any gaps in information or uncertainty about the appraisal have been recorded. Outline proposals for monitoring the predicted effects have been suggested for when the draft Nuclear NPS is designated.

S.4.7 The nature and significance of predicted potential effects were recorded using symbols and colours and a grading system as shown in the following table:

Table S.4.2 Significance and Categories of Potential Strategic Effects

Key: Significance and Categories of Potential Strategic Effects		
Major positive	++	Development would resolve an existing sustainability problem; effect considered to be of regional/national/international significance
Minor positive	+	No sustainability constraints and development acceptable; effect considered to be of regional/ national/international significance
Neutral	0	Neutral effect
Minor Negative	-	Potential sustainability issues, mitigation and/or negotiation possible; effect considered to be of regional/national/international significance
Major Negative	- -	Problematical because of known sustainability issues; mitigation or negotiation difficult and/or expensive; effect considered to be of regional/national/international significance
Uncertainty ?		Where the significance of an effect is particularly uncertain, for example because insufficient information is available at the plan stage to fully appraise the effects of the development or the potential for successful mitigation, the significance category is qualified by the addition of the symbol?

S.4.8 The other Energy NPSs have been subject to AoS with a similar approach and the AoS frameworks have been shown to be compatible.

Geographical and temporal scope of the appraisal

S.4.9 The draft Nuclear NPS applies to England and Wales and includes potentially suitable sites that can be in operation by 2025. Therefore the focus of the AoS was on the effects associated with England and Wales, although consideration was given to any significant effects for the rest of the UK and transboundary effects. Relevant member states are being consulted on the draft Nuclear NPS and its accompanying AoS and HRA reports. The designated Nuclear NPS will remain until withdrawn or suspended by the Government and be kept under review to ensure that it remains valid.

S.4.10 The Nuclear AoS includes appraisal of both the effects of the whole draft NPS and the specific effects of potentially suitable sites. Generic design characteristics for new nuclear power stations were considered for the appraisal since the detailed design will be addressed at the project EIA stage. The timescales for appraisal were as follows:

- Construction: 6 years;
- Operation: approximately 60 years;
- Decommissioning: approximately 30 years;
- Interim Storage of Waste: up to 100 years after operation ceases. It is therefore possible to envisage a scenario in which onsite interim storage might be required for around 160 years from the start of the power station's operation, to enable an adequate cooling period for fuel discharged following the end of the power station's operation. However, this is based on some conservative assumptions and there are a number of factors that could reduce or potentially increase, the total duration of onsite spent fuel storage.

S.5 The AoS and the Strategic Siting Assessment (SSA) Processes

S.5.1 The AoS is an ongoing process that develops as responses to consultation are considered and as the draft Nuclear NPS itself is developed. From the scoping stage in March 2008, the process leading to the preparation of the nuclear NPS proposed an integration of the processes of plan making and appraising sustainability. This includes the SSA process for identifying potentially suitable sites for new nuclear power stations; the SSA criteria were subject to appraisal using the AoS framework of objectives for sustainability[9]. An overview of the interactions of the NPS, SSA and AoS processes are shown in the following diagram:

Figure S.5.1 Overview of the interactions of the NPS, SSA and AoS

9 BERR (July 2008) Applying the proposed Strategic Siting Assessment Criteria: a study of the potential environmental and sustainability effects.

S.6 Addressing Challenges in Undertaking the AoS

S.6.1 The draft Nuclear NPS is a national level policy document and its impacts will be felt overall at the national level but also most particularly at the local levels where new nuclear power stations are built. The draft Nuclear NPS is unusual because it includes both strategic and spatial aspects. In order to address the main difficulty of keeping the appraisal strategic for a national plan and maintaining the appraisal for the sites at a strategic level, the appraisal recognised two levels of significance of likely effects – at the national and at the local levels. It was important not to duplicate the project level assessments (EIA and HRA) that the IPC will consider in their decision making at the development consent application stage. Any uncertainties in the findings of the appraisal or gaps in the information were recorded in the detailed appraisal matrices. Recommendations were made from the AoS to the draft Nuclear NPS to highlight to the IPC where they should consider more detailed studies, such as specific habitat or species surveys, to address uncertainties at the project level stage.

S.7 How have we consulted on the development of the AoS?

S.7.1 The AoS for the draft Nuclear NPS has been developed through a number of stages that reflect consultation responses and changes in legislation and guidance. A summary of the consultation is set out in the following table:

Table S.7.1 Summary of consultation

AoS Development	Consultation
The SEA Scoping Report[10] (March 2008)	Early consultation with the statutory bodies[11] and others on the scope and level of detail proposed for the SEA (now AoS).
The Environmental and Sustainability Study[12] (July 2008)	The potential environmental and sustainability effects of applying the SSA criteria were examined and this was included as part of the public consultation on the proposed SSA criteria.
The Update Report[13] (January 2009)	Reporting changes made to the SSA criteria as a result of consultation; explaining change to AoS as a result of the Planning Act 2008.
(April – June 2009)	Ongoing liaison with statutory environmental bodies, relevant regulators, and other Government departments.
The AoS Report[14] (October 2009)	Formal consultation with statutory bodies and the public on the draft Nuclear NPS and the AoS.

10 BERR (March 2008) Consultation on Strategic Environmental Assessment for proposed National Policy Statement for new nuclear power, URN 08/680QAN, http://www.berr.gov.uk/files/file45240.pdf

11 Countryside Council for Wales, Environment Agency, English Heritage, Natural England, Scottish Environment Protection Agency.

12 BERR (July 2008) Applying the Proposed Strategic Siting Assessment Criteria: A study of the potential environmental and sustainability effects, URN08/962, http://www.berr.gov.uk/files/file47137.pdf

13 DECC (January 2009) Applying the Strategic Siting Assessment Criteria: an update to the study of the potential environmental and sustainability effects.

14 Incorporating an Environmental Report in accordance with the European SEA Directive 2001/42/EC.

S.8 What alternatives have we considered?

S.8.1 In line with good policy and plan making objectives, and in accordance with the SEA Directive that requires consideration of reasonable alternatives, a phased approach to the appraisal of realistic alternatives was taken for the draft Nuclear NPS as follows:

- Need – do we need the Nuclear NPS?
- Process – how should the Nuclear NPS be developed?
- Location – where should the new nuclear power stations be built?

S.8.2 The first two phases of assessment for developing the draft Nuclear NPS (covering the 'Need' and 'Process' alternatives) were appraised using the AoS Framework of objectives organised into the headline Sustainable Development topics as follows; climate change, security of energy supply, health and safety, radioactive waste, the natural and the built environments. This was done to reflect the strategic level of the decision making.

S.8.3 The third phase ('Location' alternatives) was appraised using the Sustainable Development themes discussed in section S.3 of this NTS. The sites that passed the exclusionary criteria in the SSA process were appraised in detail using the AoS objectives and decision-aiding questions.

S.8.4 It is noted that the two levels of sustainable development assessment used are compatible with each other. The links between the two sets of criteria are set out in Section 2 of the Main AoS report. The assessment of alternatives is explained further in the following sections:

Need – do we need the nuclear NPS?

S.8.5 The AoS considered three possible high level options:

- A Nuclear NPS in line with Government policy that includes guidance for the IPC on potentially suitable sites;
- A Nuclear NPS that prohibits the construction of new nuclear power stations (referred to as "NPS that prohibits Nuclear");
- No NPS (business as usual).

S.8.6 The three options were appraised at a high level against the Sustainable Development (SD) themes: climate change; security of energy supply; health and safety; the natural environment, the built environment; and the economy. The AoS findings identified that during construction and decommissioning, short term effects on air quality are likely to be similar for the three options.

S.8.7 The assessment determined that the preferred alternative is the option of a Nuclear NPS in line with Government policy. This is based on the case for nuclear power in relation to other alternatives, and the effect it might have on the long-term ability of the UK to meet its emission reduction targets and maintain its security of supply. If nuclear power proves economically competitive in a low carbon economy, then its contribution to a sustainable future should be viable.

Process – how should the NPS be developed?

S.8.8 The format and detail of the NPS can influence the number, location and timing of new nuclear power stations through the policy guidance and framework for decision making that it sets out for the IPC. Four potential process options for the Nuclear NPS were identified in the Scoping Report (2008) as follows:

- A Nuclear NPS with siting criteria;
- A Nuclear NPS with a list of sites;
- A Nuclear NPS with siting criteria and a list of sites;
- A Nuclear NPS with siting criteria and a list of sites restricted to those in the vicinity of existing nuclear power stations.

S.8.9 The four options were appraised at a high level against the headline Sustainable Development topics that are particularly relevant to nuclear energy: climate change; security of energy supply; health and safety; the natural environment, the built environment; and the economy. The Option for a NPS with siting criteria and a list of sites was appraised as the preferred option since it would be more likely to reduce uncertainty for the IPC and thus reduce the time for a planning application to be determined. This would allow for earlier new nuclear build and better contribute to meeting the Government's climate change, security of energy supply and other sustainability objectives. In addition, the list of sites would have undergone a strategic level assessment which could reduce the likelihood of adverse sustainability effects occurring and provide a means of enabling such effects to be avoided or mitigated.

Location: Options for the Criteria for the Strategic Siting Assessment (SSA) Process

S.8.10 The draft NPS uses the Strategic Siting Assessment (SSA) process to identify the location of sites potentially suitable for new nuclear power stations that could be deployed by 2025. The criteria (exclusionary and discretionary) used for the SSA were subject to appraisal in the first half of 2008 using the AoS framework of objectives. This appraisal was reported in the Environmental and Sustainability Report[15], published in July 2008, and made available alongside the consultation on the SSA process and criteria.

S.8.11 The 2008 Environmental and Sustainability Study concluded that:

- the proposed SSA criteria were broadly in line with sustainability and environmental objectives;
- the discretionary nature of some criteria means that adverse environmental effects cannot be ruled out at the strategic level;
- local level impacts are not addressed by the SSA but it is made clear that these would be addressed by the nuclear regulators and others at the project level assessments.

15 BERR (July 2008) Applying the proposed Strategic Siting Assessment Criteria: a study of the potential environmental and sustainability effects.

Location: The Potentially Suitable Sites

S.8.12 The nomination process closed on 31 March 2009. All eleven nominated sites were subject to a site level AoS. In each case the appraisal identified any likely strategically significant effects, for example, on international or nationally protected nature conservation. The appraisal also identified likely significant effects at the local and regional levels, for example, cumulative effects for community prosperity through long term employment.

S.8.13 The Government considered the emerging AoS findings, together with other information provided by the nominators, various technical specialists, the regulators and the statutory environmental authorities, in order to inform their assessment of nominated sites and to help inform the development of the draft Nuclear NPS.

S.8.14 One nominated site, Dungeness, did not pass the discretionary criteria on biodiversity and there were concerns about flood risk and coastal processes. The Government therefore decided that Dungeness would not be included in the draft Nuclear NPS.

S.8.15 The Government also commissioned an Alternative Sites Study to ensure that potential alternative sites were given due consideration. The study drew on a number of information sources to identify sites that might be "worthy of further consideration" by the Government to determine whether these sites were likely to meet the SSA criteria. Three sites were identified through this process; Druridge Bay in Northumberland, Kingsnorth in Kent, and Owston Ferry in Lincolnshire. A site AoS was undertaken for each of these sites, the findings of which are available separately. After further assessment the Government decided that none of these three sites should be considered as reasonable alternatives to the sites that have been nominated, and therefore should not be included in the draft Nuclear NPS. This is because the Government considers that these sites are not credible for deployment by the end of 2025.

S.8.16 The individual Site AoS reports set out the sustainability characteristics of the potentially suitable sites and include key issues that were recommended for the draft NPS to include as particular considerations for the IPC to take into account when determining individual planning applications for new nuclear power stations. The findings of the site level AoS are available as Annexes A to J of the Main AoS report (for the ten sites included in the NPS), and a summary of their findings is presented later in this Non Technical Summary. The nominated sites subject to AoS are as follows:

- Bradwell (Annex A to Main AoS report);
- Braystones (Annex B);
- Dungeness (report available separately);
- Hartlepool (Annex C);
- Heysham (Annex D);
- Hinkley Point (Annex E);
- Kirksanton (Annex F);
- Oldbury (Annex G);
- Sellafield (Annex H);
- Sizewell (Annex I);
- Wylfa (Annex J).

S.9 What is the Current Situation and Issues for Sustainability?

S.9.1 The climate of the UK is changing and increased emission of green house gases from human activities into the atmosphere is widely recognised as one of the main contributors to global warming. Climate change represents a significant risk to ecosystems, the economy and human populations and could lead to a number of significant changes to environmental conditions. These changes are likely to exacerbate current environmental trends across the UK, such as the continued loss of natural habitats and biodiversity and increased pressure on water resources. Increased development and current lifestyles have also resulted in a growing demand for electricity, which has lead to concerns about the future energy security of the UK. Current Government energy policy is set towards meeting its climate change objectives and to become a low carbon economy.

S.10 What is the Likely Future Situation without the Nuclear NPS?

S.10.1 As set out in the Nuclear White Paper, the Government believes that without nuclear power there is a risk that the UK might not be able to meet its goal to reduce carbon dioxide emissions and to maintain secure energy supplies; or that it would be more expensive to meet the goal without nuclear power. Key sustainability topics relevant to the Nuclear NPS, such as climate change, energy and communities are all closely interrelated with complex interactions.

S.11 The Key Likely Significant Effects of the Draft Nuclear NPS

Overview

S.11.1 The draft Nuclear NPS has the potential for effects on communities and the environment nationally and at the regional or local level. Some effects are common to new nuclear power stations, for example, effects associated with the requirement for water for cooling are common to new nuclear power stations but the significance of such effects depends upon the detailed design together with the characteristics and sensitivities of the local communities and environment.

S.11.2 This section summarises the findings of the AoS of the draft Nuclear NPS according to the Sustainable Development themes and objectives for sustainability, and then summarises the key findings of the AoS for each site. The AoS identified certain key recommendations that were generally applicable to the draft NPS as follows:

The AoS recommends that the draft NPS should guide the IPC to the findings of the site level AoSs to help scope the studies needed for the project level EIAs and any Sustainability Assessments. The AoS recommends that the draft NPS should advise the IPC that the significance of effects can only be determined through site level studies and that a requirement for an Environmental Management Plan as part of the EIA will help ensure that any commitments to mitigating any significant impacts will be implemented.

Climate Change (mitigation)

S.11.3 Nuclear power stations are a low carbon energy source and associated with lower greenhouse gas emissions when compared to fossil fuel facilities. The AoS identified that there are likely to be positive effects on this sustainability objective and the significance of these effects will increase with the number of nuclear power stations in operation. Climate change adaptation is cross-cutting and covered where relevant within the following sections on biodiversity and flood risk.

The AoS made no key recommendations and the AoS identified overall that there are likely to be significant positive effects that will contribute to meeting the UK climate change commitments.

Biodiversity and Ecosystems

S.11.4 The AoS identified that all the sites included in the draft Nuclear NPS will have likely significant strategic adverse effects on national and European sites of biodiversity value. The significance of these effects and the effectiveness of mitigation possibilities depend upon the specific sensitivities of the sites together with details of design and site layout. This will be addressed alongside wider effects on local biodiversity during the project level HRA and EIA assessments. There can be possibilities to mitigate certain potential adverse effects on biodiversity, for example, project design to avoid sensitive areas, and habitat retention and species protection measures on site.

S.11.5 The HRA identified that all the sites have the potential for an adverse effect on European site integrity. The HRA recommends that further project level HRAs should be required and the draft Nuclear NPS requires that for new nuclear power stations any development consent will be required to be supported by a detailed HRA at the project level, including Appropriate Assessment where necessary.

S.11.6 The AoS identified the common implications for effects on biodiversity (international, national and local importance) and ecosystems from new nuclear power stations and this is set out in the draft Nuclear NPS as follows:

- Water discharge, abstraction and quality;
- Habitat and species loss and fragmentation;
- Coastal squeeze;
- Disturbance events (noise, light and visual);
- Air quality.

S.11.7 The AoS identified that there are key inter-relationships between biodiversity and other sustainability effects, most notably flood risk management, health and well-being, and sustainable communities. Significant cumulative effects are also possible in relation to proposed adaptation measures for climate change, and in relation to water quality and resources, flood risk, soils and geology, and air quality. Interactions and cumulative effects are likely where more than one new nuclear power station may be built and for biodiversity this may be significant with the cluster of two sites on the Severn Estuary and the cluster of four sites in the North West region. Consideration will also need to be given to cumulative effects of other major developments and infrastructure projects.

The AoS recommends that the draft NPS should advise the IPC that the significance of biodiversity effects can only be determined through project level studies and guide the IPC to the findings of the site level AoSs and site HRAs to help agree the scope of the studies needed for the project level EIAs and HRAs. Overall the AoS found that there are likely to be significant adverse effects on national and European sites of biodiversity value and that the effectiveness of mitigation possibilities is uncertain and needs to be evaluated at the project level assessments. The AoS also found that there are likely to be significant adverse effects on the wider biodiversity at the local level and that these need to be evaluated during the project level EIAs.

Communities: population, employment and viability; supporting infrastructure

S.11.8 The AoS identified that there are likely to be significant positive effects for employment locally and associated economic benefit through the use of supporting services, particularly during the construction phase and this could be of regional significance. During the operational phase and in the longer term, the Nuclear NPS is likely to contribute significantly to the development of jobs nationally in the nuclear and associated industries, including enhancement of training and skills, and provision of goods and services to the nuclear industry.

S.11.9 As with any large scale construction project, there is the potential for short term adverse effects during construction if a number of sites were developed at the same time with the risk of a shortage of construction workers, local communities disturbed by an incoming workforce, and additional pressures placed on local services and transport networks. However, there are possibilities for mitigating such effects depending upon local circumstances and needs.

S.11.10 The opportunities for upskilling, education and supporting industries are likely to be more significant if there were a cluster of new nuclear power stations, particularly for the North West Region and with some similar benefits possible for the South West and the East of England Regions. The effects of the draft Nuclear NPS in combination with other renewable energy projects is likely to contribute positively to objectives for regional economic development. However, there is the potential for adverse cumulative effects on tourism objectives in Cumbria, including the Lakes District National Park, due to visual impacts and the public perception of additional nuclear power stations in the sub-region.

The AoS recommends that the draft NPS should advise the IPC of the potential enhancement for positive economic development effects. Overall the AoS found that there are likely to be significant beneficial effects on employment and viability for communities.

Health and Well-Being

S.11.11 The AoS identified the common implications for health and well-being from new nuclear power stations and this is set out in the draft Nuclear NPS as follows:

- Radiation from permitted discharges and potential hazards from accidental emissions;
- Safety and security;
- Employment;
- Emissions to water and air
- Noise;
- Accessibility to green space and exercise.

S.11.12 The draft Nuclear NPS sets out how the existing regulatory systems for operation of nuclear power stations will continue to apply to the new build so that potential effects associated with safety, security, and radiation doses to the public and workers will be dealt with through the current nuclear licensing and health protection systems. The Secretary of State and the HPA have concluded that even if 20 more nuclear power stations were built, the radiation dose for any member of the public in the UK would be well within internationally agreed limits[16].

16 http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/nuclear/new/reg_just/reg_just.aspx

S.11.13 Overall, there are health benefits to be realised from having a reliable and secure supply of energy. The AoS also identified that there are indirect positive health effects associated with enhanced prosperity and long-term employment opportunities; this will only be significant for local communities if employment is secured for local people. Any indirect effects on supporting services, associated infrastructure, and health inequalities are not significant at the national scale and will be addressed during the project level assessments; this includes the adverse local effects from noise and disturbance associated with the construction of many major infrastructure projects. Nuclear power stations are often located in rural areas on the coast with potential conflicts for recreation and amenity.

The AoS recommends that the draft NPS should guide the IPC to consider requesting a sustainability statement / assessment for each application to ensure full consideration is given to sustainable communities and interactions between a range of sustainability issues, including the wider determinants of health. The NPS should highlight to the IPC that there may be beneficial effects for health and well-being from secure long term employment and community viability arising from new nuclear power stations. The AoS also recommends that the draft NPS should advise the IPC that nuclear power stations are often located in rural areas on the coast with potential conflicts for recreation and amenity (and their subsequent impacts on health and well-being).

Cultural Heritage

S.11.14 The predicted effects of the draft Nuclear NPS on cultural heritage are likely to be negative throughout all phases of development and are associated with the location and scale of development at the potentially suitable sites. The significance of these effects will depend on the importance of the cultural heritage features, their location within the site, and their setting relative to the site. Mitigation measures may be possible, although it may be very difficult to mitigate for adverse effects on the settings of important cultural features. Overall the AoS identified that adverse effects were likely to be at a local scale, except for one site where the importance of the setting of nationally protected features is likely to increase the significance of the effects.

The AoS recommends that the draft NPS should advise the IPC that significant adverse effects to cultural heritage resources may be difficult to mitigate. Overall the AoS found that there are likely to be minor significant adverse effects on cultural resources except for one site where the effect may be more significant. The significance and effectiveness of mitigation possibilities is uncertain and needs to be evaluated at project EIA level.

Landscape

S.11.15 The potentially suitable sites generally share certain landscape and visual characteristics since they are usually in less populated areas in rural and coastal locations that may have value for visual amenity and as landscape resources. The AoS identified that there is potential for long-term irreversible adverse effects on landscape until decommissioning. The significance would be increased if there are proposals for more visually intrusive towers for cooling.

S.11.16 Some adverse effects on the landscape can be mitigated by changes to the site layout, use of buffer zones, and reinstatement after the short term effects during construction. Many of the proposed power station sites will be seen in the context of existing power stations. Nationally significant adverse effects were identified for the site at Sizewell which is completely within an Area of Outstanding Natural Beauty. If Sellafield is developed with Kirksanton and Braystones, this cluster of sites in Cumbria may have an increased significant negative impact on landscape and associated visual/amenity values due to their cumulative effects on the Lake District National Park.

The AoS recommends that the draft NPS should advise the IPC that there are likely to be some visual impacts that cannot be mitigated due to the scale of new nuclear power stations; the significance of this is increased if cooling towers are proposed. The significance and effectiveness of mitigation possibilities is uncertain and needs to be evaluated at project EIA level. The AoS recommends that the draft NPS should advise the IPC of the likely adverse effects on landscape value and visual amenity from the three potentially suitable sites in Cumbria and their cumulative effects on the Lake District National Park. Overall the AoS found that there may be neutral or minor negative effects on landscape except for the sites in Cumbria where effects may be of national significance.

Air Quality

S.11.17 Radioactive discharges to air are strictly controlled by the regulatory system and discussed in the section on radioactive waste. Short term air quality impacts during construction will depend upon local site specific factors, such as transport routes and proximity to residential housing and these will be dealt with during the project level EIA. Air quality is unlikely to be a significant issue, principally due to the relatively low level of air pollutant emissions from nuclear power stations during operation and the satisfactory existing air quality at the potentially suitable sites.

The AoS recommends that the NPS should highlight to the IPC that impacts on air quality are unlikely to be significant but that impacts associated with the construction phase should be considered in the scope of the project level EIAs. Overall, the AoS found that effects on air quality are likely to be neutral.

Soils, Geology and Land Use

S.11.18 None of the potentially suitable sites are located on or adjacent to sites of national or regional geological or geomorphological importance. Some minor adverse effects were identified by the AoS at the local levels and associated with potentially contaminated land adjacent to some sites and impacts on peat superficial deposits at two sites. There is the potential for impacts on soils to affect the soil water regime which then may affect terrestrial habitats and this will be need to be considered as part of the project level EIAs and HRAs. As with any major construction project, there is an increased risk of pollution and potential contamination of soils but this will be dealt with by the appropriate environmental management controls through the EIA process.

The AoS recommends that the NPS should inform the IPC that impacts on soils may affect the soil water regime which may affect various terrestrial habitats and this will need to be considered in the project level EIAs and HRAs. Overall, the effects of the draft Nuclear NPS are considered to be neutral on soils and geology.

Water Quality and Resources

S.11.19 Radioactive discharges to water are strictly controlled by the regulatory system and discussed in the section on radioactive waste. The AoS identified that for all sites minor negative effects may be expected on coastal or estuarial water quality locally where cooling water is to be abstracted and/or discharged. Such effects may compromise the achievement of water quality objectives, for example, the requirements of the Water Framework Directive (WFD) which aims to maintain or achieve good status. The significance of the effects and effectiveness of mitigation possibilities depends on the location and will need to be evaluated during studies as part of the project level EIAs. Interactions from these effects on European and nationally protected habitats and species will also need to be evaluated during project level EIAs and HRAs. These abstraction and discharge activities will also be subject to Environment Agency licensing and consenting processes, though it is noted that these processes may not fully mitigate against all effects. There may be minor negative effects on water supply and waste water treatment capacity in those regions already under stress.

S.11.20 Cumulative effects are likely to occur where there are clusters of nominated sites with increased water requirements and where several sites discharge cooling waters to the same water body. These effects are likely to be significant in the South West region for the Severn Estuary. Generally, the effects of the draft Nuclear NPS on water quality and resources may be minor negative, although this is likely to be able to be mitigated.

The AoS recommends that the NPS should highlight to the IPC the characteristics of cooling water for new nuclear power stations and the implications for the marine and estuarial environments, including the interactions between discharges from regional clusters of nominated sites. The NPS should also inform the IPC that there could be increased water demand, particularly during the construction phase, which would be of greatest significance in those regions that are already under water stress. Generally, the AoS identified that minor negative effects may be mitigated.

Flood Risk

S.11.21 The beneficial effect of power generation from nuclear power stations with regard to climate change mitigation is noted earlier under the climate change topic. As a low carbon source, nuclear power stations are expected to make a positive contribution to achieving carbon reduction targets which, indirectly, should have a beneficial effect on flood risk through moderating changes in rainfall patterns and sea level rise. Climate change adaptation is primarily considered in this section with regard to flood risk management.

S.11.22 In other respects, the relationship between the draft Nuclear NPS and flood risk is essentially local or possibly sub-regional where a number of potentially suitable sites are in proximity to each other. It also has a number of different effects. The first of these is the local impact that the individual development may have on the risk of flooding to land adjacent to those sites. Secondly the sites themselves, which are all proposed in coastal or estuarine locations, may be vulnerable to the risk of flooding from a number of causes, coastal, storm surge, fluvial, groundwater and pluvial. Finally flood risk management measures put in place to mitigate the impacts of flooding on or from individual sites may impact on coastal processes, hydrodynamics and sediment transport, which in turn may impact on designated habitats. All of these flood risk effects can occur during the construction, operation or decommissioning phases. As a result flood risk assessments need to take a long term view.

S.11.23 The flood risk effects to areas surrounding development sites could be either negative or positive. Negative impacts could be that flood risk is increased to the surrounding area as a result of any land rising required to protect the power stations or the footprint and layout of the sites which could impact upon floodplain storage and flood flow pathways. Positive impacts could also arise, as flood risk mitigation measures constructed as a result of the power stations could also provide flood risk protection for new and existing developments in the district. Similar negative and positive impacts could affect designated landscapes, for example, sensitive habitats could become more vulnerable to flooding, or as a result of improved defences – less vulnerable.

S.11.24 Climate change will increase flood risk from all causes. Coastal flood risk is likely to increase as a result of predicted increases in sea level and changes in storm surge. Changes to the seasonal distribution of rainfall and in the intensity of extreme rainfall events are also likely to increase flood risk. Climate change is also likely to result in changes to coastal erosion.

S.11.25 The mitigation measures that may be required to manage flood risk as a result of the draft Nuclear NPS could have potentially adverse effects on coastal processes and hydrodynamics. These measures have the potential to have secondary impacts on biodiversity and water quality, therefore potentially hindering the objectives and requirements of the EU Water Framework Directive.

The AoS recommends that the NPS should highlight to the IPC the need for detailed, site-specific investigations, including flood risk assessment, to determine the most appropriate and sustainable methods for protecting sites from flooding through the life cycle of the new nuclear power stations and to assess how these measures may affect flood risk in adjacent areas. Studies should also be undertaken to assess the impacts that any flood control measures may have on coastal processes and, indirectly, on ecology and biodiversity. Overall, the AoS identified that the effect of the draft NPS on flood risk and of flood risk on the sites in the draft NPS is likely to be negative, and the scale of the effects are likely to increase over time as a result of climate change.

Radioactive and Hazardous Waste

S.11.26 Before development consents for new nuclear power stations are granted, the Government will need to be satisfied that effective arrangements exist or will exist to manage and dispose of the waste they will produce[17]. The draft Nuclear NPS sets out the Government's consideration of the management of radioactive wastes, in particular, intermediate level waste and spent fuel. The AoS has considered the sustainability implications of managing the different types of waste associated with the construction, operation and decommissioning of new nuclear power stations in the UK under the following headings:

- Spent Fuel;
- Intermediate Level Waste (ILW);
- Low Level Waste (LLW);
- Gaseous and liquid radioactive discharges;
- Non-radioactive hazardous waste.

S.11.27 The AoS has identified that the effects of waste management may arise both at a nuclear power station site and offsite at other locations where packaging, transport and/or disposal of waste is undertaken. Some minor negative effects have been identified at nuclear power station sites. These are principally associated with the management and storage of spent fuel and ILW. Minor negative effects may potentially arise during construction and decommissioning of interim waste storage facilities although some of these effects, for example on soils, cultural heritage and landscape are site specific and will need to be assessed at the project level.

S.11.28 The most important consideration for offsite waste management facilities is the additional quantity of spent fuel to be disposed of from new nuclear power stations that will require final disposal in a Geological Disposal Facility (GDF) that will be managed by the Nuclear Decommissioning Authority (NDA). The significance of these effects will depend upon the number of new nuclear power stations built. It is estimated that to dispose of the spent fuel produced by a ten GW programme of new nuclear power stations operating for 60 years would increase the underground area of a GDF required for the disposal of spent fuel and High Level Waste by around 50 to 55%.

S12 The Potentially Suitable Sites with Key Issues for the draft Nuclear NPS

Introduction

S.12.1 A site level AoS has been undertaken for each of the nominated sites. These appraisals identified potential impacts and likely effects of a generic design of a new nuclear power station. The significance of potential effects and the effectiveness of possible mitigation will depend upon detailed studies carried out as part of the EIA and other studies for individual applications for development consent. The individual site AoS reports are available as Annexes A to J of the Main AoS report.

17 Meeting the Energy Challenge: A White Paper on Nuclear Power, CM 7296, January 2008 [page 99].

S.12.2 The site AoS reports identified likely strategically significant effects at the national or international levels and likely locally significant effects at the local or regional level. The significance of local effects and effectiveness of mitigation possibilities for adverse effects is less certain until detailed project level studies have been undertaken. The site AoS reports recommend to the draft Nuclear NPS that this information would be helpful to the IPC when agreeing the scope of Environmental Impact Assessments (EIAs), other detailed project level studies and when considering applications for development consent. Part 5 of the draft Nuclear NPS sets out the findings of the SSA process for each nominated site and includes other issues raised by the site AoS reports.

Bradwell

S.12.3 The site at Bradwell is located in the east of England, on the northern coast of the Dengie Peninsula. Potential likely effects and key findings recommended to the draft Nuclear NPS as guidance for the IPC to consider include:

- Adverse effects on the settings of nationally designated cultural heritage sites, which would be difficult to mitigate.
- Adverse effects on three national and internationally protected nature conservation sites; on water quality and fish/shellfish populations in nearby coastal waters and on coastal erosion through upgrading of flood defences. Mitigation opportunities possible.
- Adverse setting effects upon nearby Scheduled Ancient Monuments and listed buildings.
- Positive effects associated with long-term employment and enhanced prosperity for local communities.
- The site is not part of a cluster of nominated sites, therefore regional cumulative effects are not considered relevant.

Braystones

S.12.4 The site at Braystones is located in the north-west of England. There is no existing nuclear power station in close proximity to the site. Potential likely effects and key findings recommended to the draft Nuclear NPS as guidance for the IPC to consider include:

- Adverse effects on the settings of four national and internationally protected nature conservation sites, and on water quality in the region. There are mitigation opportunities are available.
- Adverse visual impacts on a predominantly rural landscape, potentially visible from Lake District National Park, that would be difficult to mitigate.
- Positive effects associated with long-term employment and enhanced prosperity for local communities.
- The site is in a cluster of three nominated sites in the Cumbria area. Potential regional cumulative effects both positive and adverse have been identified.

Hartlepool

S.12.5 The site at Hartlepool is located in the north-east of England, in an established industrial area. Key findings recommended to the draft Nuclear NPS to consider include:

- Adverse effects on the settings of four national and internationally protected nature conservation sites; mitigation opportunities possible.
- Adverse visual impact on the landscape, but in the context of an already industrialised area.
- Positive local effects on long-term employment and enhanced prosperity for local communities.
- The site is not part of a cluster of nominated sites, therefore regional cumulative effects are not considered relevant.

Heysham

S.12.6 The site at Heysham is located in the north-west of England, south of Morecambe Bay and adjacent to the existing Heysham Docks. Potential likely effects and key findings recommended to the draft Nuclear NPS as guidance for the IPC to consider include:

- Adverse effects on two national and internationally protected conservation sites, and on water quality in the region. Mitigation opportunities are available.
- Adverse visual impacts, potentially visible from Lake District National Park, but seen in the context of an already industrialised area.
- Positive local effects on long-term employment and enhanced prosperity for local communities.
- The site is approximately 30km south of a cluster of three nominated sites in the Cumbria area. Potential regional cumulative effects both positive and adverse may apply if all sites in the region were to be developed.

Hinkley Point

S.12.7 The site at Hinkley Point is located in the south-west of England, on the Severn Estuary. Potential likely effects and key findings recommended to the draft Nuclear NPS as guidance for the IPC to consider include:

- Adverse effects on the settings of four national and internationally protected conservation sites; on water quality and fish/shellfish populations in nearby estuarine/coastal waters. Mitigation opportunities are possible.
- Adverse visual impact on views from an AONB, which would be difficult to mitigate.
- Positive cumulative effects associated with long-term employment and enhanced prosperity in the region.
- The site is in a cluster of two nominated sites in the south west region. Potential regional cumulative effects both positive and adverse may apply if both sites in the region were to be developed.

- Further significant adverse cumulative effects if both new power stations were to be developed alongside the Severn Tidal Power scheme; effects of which would be difficult to mitigate.

Kirksanton

S.12.8 The site at Kirksanton is located on the Cumbrian coast in the north-west of England. There is no existing nuclear power station In close proximity to the site. Potential likely effects and key findings recommended to the draft Nuclear NPS as guidance for the IPC to consider include:

- Adverse effects on two national and internationally protected conservation sites, and adverse effects on water quality in the region. Mitigation opportunities are available.
- Adverse visual impacts on a predominantly rural landscape, potentially visible from the Lake District National Park, which would be difficult to mitigate.
- Positive effects associated with long-term employment and enhanced prosperity for communities.
- The site is in a cluster of three nominated sites in the Cumbria area. Potential regional cumulative effects both positive and adverse have been identified.

Oldbury

S.12.9 The site at Oldbury is situated on the southern bank of the Bristol Channel /Severn Estuary in the south-west of England. Potential likely effects and key findings issues recommended to the draft Nuclear NPS as guidance for the IPC to consider include:

- Cooling towers are anticipated owing to insufficient volume of water for direct cooling systems from the river Severn at this location. There would be associated adverse visual impact on two AONB designated landscapes (within 10km of the site), which would be difficult to mitigate.
- Adverse effects on two national and internationally protected conservation sites, and effects on water quality in the region. Mitigation opportunities are possible.
- Positive effects for long term employment and enhanced prosperity for local communities.
- The site is in a cluster of two nominated sites in the south west region. Potential regional cumulative effects both positive and adverse may apply if both sites in the region were to be developed.
- Further significant adverse cumulative effects if both new power stations were to be developed alongside the Severn Tidal Power scheme; effects of which would be difficult to mitigate.

Sellafield

S.12.10 The site at Sellafield is located in the north-west of England, in an established area for the nuclear industry. Potential likely effects and key findings recommended to the draft Nuclear NPS as guidance for the IPC to consider include:

- Adverse effects on three national and internationally protected nature conservation sites, and adverse effects on water quality in the region. Mitigation opportunities are available.
- Low flood risk. Some additional adverse visual impact on the landscape, which may be visible from the Lake District National Park, but this would be in the context of an already industrialised area.
- Positive effects associated with long-term employment and enhanced prosperity for local communities.
- The site is in a cluster of three nominated sites in the Cumbria area. Potential regional cumulative effects both positive and adverse have been identified.

Sizewell

S.12.11 The site at Sizewell is located predominantly to the north of the existing Sizewell B nuclear power station near Leiston, Suffolk, in the East of England. Potential likely effects and key findings recommended to the draft Nuclear NPS as guidance for the IPC to consider include:

- Adverse effects on nationally designated landscape areas. The site lies within an AONB and is part of a Heritage Coast. This would be difficult to mitigate.
- Adverse effects on three national and internationally protected nature conservation sites; and effects on water quality, and fish/shellfish populations in nearby coastal waters. Mitigation opportunities are possible.
- Positive effects associated with long-term employment and enhanced prosperity for local communities.
- The site is not part of a cluster of nominated sites, therefore regional cumulative effects are not considered relevant.

Wylfa

S.12.12 The site at Wylfa is located on the north coast of Anglesey, an island off the coast of North Wales, bounded by the Irish Sea. Potential likely effects and key findings recommended to the draft Nuclear NPS as guidance for the IPC to consider include:

- Favorable conditions in terms of coastal flooding, erosion, and dispersion of cooling water.
- Adverse effects on four nationally and internationally protected nature conservation sites; but with mitigation possibilities available.
- Significant adverse effects on the local landscapes of an AONB and Heritage Coast.
- Significant beneficial effects for long-term employment and enhanced prosperity for local communities.

- The site is not part of a cluster of nominated sites, therefore regional cumulative effects are not considered relevant.

Interactions and Cumulative Effects

S.12.13 Many of the potential impacts and likely significant effects of the draft Nuclear NPS for sustainable development are inter-related, particularly between biodiversity, water, climate change, human health, and communities – their social and economic viability including supporting infrastructure and basic services. Cumulative and synergistic effects may arise from the interactions and additions of small insignificant effects and the AoS identified that this was potentially likely where there are clusters of new nuclear power stations. These inter-relationships are considered in the relevant topic sections of the AoS.

S.12.14 The AoS found that these interactions and cumulative effects were more likely to be significant where there are clusters of proposed new nuclear power stations. The AoS recommended that for some regions the draft NPS should advise the IPC to consider interactions and cumulative effects if more than one station is built as follows:

- North West Region: Braystones, Heysham, Kirksanton and Sellafield. The AoSs identified potential beneficial effects of regional significance on employment and community viability, with additional positive effects on health and well-being from secure employment. However, there are also potential adverse cumulative effects on landscape and visual impacts in relation to the character of the surrounding area including the Lake District National Park, and other development objectives for biodiversity, tourism and recreation/amenity.
- South West Region: Hinkley and Oldbury. The AoSs identified potential interactions and cumulative effects on important biodiversity sites in the Severn Estuary and River Wye. Potential positive effects on local employment, upskilling, community viability and health/well-being could be more significant if more than one new nuclear power station is built.

Summary of AoS Findings

S.12.15 Overall and generally, the AoS identified that the draft Nuclear NPS was likely to have significant beneficial effects for energy security of supply and to contribute positively to the Government's targets for a low carbon economy, reducing emissions of greenhouse gases and mitigating the predicted effects of climate change. Significant adverse effects were indicated for internationally important nature conservation sites; the relative significance and effectiveness of mitigation possibilities will be determined at the subsequent project level EIAs and with individual planning applications to the IPC.

S.12.16 At local and regional levels, a combination of likely significant adverse and beneficial effects was identified and their significance depends upon further localised investigations; these will be carried out in more detail with project level EIA studies. Generally, likely adverse effects were associated with capacity of supporting infrastructure, water, flood risk and biodiversity; likely beneficial effects were associated with long term employment and community viability.

S.13 How did the AoS help the development of the draft Nuclear NPS?

S.13.1 The AoS was carried out in an iterative and ongoing way with the development of the draft Nuclear NPS. The key recommendations from the AoS were associated with identifying any significant adverse effects and possibilities for mitigation that could help inform the draft NPS and its guidance on impacts for the IPC when considering applications for development consent. The AoS also drew attention to the potential for cumulative effects where there might be clusters of new nuclear power stations, particularly in the North West.

S.14 How will we monitor the likely effects of the draft Nuclear NPS?

S.14.1 Monitoring helps to examine the effects predicted through the AoS process against the actual effects of the draft Nuclear NPS when it is implemented. It is not necessary to monitor everything or monitor a predicted effect indefinitely but rather to monitor the significant predicted and actual effects. The key sustainability effects of the Nuclear NPS could be monitored through the monitoring frameworks already carried out by the environmental and nuclear regulators, and the planning and health authorities, for example, as follows:

- the extent of nuclear generating activities will be monitored through the nuclear licensing procedures;
- pollution control and environmental management monitoring is carried out by the environmental authorities;
- human health protection is carried out by the health authorities;
- employment and access to community facilities and services are monitored by Regional Planning Bodies and Local Planning Authorities.

S.14.2 The Government will agree a list of indicators to monitor the performance of the NPS and include details of this monitoring in the AoS Post Adoption Statement which will be published at the same time the Nuclear NPS is designated.

S.15 Next Steps

S.15.1 The draft Nuclear NPS, the AoS and the HRA Reports will be available for review and public comment. The documents are made available on the DECC website (www.energynpsconsultation.decc.gov.uk) and details of how to comment are set out in the Consultation Document[18]. If you have any comments on issues raised in the AoS or HRA, please respond as part of the consultation on the draft Nuclear NPS.

S.15.2 The Government will consider comments received during the public consultation in their decision making on finalising the NPS. On designation of the NPS, an AoS Statement will be published and this will outline how the findings of the AoS and the responses to consultation have been taken into account. It will also provide further information on how monitoring will be carried out during the implementation of the Nuclear NPS.

18 Consultation Document www.energynpsconsultation.decc.gov.uk

Main Appraisal of Sustainability: Main Report

1. Background to the NPS and AoS

1.1 The Planning Act 2008 and National Policy Statements (NPSs)

1.1.1 The Planning Act[19] is intended to provide a more efficient, transparent and accessible planning system for Nationally Significant Infrastructure Projects (NSIPs) for transport, energy, water, wastewater and waste. This includes statutory climate change mitigation and adaptation requirements. A new independent Infrastructure Planning Commission (IPC) will take responsibility for considering and deciding on major infrastructure applications and this will help speed up the planning process. The Government is producing National Policy Statements (NPSs) to provide clarity on the national need for the infrastructure and to set the policy and guidance framework for the IPC to use when making its planning decisions. NPSs will be subject to public consultation and Parliamentary scrutiny.

1.2 The Energy National Policy Statements

1.2.1 The Department of Energy and Climate Change (DECC) is responsible for preparing the NPSs that relate to energy infrastructure projects. The Overarching NPS for Energy (EN-1) sets out the high level objectives, policy and regulatory framework for new energy infrastructure consistent with sustainable development and addressing climate change. There are a further five technology specific NPSs as follows:

- EN-2 Fossil Fuel Electricity Generating;
- EN-3 Renewable Electricity Generation;
- EN-4 Gas Supply Infrastructure and Gas and Oil Pipelines;
- EN-5 Electricity Transmission and Distribution Networks;
- EN-6 Nuclear Power Generation.

1.2.2 These six NPSs set out Government's energy policy, the national need for energy infrastructure, and guidance to the IPC on how to assess the impacts of such infrastructure. Developers will need to ensure that their applications for development consent are consistent with the requirements of relevant NPSs. The IPC will also take into account local impact reports prepared by local authorities. The Nuclear NPS is different from the other energy NPSs because it includes a list of potentially suitable sites for new nuclear power stations. The Nuclear NPS with the potentially suitable sites is the subject of this Appraisal of Sustainability (AoS).

19 Planning Act November 2008.

1.2.3 The Overarching Energy NPS sets out at a strategic level Government policy with a framework for consenting planning decisions of major energy infrastructure, including policies to address security of supply and the reduction of carbon emissions, the need for new generating capacity and a mix of technologies. This will allow the IPC to concentrate on the potential impacts of the development at the proposed location(s), and whether applications should be granted consent. The Overarching Energy NPS will provide assessment principles for the IPC in dealing with generic impacts of development; the technology specific NPSs will provide guidance on impacts that are particular to individual technology types.

1.3 The draft Nuclear National Policy Statement (NPS)

1.3.1 The 2008 Nuclear White Paper set out the Government's belief that *"new nuclear power stations should have a role to play in this country's future energy mix alongside other low-carbon sources; that it would be in the public interest to allow energy companies the option of investing in new nuclear power stations; and that the Government should take active steps to facilitate this"*.

1.3.2 The draft Nuclear NPS sets out the Government's policy on the national strategic issues which need to be taken into account when granting consent for the construction of new nuclear power stations. A significant component of the draft Nuclear NPS, which differs in this respect from the other energy NPSs, is the list of sites which have been assessed at a strategic level and which Government considers to be potentially suitable[20] for the deployment of new nuclear power stations by the end of 2025.

1.3.3 The main objective of the draft Nuclear NPS is to provide the primary basis for planning decisions by the IPC on applications for development consent for a new nuclear power station. It sets out the role of nuclear power and the key features of relevant planning policy in which applications for new nuclear power stations should be considered. It describes the site nominations and the Strategic Siting Assessment (SSA) process and includes a list of sites that have been assessed to be potentially suitable for new nuclear power stations. This reduces the need for the IPC to consider alternative sites and helps make the decision making more efficient.

1.3.4 The draft Nuclear NPS has been developed using a Strategic Siting Assessment (SSA) process for identifying potentially suitable sites for deployment of new nuclear power stations by 2025. The early stage of the NPS development included preparing exclusionary and discretionary criteria to be used in the SSA process, in consultation with regulators, technical specialists and the public. The SSA process was also subject to an Appraisal of Sustainability (AoS)[21] and a Habitats Regulations Assessment (HRA)[22] screening as part of the overall development of the draft Nuclear NPS and these reports were included in the consultation processes.

20 As set out in the Planning Act 2008, a NPS may identify one or more locations as suitable (or potentially suitable) or unsuitable for a specified description of development. For the purposes of this document, "deployment of new nuclear power stations" means commencing operation of one or more new nuclear power stations on the site.

21 Applying the proposed Strategic Siting Assessment Criteria: A study of the potential environmental and sustainability effects (July, 2008) BERR.

22 Habitats Regulations Assessment Screening Report (July 2008) BERR.

1.3.5 Nominations to develop sites were invited and these nominations were assessed against the conditions of nominating and the SSA criteria. Eleven nominated sites[23] passed the exclusionary criteria and were subject to the discretionary criteria. These eleven sites also underwent appraisal through the AoS process. The findings of the AoS helped to inform the SSA in identifying ten sites which are potentially suitable for the deployment of new nuclear power stations in England and Wales. One site, Dungeness, did not pass the discretionary criteria on biodiversity and there were concerns about flood risk and coastal processes.

1.3.6 As a result of the SSA process, the Government has concluded that there are ten sites that are potentially suitable for deployment of new nuclear power stations by 2025. This list of sites, shown in the following figure is part of the current Government consultation.

Figure 1.1 Potentially Suitable Sites

23 The eleven nominated sites: Bradwell, Braystones, Dungeness, Hartlepool, Heysham, Hinkley Point, Kirksanton, Oldbury, Sellafield, Sizewell and Wylfa.

1.3.7 New nuclear power stations may have negative and positive impacts on the environment and local communities. The significance of these impacts depends upon the characteristics of the local area and the detailed design of the nuclear power station. Under the new planning regime, the promoters of new nuclear power stations will still need to provide an Environmental Statement to accompany their application for development consent. Any new nuclear power station will still be subject to safety licensing conditions and the operator will have to comply with the safety and environmental conditions set by the regulators.

1.3.8 The draft NPS sets out guidance for the IPC, including the general principles that should be applied in the assessment of impacts, and advises on the impacts from new nuclear power stations that are likely to have the most significant effect on sustainable development. The outline contents of the draft Nuclear NPS are as follows:

- Part 1 is an introduction and context to the draft NPS;
- Part 2 sets out Government policy and energy infrastructure development;
- Part 3 sets out assessment principles; explains the SSA process, regulatory framework, and radioactive waste management;
- Part 4 presents guidance for the IPC in consideration of development applications;
- Part 5 of the NPS sets out an analysis for each site detailing the assessment of the site against the SSA criteria, and highlighting particular issues that were raised in the assessment and may need to be considered for development consent and site licensing. This will help scope the information that needs to be provided in the Environmental Statement[24] and should speed up the decision-making process for building new nuclear power stations.

1.3.9 A key characteristic of nuclear power stations is the requirement to manage radioactive waste. The Government considers that it is technically possible to dispose of new higher activity radioactive waste in a geological disposal facility and that this would be a viable solution and the right approach for managing waste from any new nuclear power stations. The Government considers that it would be technically possible and desirable to dispose of both new and legacy waste in the same geological disposal facilities and that this should be explored through the Managing Radioactive Waste Safely programme. The Government considers that waste can and should be stored in safe and secure interim storage facilities until a geological disposal facility (GDF) becomes available.

24 To be prepared by developers prior to submission of a development consent application to the IPC.

2. The AoS Process and Methods

2.1 Overview of the AoS Process and other Assessments

Appraisal of Sustainability (AoS)

2.1.1 The Planning Act 2008 (Section 5 (3)) requires that "…an appraisal of the sustainability of the policy set out in the statement" must be carried out before a statement can be designated as a NPS. The main purpose of an AoS is to examine the sustainability effects of the developing NPS and provide decision makers, consultees and others with information on the wider effects of future development.

2.1.2 Our approach to the AoS was modelled on the Government's guidance for preparing SEAs and Sustainability Appraisals, as there is no guidance yet on preparing an AoS. This is a staged approach as outlined in the following figure:

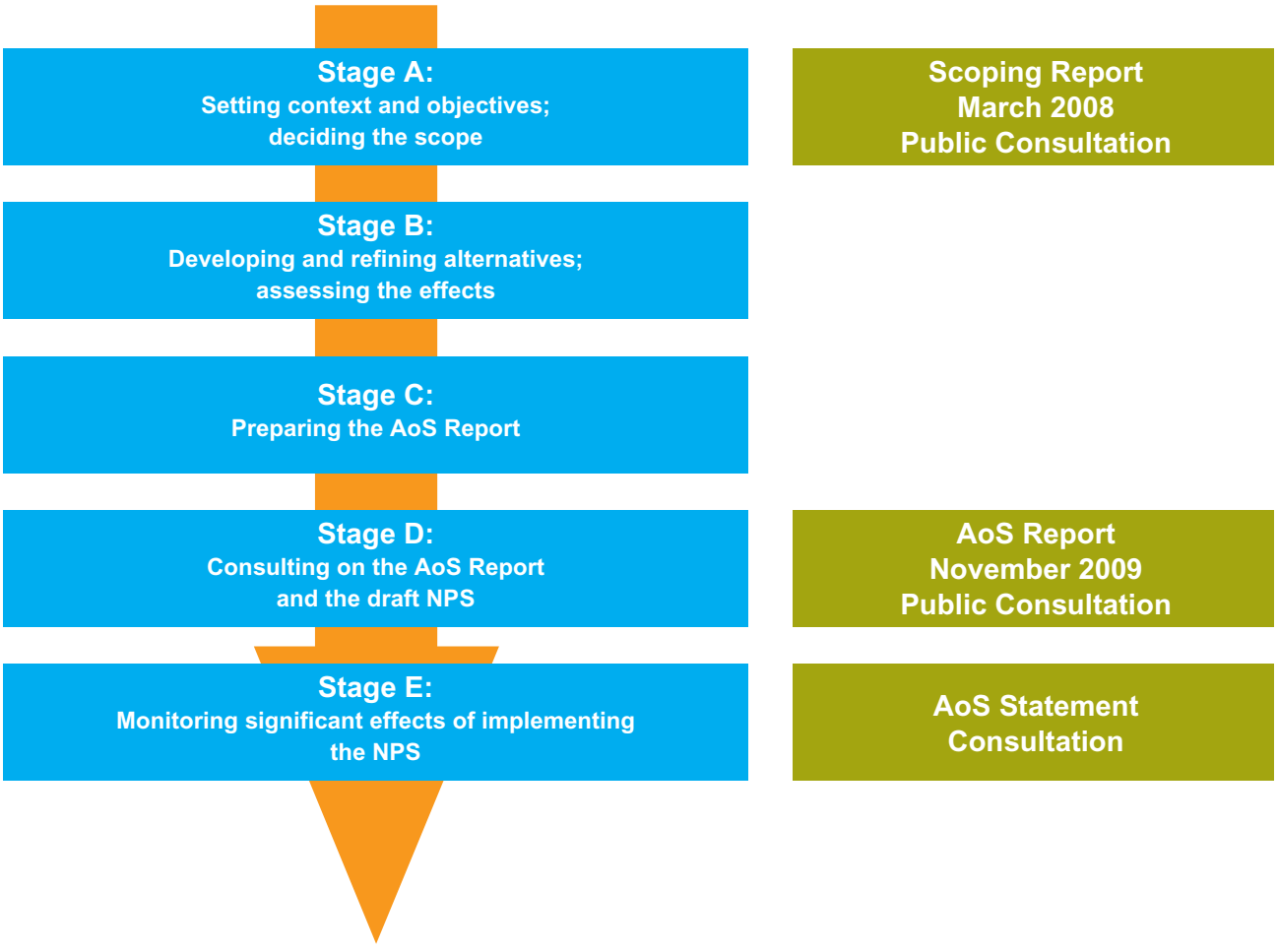

Figure 2.1: Stages of AoS (incorporating SEA)

Strategic Environmental Assessment (SEA)

2.1.3 This appraisal incorporates an assessment in accordance with the requirements of the European Strategic Environmental Assessment Directive[25] (the SEA Directive) and the transposing Regulations in the UK. The SEA Directive aims for a high level of environmental protection and to promote sustainable development. It applies to certain plans and programmes that are likely to have a significant effect on the environment, and particularly those that set development consent frameworks for projects such as the draft Nuclear NPS. SEA helps inform the preparation of plans by identifying and examining the potential significant effects of the plan on environmental factors.

2.1.4 Social and economic factors are considered in an AoS in a similar manner as environmental factors in SEA, aiming to integrate social, economic and environmental aspects to better promote sustainable development. The integrated appraisal reported in this document is an AoS incorporating the requirements of the SEA Directive and will be referred to throughout the report as an AoS.

Environmental Impact Assessment (EIA)

2.1.5 The environmental assessment process continues from the strategic level SEA of plans and programmes to the project level Environmental Impact Assessment (EIA). Under the new planning regime, developers will still have to submit an Environmental Statement reporting the EIA with their application to the IPC for development consent. EIA is a process that provides information to planners, other regulators and the public about certain proposed developments and their likely effects on the environment. It is mandatory for proposed new nuclear power stations to be subject to EIA. By integrating the EIA process and the emerging design of a development as early as possible, potential adverse impacts can be best mitigated and opportunities for environmental enhancement optimised. SEA sets the strategic context for future development and this then makes the subsequent project level EIAs more effective.

Habitats Regulation Assessment (HRA)

2.1.6 The draft Nuclear NPS has also been assessed in accordance with the European Habitats Directive. The main aim of the European Habitats Directive is to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore natural habitats and wild species at a favourable conservation status, introducing robust protection for those habitats and species of European importance. In applying these measures Member States are required to take account of economic, social and cultural requirements and regional and local characteristics. The AoS was carried out at the same time as the HRA and was informed by emerging findings. However, the HRA and the AoS are presented as two separate reports to make the technical information manageable and more readily accessible to those readers with particular responsibilities and interests.

25 Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment.

Consultation

2.1.7 Consultation is an important part of the assessment processes. It is a requirement of the SEA Directive that authorities with specific environmental responsibilities should be consulted on the scope of the SEA. During the development of the AoS there has been ongoing consultation and liaison with these statutory bodies and other bodies with a regulatory or advisory role in relation to nuclear facilities and their development[26].

2.1.8 It is also a requirement[27] of the SEA Directive that these bodies and the public are given an effective opportunity to comment on the draft Nuclear NPS and the accompanying report, which in this case is an AoS Report (incorporating an Environmental Report in accordance with the SEA Directive). This consultation stage is further explained at the end of this chapter in Section 2.6 and includes next steps on how the Government will address the comments received.

2.2 Developing the AoS

2.2.1 The Government began the process leading to the preparation of the draft Nuclear NPS before the implementation of the Planning Act in 2008 and the requirement for an AoS. However, the process anticipated the emerging planning reforms and from the outset the appraisal considered social and economic factors as well as those environmental factors that are likely to be addressed through SEA. The draft Nuclear NPS is different from the other draft Energy NPSs as it includes both national policy and a list of sites that have been assessed as potentially suitable for building new nuclear power stations that could be in operation by the end of 2025.

2.2.2 Also from the outset, the process leading to the preparation of the Nuclear NPS proposed an integration of plan making and the appraisal processes. The Strategic Siting Assessment (SSA) process for identifying potentially suitable sites is based on criteria that were scoped as appropriate for a Nuclear NPS. The SSA criteria were subject to appraisal using the AoS framework of objectives for sustainability. The roles and interactions of the process of developing the draft NPS, including the SSA, and the AoS process, are set out in Figure 2.2.

26 Department of Health, Health Protection Agency, Nuclear Installations Inspectorate, Defra and the Industrial Pollution and Radiochemical Inspectorate (part of Department of the Environment, Northern Ireland).

27 "The authorities [with relevant environmental responsibilities] and the public…shall be given an early and effective opportunity within appropriate timeframes to express their opinion on the draft plan or programme and the accompanying environmental report before the adaptation of the plan or programme." (SEA Directive Article 6 (2)).

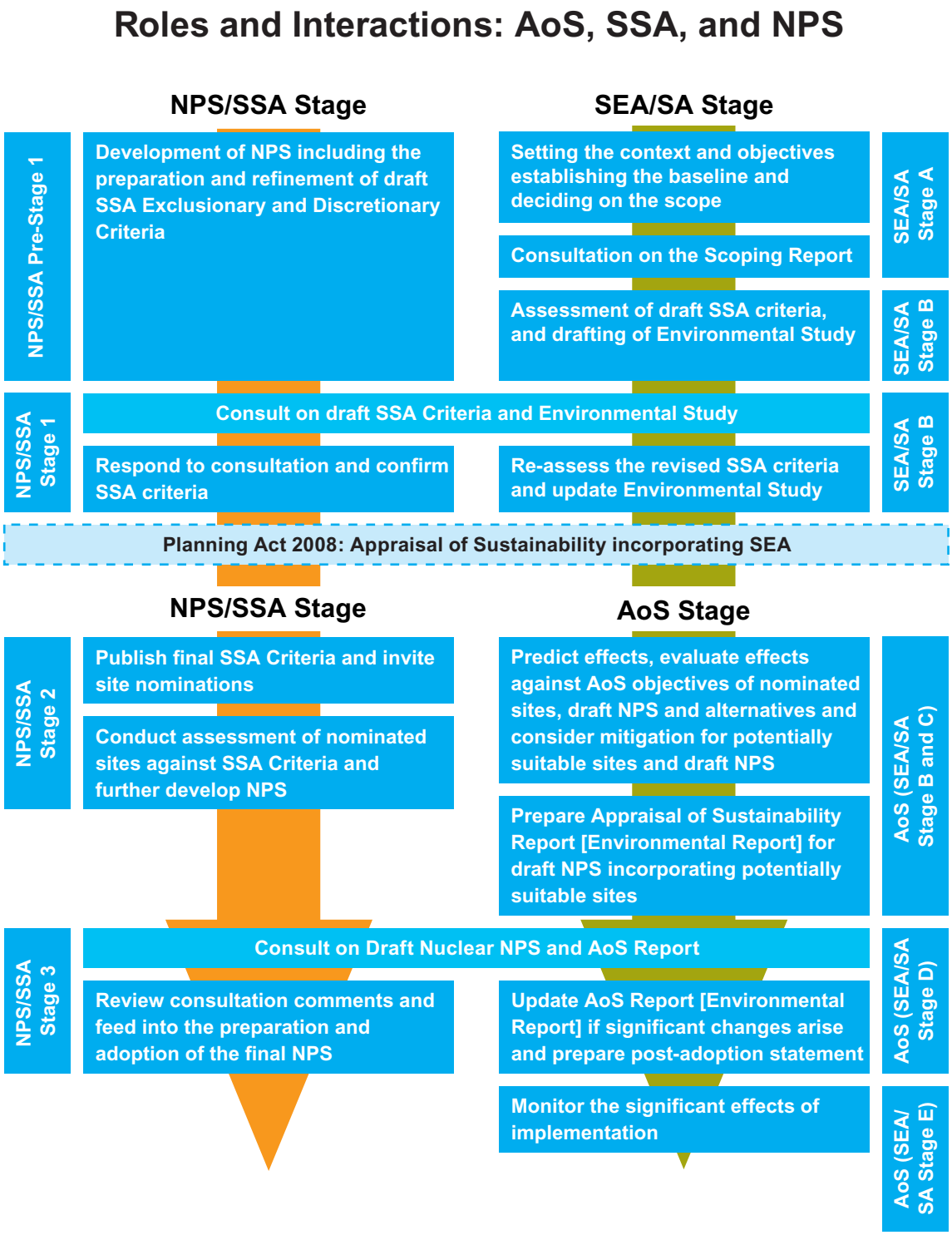

Figure 2.2: Roles and Interactions: AoS, SSA, and NPS

2.2.3 Thus the AoS has been developed through a number of stages that reflect consultation responses and changes in legislation and guidance. The key steps in the development of the process so far are set out in Table 2.1:

Table 2.1: Key Steps in Developing the AoS

AoS Development	Purpose
Consultation on The SEA Scoping Report[28] (March 2008)	A report comprising early consultation with the statutory bodies and other interested parties on the scope and level of detail proposed for the SEA (now AoS) in accordance with the SEA Directive.
The Environmental Study and Sustainability Study[29] (July 2008)	As part of the consultation on the proposed SSA criteria, this comprised a study of the potential environmental and sustainability effects of applying the SSA criteria.
The Update Report[30] (January 2009)	A report to update the environmental study with changes made to the SSA criteria as a result of consultation. Also explains changes from an SEA to an AoS in accordance with new requirements outlined in the Planning Act 2008.
Ongoing consultation during appraisal stage (April – November 2009)	Liaison with statutory environmental bodies, relevant regulators, and other Government departments to assist with refinement of AoS methods and assessments.
This AoS Report (November 2009)	Meeting the requirements of the Planning Act 2008 for AoS and incorporating the requirements of the SEA Directive. The AoS Report comprises: • Non Technical Summary • Main AoS • Sites AoS
AoS Designation Statement	Following consultation on the draft Nuclear NPS and the AoS Report, this final AoS Statement will set out how the consultation and the appraisal have been taken into account in deciding the final NPS to be designated.

28 BERR (March 2008) Consultation on Strategic Environmental Assessment for proposed National Policy Statement for new nuclear power, URN 08/680QAN, http://www.berr.gov.uk/files/file45240.pdf

29 BERR (July 2008) Applying the Proposed Strategic Siting Assessment Criteria: A study of the potential environmental and sustainability effects, URN08/962, http://www.berr.gov.uk/files/file47137.pdf

30 Incorporating an Environmental Report in accordance with the European SEA Directive 2001/42/EC.

2.3 Scoping

Identifying other relevant policies, plans, programmes, sustainability objectives
Collecting baseline information
Identifying key sustainability issues
Developing relevant objectives, indicators and targets
Consulting on the proposed scope of the AoS

2.3.1 The SEA Scoping Report was[31] published in March 2008 and set out the proposed scope of the SEA with additional socio-economic topics in anticipation of the implementation of the Planning Act in 2008 and the requirement for AoS. The subsequent change in terminology does not imply any change in the scope of the environmental and sustainability assessments since the AoS incorporates an SEA.

2.3.2 The Scoping Report set out the proposed framework for appraisal including:

- background and outline of the proposed draft Nuclear NPS;
- geographical scope: UK (policy); England and Wales (sites);
- main elements of the developing NPS to be appraised: SSA criteria and sites;
- baseline information against which the appraisal would be carried out and policy context;
- topics to be considered;
- framework of AoS objectives, decision-aiding questions and possible indicators for monitoring;
- methods of assessment, including approach and definitions of certainty, nature, timescales, and spatial extent for assessing the SSA criteria.

2.3.3 The scope of this AoS was identified through analysis of relevant baseline information, the policy context, the relevance to the developing draft NPS and the responses to the scoping consultation in March 2008. The appraisal itself was carried out using a set of sustainability objectives as a way of identifying and evaluating the potential significant effects of the draft NPS on communities and the environment.

31 BERR (March 2008) Consultation on Strategic Environmental Assessment for proposed National Policy Statement for new nuclear power, URN 08/680QAN, http://www.berr.gov.uk/files/file45240.pdf

2.4 Alternatives and Assessing Effects

Developing the draft NPS strategic alternatives
Predicting the effects of the draft NPS, including alternatives
Evaluating the effects of the draft NPS, including alternatives
Considering ways of mitigating adverse effects
Proposing measures to monitor the significant effects of implementing the NPS

2.4.1 This second stage of the appraisal process involved identifying, describing and evaluating the potential significant effects of the developing draft Nuclear NPS. Consideration was given to possibilities for mitigating significant adverse effects. The methods of appraisal were refined as both the draft NPS and the AoS were developed, including identifying the appropriate levels of detail for each element of the emerging draft NPS, and in ongoing consultation with the statutory bodies for SEA.

AoS Objectives for Sustainable Development

2.4.2 The SEA Directive suggests a range of topics for assessing a plan including biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage, landscape and the inter-relationships between these factors. All these topics have been considered in appraising the draft Nuclear NPS. The AoS objectives for these topics were grouped into Sustainable Development (SD) themes to help with appraising different aspects of the emerging draft NPS. The AoS objectives used were as shown on Table 2.2.

Nature and Significance of Effects

2.4.3 Often topics are inter-related, for example, changes to transport types and routes can affect emissions of carbon dioxide that contribute to the effects of climate change. This may subsequently affect biodiversity and the risk of flooding. Secondary or indirect effects may occur as a result of a complex pathway between an activity, such as building flood defences, and the sensitivity of the receiving environment. For example, the flood defences may change movements of sediments and thus affect the ecology of a nearby wetland.

Table 2.2: Sustainable Development themes and AoS objectives

Sustainable Development Theme/AoS Objective (The SD Themes are shown in bold text in grey boxes and the AoS Objectives are shown in normal text in white boxes beneath their Theme. Numbers in brackets refer to the numbers given to the Objectives in the SEA Scoping Report March 2008)
SD Theme: Climate Change (Mitigation)
to minimise greenhouse gas emissions (13)
SD Theme: Biodiversity and Ecosystems
to avoid adverse impacts on the integrity of wildlife sites of international and national importance (1)
to avoid adverse impacts on valuable ecological networks and ecosystem functionality (2)
to avoid adverse impacts on Priority Habitats and Species including European Protected Species (3)
SD Theme: Communities – population, employment, and viability
to create employment opportunities (4)
to encourage the development of sustainable communities (5)
to avoid adverse impacts on property and land values and avoid planning blight (10)
SD Theme: Communities – supporting infrastructure
to avoid adverse impacts on the function and efficiency of the strategic transport infrastructure (8)
to avoid disruption to basic services and infrastructure (9)
SD Theme: Human Health and Well-Being
to avoid adverse impacts on physical health (6)
to avoid adverse impacts on mental health (7)
to avoid the loss of access and recreational opportunities, their quality and user convenience (11)
SD Theme: Cultural Heritage
to avoid adverse impacts on the internationally and nationally important features of the historic environment (22)
to avoid adverse impacts on the setting and quality of built heritage, archaeology and historic landscapes (23)
SD Theme: Landscape
to avoid adverse impacts on nationally important landscapes (24)
to avoid adverse impacts on landscape character, quality and tranquillity, diversity and distinctiveness (25)
SD Theme: Air Quality
to avoid adverse impacts on air quality (12)

Sustainable Development Theme/AoS Objective (The SD Themes are shown in bold text in grey boxes and the AoS Objectives are shown in normal text in white boxes beneath their Theme. Numbers in brackets refer to the numbers given to the Objectives in the SEA Scoping Report March 2008)
SD Theme: Soils, Geology, Land Use
to avoid damage to geological resources (19)
to avoid the use of greenfield land and encourage the re-use of brownfield sites (20)
to avoid the contamination of soils and adverse impacts on soil functions (21)
to avoid damage to geological resources (24)
SD Theme: Water Quality and Resources
to avoid adverse impacts on surface water hydrology and channel geomorphology (including coastal geomorphology) (15)
to avoid adverse impacts on surface water quality (including coastal and marine water quality) and assist achievement of Water Framework Directive objectives (16)
to avoid adverse impacts on the supply of water resources (17)
to avoid adverse impacts on groundwater quality, distribution and flow and assist achievement of Water Framework Directive objectives (18)
SD Theme: Flood Risk
to avoid increased flood risk (including coastal flood risk) and seek to reduce risks where possible (14)
Radioactive and associated hazardous waste is cross-cutting and has the potential to affect many of the above objectives for sustainable development. As this topic is unique to new nuclear power stations, consideration of the likely significant effects is dealt with as a separate chapter in the AoS
Sub-objectives (guide questions) were identified through the scoping process for each of the above AoS objectives. These more specifically define each objective and help to avoid duplication for cross-cutting issues during the appraisal. The guide questions are set out in Table 2.8 which also demonstrates the compatibility between the AoS frameworks for the Overarching and other draft Energy NPSs and the draft Nuclear NPS (see Section 2.5 below)

2.4.4 Cumulative effects arise, for example, where several developments each have insignificant effects but together have a significant effect; or where several individual effects have a combined effect. Synergistic effects interact to produce a total effect greater than the sum of the individual effects. For example, a wildlife habitat can become progressively fragmented with limited effects on a particular species until the last fragmentation makes the area too small to support the species. Beneficial cumulative effects may occur with several developments in a sub-region; collectively they reach a threshold for employment and other supporting infrastructure such that the communities become more sustainable.

2.4.5 The potential effects of the draft Nuclear NPS may be positive or negative and where potential significant adverse effects were identified, mitigation measures have been suggested. Each topic was appraised using professional judgment and available information. Any gaps in information or uncertainty about the appraisal have been recorded. Outline proposals for monitoring the predicted effects have been suggested for when the NPS is designated.

2.4.6 The nature and significance of predicted potential effects were recorded with commentary in matrices using symbols and colours with a grading system as shown on Table 2.3.

Geographical and Temporal Scope of the AoS

2.4.7 The effect of the draft Nuclear NPS is limited to England and Wales and includes a list of sites that are potentially suitable for deployment of new nuclear power stations by the end of 2025. Therefore the focus of the AoS was on the effects associated with England and Wales, although consideration was given to any significant effects for the rest of the UK and transboundary effects. Relevant member states are being consulted on the draft Nuclear NPS and its accompanying AoS and HRA reports. The Nuclear AoS includes appraisal of both the effects of the whole draft NPS and the specific effects of potentially suitable sites. Generic design characteristics for new nuclear power stations were considered for the appraisal since the detailed design will be addressed at the project EIA stage. This is set out in more detail later in Table 2.6. The timescales for appraisal were as follows:

- Construction: 5-6 years;
- Operation: approximately 60 years;
- Decommissioning: minimum 30 years;
- Interim waste storage on site: approximately 100 years after the end of operation;
- Lifetime of site: around 166 years (6+60+100 years).

2.4.8 The time that will be required for the safe and secure onsite interim storage of spent fuel and intermediate level waste in contingent on a number of factors. It is possible to envisage a scenario in which onsite interim storage facilities might be required to last for around 160 years from the start of the power station's operation, to enable cooling for the spent fuel from the last years of the power station's operation. However this is based on some conservative assumptions and there are a number of factors that could reduce, or potentially increase, the total duration on onsite spent fuel storage[32].

32 The arrangements for the management and disposal of waste from new nuclear power stations: a summary of evidence. www.energynpsconsultation.decc.gov.uk

Table 2.3: Significance and categories of potential strategic effects

Key: Significance and categories of potential strategic effects		
Major positive	++	Development would resolve an existing sustainability problem; effect considered to be of regional/national/international significance
Minor positive	+	No sustainability constraints and development acceptable; effect considered to be of regional/ national/international significance
Neutral	0	Neutral effect
Minor Negative	-	Potential sustainability issues, mitigation and/or negotiation possible; effect considered to be of regional/national/international significance
Major Negative	- -	Problematical because of known sustainability issues; mitigation or negotiation difficult and/or expensive; effect considered to be of regional/national/ international significance
Uncertainty ?		Where the significance of an effect is particularly uncertain, for example because insufficient information is available at the plan stage to fully appraise the effects of the development or the potential for successful mitigation, the significance category is qualified by the addition of the symbol "?"

The Environmental and Sustainability Study July 2008

2.4.9 As part of the consultation on the Strategic Siting Assessment (SSA) process, the Government sought views on the proposed SSA criteria. Studies were undertaken to assess the potential environmental and sustainability effects of siting in accordance with the proposed criteria against the 25 objectives for sustainability agreed through the scoping process. The studies considered how each proposed SSA criterion might affect sustainability objectives as follows:

- Background;
- overview of potential impacts for each phase of nuclear power activity: construction, operation and decommissioning;
- identification of any significant effects, cumulative effects and suggested mitigation.

2.4.10 The studies concluded that:

- the proposed SSA criteria were broadly in line with sustainability and environmental objectives;
- the discretionary nature of some criteria means that adverse environmental effects cannot be ruled out at the strategic level;
- certain local level impacts are not addressed by the SSA but it is made clear that these would be addressed through EIAs accompanying individual planning applications.

The Update Report January 2009

2.4.11 This report updated the environmental and sustainability impacts of siting new nuclear power stations on sites that would be identified through the application of the SSA criteria. Changes were made to three of the proposed SSA criteria as a result of the consultation. The proposed changes to the criteria were appraised using the SEA objectives and found to be neutral or positive with regard to sustainability effects, as shown in the following table:

Table 2.4: Changes to SSA Criteria arising from Consultation

SSA Criterion	Change arising from consultation	AoS Findings
Size of site to accommodate operation	Previously included size of site to accommodate construction and decommissioning which is now flagged for local consideration	Possibility that construction and decommissioning may require larger area than nominated is noted in AoS
Seismic risk (vibratory ground motion)	From exclusionary to flag for local consideration	Positive
Capable faulting	From exclusionary to flag for local consideration	Positive
Tsunami, storm surge and coastal processes	Tsunami and storm surge to be merged with flood risk. Coastal processes becomes separate criterion	Neutral

2.4.12 The studies concluded that the changes to the SSA criteria did not materially change the conclusion reached in the environmental study that the proposed SSA criteria are broadly in line with principles of sustainability and environmental protection. The update report also set out the Government's evolving thinking on the alternatives to be appraised following responses to the scoping report and comments made in responses to the consultation on the environmental study. The report also explained the changes from an SEA to an AoS, incorporating SEA, in accordance with the new requirements as set out in the Planning Act 2008.

Alternatives to the draft Nuclear NPS which were considered

2.4.13 Nuclear power stations have effects on sustainable development; the nature and scope of these effects essentially depend upon if nuclear power stations are built, how many are built, where they are built, and when they are built. The way in which the draft Nuclear NPS is developed, and its contents, will influence the number, location and timing of any nuclear power stations that might eventually be built by energy companies. The role of the AoS is to examine the sustainability effects of reasonable alternatives so that its findings can help inform the development of the draft NPS. The Government decided to consider alternatives through a hierarchy as suggested by SEA and SA guidance as follows:

- Need: do we need the plan?
- Process: how should it be done?
- Location: where should it go?

2.4.14 The 25 SEA objectives agreed as a result of the scoping report in March 2008 were designed to appraise the SSA criteria and sites in detail. The factors covered by the SEA objectives were grouped into twelve Sustainable Development (SD) Themes for appraising the sites (see previously Table 2.2). These SD themes and topics covered by the SEA objectives were grouped into six broader headline topics for sustainability in order to make them more suitable for the higher level appraisals of the need and process alternatives as shown on Table 2.5.

Table 2.5: Headline Sustainable Development Topics for the Appraisal of Need and Process Alternatives

Headline Sustainable Development Topics	**AoS/SEA Topics** (numbers refer to objectives from the Scoping Report; *italics refer to topics suggested in the SEA Directive*)
Climate Change	Climate change (13) *Climatic Factors*
Security of Energy Supply	Communities, Health, Infrastructure (8, 9, 6, 7) *Population, Human Health, Material Assets*
Health and Safety	Communities, Health (6, 7, 11) *Population, Human Health*
Radioactive Waste Generation	Cross-cutting topic
The Natural Environment	Biodiversity and Ecosystems (1, 2, 3) Soil (19, 20, 21) Air (12) Water (14, 15, 16, 17, 18) Landscape (24, 25) *Biodiversity, fauna, flora, soil, air, landscape*
The Built Environment	Landscape (24, 25), Archaeology and Cultural Heritage (22, 23), Material Assets (8, 9) *Biodiversity, fauna, flora, landscape, cultural heritage including architectural and archaeological heritage, material assets*
The Economy	Communities, Population, Employment (4, 5, 10)

2.4.15 Need – do we need the Nuclear NPS? Three possible high level scenarios were considered for the NPS:

- A Nuclear NPS in line with Government policy that includes guidance for the IPC on potentially suitable sites (listing and/or selection criteria);
- A Nuclear NPS that prohibits the construction of new nuclear power stations;
- No NPS specific to building new nuclear power stations.

2.4.16 Process – how should the NPS be developed? The format and detail of the NPS can influence the number, location and timing of new nuclear power stations through the policy guidance and framework for decision making that it sets out for the IPC. Four potential options for the nuclear NPS were identified:

- A Nuclear NPS with siting criteria;
- A Nuclear NPS with a list of sites;
- A Nuclear NPS with siting criteria and a list of sites;
- A Nuclear NPS with siting criteria and a list of sites restricted to those in the vicinity of existing nuclear power stations.

2.4.17 Location – where should new nuclear power stations be built? Nominations for sites were invited by the Government during March 2009. Sites nominated by energy developers and assessed as being potentially suitable with regard to the SSA exclusionary criteria were subject to Appraisal of Sustainability using the 25 SEA/AoS objectives (see Table 2.2).

Appraising the Potentially Suitable Sites

2.4.18 The draft Nuclear NPS needs to incorporate both the national situation and also the local situations with regard to the potentially suitable sites in order to be able to guide the IPC to key issues that require particular attention when considering individual planning applications. The AoS appraised the NPS as a whole at the strategic level and also each of the potentially suitable sites.

2.4.19 It is important that the sites AoSs are kept focused on strategic appraisal, highlighting key local issues, but avoiding duplication of the project level assessments, such as EIA, that will accompany subsequent individual planning applications to the new IPC. The AoS method was developed to acknowledge two levels of significance for sustainability effects associated with the sites:

- Local Effects: these include effects at the local level, for example, an effect on a nearby County Wildlife Site, and that are more appropriately addressed through the development consent process with the IPC. Each site was characterised and the key issues for sustainability summarised (including suggestions for mitigation of potential significant adverse effects) to inform the draft NPS in developing its guidance to the IPC.

- Strategic Effects: these include effects that are more significant at the regional to national or international levels, for example, an effect on biodiversity of national and international value.

2.4.20 The AoS for each of the sites considered the relevant policy context at a regional level, which helped to identify key sustainability objectives that need to be taken into account in the appraisal and potential cumulative effects that could arise with other plans and projects. Existing and emerging local policy and information documents were considered, where relevant, for the characterisation of baseline conditions and the appraisal of effects. The site reports also took into account detailed information such as Environmental Statements accompanying current planning applications as they are in the public domain. Any gaps in information or uncertainties for the appraisals were recorded in the detailed working matrices. Summaries of strategically significant effects and mitigation possibilities were collated by topic and for each site individually, and included consideration of interactions, synergies, and cumulative effects. Details of these methods are set out in the Site AoS Reports (Annexes A-J of this AoS Report).

2.4.21 It was not intended to consider the implications of different nuclear power station designs at each nominated site. It is considered that these are better addressed at the project level by the developer, the regulators, and the planning consultation process. Therefore, the AoS made a number of assumptions about the generic design characteristics of new nuclear power stations.

2.4.22 The assumptions about generic design characteristics were summarised into a base case in order to provide a standardised approach to the appraisal of the sites. The base case was used to guide the appraisal for each site, except in cases where a nominator had provided further detail. For example, if a developer is proposing cooling towers, (that would require less water to be abstracted), instead of direct cooling, this has been considered in the appraisal. The key assumptions used for the site level AoSs are outlined in Table 2.6.

Table 2.6: Generic Design Characteristics for New Nuclear Power Stations

Base Case Generic Design Characteristics for New Nuclear Power Station
1 nuclear reactor
Technology neutral (i.e. unknown reactor type)
A requirement for cooling water abstraction
Discharges of cooling water
Site boundary as indicated on nomination form
Timescales: Construction: approximately 5-6 yrs Operation: approximately 60 years (life extensions would require regulatory approval) Decommissioning: around 30 years Interim radioactive waste storage facilities – 160 years from first arising of waste.[33]
No. of employees: Construction: approx 4,000 (around 50% from within region) Operation: approx 500 Decommissioning= range of 400-800 at key phases Associated employment creation= 2000
Coastal and flood protection measures (where relevant)
Infrastructure for transporting reactor (for example, jetty, landing facility)
Highway improvements, access routes
Associated transmission infrastructure
Other associated infrastructure/plant
Radioactive discharges will be within legal limits

33 The time that will be required for the safe and secure onsite interim storage of spent fuel and intermediate level waste is contingent on a number of factors. It is therefore possible to envisage a scenario in which onsite interim storage might be required for around 160 years from the start of the power stations operation, to enable an adequate cooling period for fuel discharged following the end of the power stations operations. However this is based on some conservative assumptions and there are a number of factors that could reduce, or potentially increase, the total duration on onsite spent fuel storage.

2.5 The Relationship between the Nuclear AoS and the other Energy AoSs

2.5.1 The draft Nuclear NPS is different from the draft Overarching and the other Energy NPSs because it includes a list of potentially suitable sites for new nuclear power stations. It is subject to a separate AoS with assessment processes that commenced in early 2008.

2.5.2 The non-nuclear and the nuclear AoSs relate to the scope of the NPSs and cover policy for energy Nationally Significant Infrastructure Projects (NSIPs) in England and Wales (and Scotland for cross border non-nuclear projects); the potentially suitable sites identified for the nuclear AoS are located in England and Wales.

2.5.3 Both the AoS for the Overarching/Other Energy NPSs and the AoS for the draft Nuclear NPS used an objectives-led assessment process in accordance with UK guidance on SEA and as an integrated appraisal modelled on the Sustainability Appraisal method for spatial plans. This included an appraisal framework of Sustainable Development (SD) themes, AoS objectives and sub-objectives/guide questions.

2.5.4 The relationship between the two sets of appraisal frameworks for the non-nuclear and the nuclear AoSs is set out in Table 2.8 at the end of this chapter. There is direct correlation between most of the sustainability topics addressed. Some issues are categorised differently and this reflects their cross-cutting nature – they could be organised in a number of different categories of SD themes. These are explained as follows:

- Overarching AoS SD Theme Resources and Raw Materials: the Nuclear AoS considers energy infrastructure and (non-nuclear) waste management within Communities: Supporting Infrastructure with regard to capacity of services; potential indirect or secondary effects are considered in the relevant issue. Consideration of radioactive and hazardous waste is a unique characteristic of the Nuclear AoS and is addressed as a separate section in the AoS Report.
- Overarching AoS SD Theme Traffic and Transport: categorised within Communities: supporting infrastructure for the nuclear AoS.
- Overarching AoS SD Theme Noise: people and fauna are the receptors with regard to noise. There are no specific guide questions relating to noise within the nuclear SA framework but the effects of noise are implicit in the guide questions for health and well-being, and biodiversity; consideration is also given to potential effects on cultural heritage and landscape through disturbance and loss of tranquillity.
- Overarching AoS SD Theme Equality: there is no specific reference to equality for the nuclear AoS but this is implicit in the objective for encouraging the development of sustainable communities.

2.5.5 Both the non-nuclear and the nuclear AoSs took a topic-based approach and for each SD Theme/ objective for sustainability, the AoSs considered the policy context relevant to the appraisal, the current situation including any problems, the likely evolution without the draft NPS, and the likely effects of the draft NPS. The findings of the AoSs were provided to inform the development of the draft NPSs in an iterative and ongoing way.

2.5.6 Both the non-nuclear and the nuclear AoSs recognised categories (positive, negative, neutral) and two grades (major, minor) of effects and as set out for the Nuclear AoS above in Table 2.3). The nuclear AoS had to accommodate both strategic and spatially specific appraisals – so for the site AoSs a distinction between locally (local, sub-regional) and strategically (regional, national, international) significant effects was also made (see below). The site AoSs also differentiated between the construction, operation and decommissioning phases of new nuclear power stations. Both AoSs considered significant inter-relationships, synergistic and cumulative effects between sustainability effects and in accordance with the SEA Directive.

2.6 The AoS Report, this Consultation and Next Steps

Preparing the Appraisal of Sustainability Report
Consulting on the draft NPS and the AoS Report
Assessing any significant changes; Make decisions and provide information;
The AoS Statement to accompany a designated NPS

2.6.1 This AoS Report sets out the findings of the appraisals in Chapter 7. Recommendations arising from these findings were made to inform the development of the draft NPS; the key AoS recommendations and how the draft NPS responded is set out in Appendix 2. Where possible, the Government incorporated recommendations from the AoS and comments from the statutory consultees.

2.6.2 The draft Nuclear NPS and this AoS Report will be available for review and public comment. The documents are available on the DECC website (www.decc.gov.uk) and details of how to comment are set out in the Consultation Document[34]. The Government will consider comments received during the public consultation in their decision making on finalising the NPS. On designation of the NPS, an AoS Statement will be published and this will outline how the findings of the AoS and the responses to consultation have been taken into account. It will also provide further information on how monitoring will be carried out during the implementation of the NPS.

2.6.3 The SEA Directive requires certain information to be provided in the report and therefore, it is necessary to signpost those elements that refer to SEA within the AoS Report. A Non Technical Summary is required. The following table (Table 2.7) sets out where the requirements of the SEA Directive are to be found in this AoS Report.

34 www.energynpsconsultation.decc.gov.uk

Table 2.7: Meeting the requirements of the SEA Directive

Key Requirement of the SEA Directive (information to be provided in the environmental report)	**Location in this AoS Report**
"an outline of the contents, main objectives of the plan or Programme and relationship with other relevant plans and Programmes" (Annex I(a))	Provided in Chapter 1
"the environmental protection objectives, established at international, Community or Member State level, which are relevant to the plan or Programme and the way those objectives and any environmental considerations have been taken into account during its preparation" (Annex I(e))	Provided in Topic Appendices A1-A11 (Appendix 1) and Site Annexes A-J Summarised in Chapter 2 Summarised in Chapters 6, 7
"the relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or Programme" (Annex 1(b))	Provided in Topic Appendices A1-A11 (Appendix 1) and Site Annexes A-J Summarised in Chapters 6, 7
"the environmental characteristics of areas likely to be significantly affected" (Annex I(c))	Provided in Topic Appendices A1-A11 (Appendix 1) and Site Annexes A-J Summarised in Chapters 6, 7
"any existing environmental problems which are relevant to the plan or Programme including, in particular, those relating to any areas of a particular environmental importance, such as areas designated pursuant to Directives 79/409/EEC and 92/43/EEC" (Annex I(d))	Provided in Topic Appendices A1-A11 (Appendix 1) and Site Annexes A-J Summarised in Chapters 6, 7 Chapter 3 also refers [Environment and Sustainability Study (July 2008)]
"the likely significant effects on the environment, including on issues such as biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above factors. These effects should include secondary, cumulative, synergistic, short, medium and long-term permanent and temporary, positive and negative effects" (Annex I(f))	Provided in Topic Appendices A1-A11 (Appendix 1) and Site Annexes A-J Summarised in Chapters 6, 7
"the measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the plan or Programme" (Annex I(g))	Provided in Topic Appendices A1-A11 (Appendix 1) and Site Annexes A-J Summarised in Chapters 6, 7

Key Requirement of the SEA Directive (information to be provided in the environmental report)	**Location in this AoS Report**
"a description of the measures envisaged concerning monitoring…" (Annex I(i))	Provided in Chapter 8
"an outline of the reasons for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know how) encountered in compiling the required information" (Annex I(h))	Provided in Chapters 3, 4, 5 Provided in Chapters 6, 7
"a non-technical summary of the information provided under the above headings" (Annex I(j))	Set out at the beginning of this report

2.7 Summary

2.7.1 Sustainability and environmental assessments are ongoing processes that progress from strategic to project levels. This AoS incorporates the requirements of the SEA Directive and has examined the significant effects of the draft Nuclear NPS on environmental and other relevant socio-economic factors at the strategic level. The process has followed Government guidance on SEA and Sustainability Appraisal. Methods of assessment, and the elements of the draft NPS to be assessed, have been agreed through statutory consultation and ongoing liaison with statutory consultees.

Table 2.8: Relationship between the Nuclear AoS and the Non-Nuclear AoS Frameworks of Themes and Objectives for Appraisal

Overarching/Other Energy NPS AoS Themes and Objectives	Nuclear NPS AoS Themes and Objectives (Amendments in bold red italics made as a result of public consultation; Numbers refer to those used in SEA Scoping Report March 2008)
SD Theme: Climate Change **AoS Objective:** **1. To minimise detrimental effects on the climate from greenhouse gases and ozone depleting substances and maximise resilience to climate change.**	**SD Theme: Climate Change** **AoS Objective:** 13. to minimise greenhouse gas emissions
Will the NPS ensure that the carbon throughput of the national portfolio of major energy infrastructure is reduced (at least in proportion to the carbon targets and budgets set under the Climate Change Act)? Will the NPS significantly change the direct or indirect emissions of carbon dioxide and other greenhouse gases? Will the NPS significantly change in the indirect emissions of carbon dioxide or other greenhouse gases due to changes in energy use? Will the NPS promote future proofing (e.g. through good design) against the effects and risks of climate change (e.g. sea level rise and changes in weather patterns)? Will the NPS promote long term adaptation to the effects of climate change? Will the NPS have wider implications for the mitigation of climate risks?	Will it take account of future effects and risks of climate change e.g. sea level rise? Will future changes in weather patterns be considered? Will it result in increased vehicular emissions (particularly carbon dioxide)? Will it result in increased emissions from asset construction, maintenance and demolition, waste recycling and disposal or other activities? Note: Adaptation to climate change is discussed in other relvant topic appriasals, eg. biodiversity, water, flood risk.

Overarching/Other Energy NPS AoS Themes and Objectives	Nuclear NPS AoS Themes and Objectives (Amendments in bold red italics made as a result of public consultation; Numbers refer to those used in SEA Scoping Report March 2008)
SD Theme: Ecology (Flora and Fauna) **AoS Objective:** 2. To protect and enhance protected habitats, species, valuable ecological networks and ecosystem functionality.	**SD Theme: Biodiversity & Ecosystem Services** **AoS Objective:** 1. to avoid adverse impacts on the integrity of wildlife sites of international and national importance 2. to avoid adverse impacts on valuable ecological networks and ecosystem functionality 3. to avoid adverse impacts on Priority Habitats and Species including European Protected Species
Will the NPS help to prevent damage to and enhance species and habitats (e.g. by promoting good design)? Will the NPS seek to minimise habitat fragmentation and severance of migration and commuter routes? Will the NPS promote new habitat creation or restoration and linkages with existing habitats? Will the NPS promote the sustainable management of natural habitats? Will the NPS affect the structure and function of ecosystem processes? Will the NPS limit air pollution to levels which do not damage natural systems by acidification or eutrophication?	Will it result in the loss of habitats of international/ national importance? Will it affect other statutory or non-statutory wildlife sites? Will it result in harm to internationally or nationally important or protected species? Will it adversely affect the achievement of favourable conservation status for internationally and nationally important wildlife sites? Will it affect the structure and function/ecosystem processes that are essential to restoring, securing and/or maintaining favourable condition of a feature or a site? Will the proposal enable the BAP targets for maintenance, restoration and expansion to be met? Will the proposal result in changes to coastal evolution that is otherwise needed to sustain coastal habitats? Will it result in the release of harmful substances e.g. oil, fuel and other pollution into waterbodies which could affect aquatic ecosystems? Will it result in the accidental migration of radionuclides which could harm aquatic or terrestrial ecosystems? Will it result in changes to stream hydrology and morphology that could affect aquatic or terrestrial ecosystems? Will it result in thermal discharges that could adversely affect aquatic ecosystems? Will it result in soil contamination that could damage aquatic or terrestrial ecosystems?

Overarching/Other Energy NPS AoS Themes and Objectives	**Nuclear NPS AoS Themes and Objectives** **(Amendments in bold red italics made as a result of public consultation; Numbers refer to those used in SEA Scoping Report March 2008)**
SD Theme: Resources and Raw Materials **AoS Objective:** 3. To promote the sustainable use of resources and natural assets and to deliver secure, clean and affordable energy?	**SD Theme:** **AoS Objective:**
Will the NPS adhere to the waste management hierarchy? Will the NPS help to meet the joint challenge of tackling climate change and ensuring secure, clean and affordable energy? Will the NPS generate waste by products? Will the NPS promote the UK's competitiveness, vitality and adaptability within the energy market? Will the NPS promote security of supply in the energy market? Will the NPS have wider effects on energy economics?	Guide questions under Communities: Supporting Infrastructure: Will it result in loss or disruption to basic services and infrastructure ***(e.g. electricity, gas)?*** ***Will it place significant pressure on local/regional waste management facilities (non-nuclear waste)?***

Overarching/Other Energy NPS AoS Themes and Objectives	Nuclear NPS AoS Themes and Objectives (Amendments in bold red italics made as a result of public consultation; Numbers refer to those used in SEA Scoping Report March 2008)
SD Theme: Economy and Skills **AoS Objective:** 4. To promote a strong and stable economy with opportunities for all.	**SD Theme: Communities: Population, Employment & Viability** **AoS Objective:** 4. to create employment opportunities 5. to encourage the development of sustainable communities 10. to avoid adverse impacts on property and land values and avoid planning blight Will the NPS promote sustainable growth in the national economy?
Will the NPS improve the reliability of the national energy supply? Will the NPS have wider socio-economic effects such as impact fuel poverty or have effects on specific groups? Will the NPS promote investment for the long term? Will the NPS promote diversification of the economy? Will the NPS increase the national skills base? Will the NPS avoid adverse effects on the national economy?	Will it create both temporary and permanent jobs in areas of need? Will it result in in-migration of population? Will it result in out-migration of population? Will it affect the population dynamics of nearby communities (age-structure)? Will it result in a decrease in property and land values as a result of a change in perceptions or blight?

Overarching/Other Energy NPS AoS Themes and Objectives	Nuclear NPS AoS Themes and Objectives (Amendments in bold red italics made as a result of public consultation; Numbers refer to those used in SEA Scoping Report March 2008)
SD Theme: Flood Risk **AoS Objective:** 5. To avoid, reduce and manage flood risk (including coastal flood risk) from all sources and coastal erosion risks by locating infrastructure in lower risk areas and ensuring it is resilient over its lifetime without increasing risks elsewhere.	**SD Theme: Flood Risk** **AoS Objective:** 14. to avoid increased flood risk (including coastal flood risk) and seek to reduce risks where possible
Will the NPS help to minimise the risk of flooding to existing properties and new energy infrastructure? Will the NPS help to discourage inappropriate development in areas at risk from flooding and costal erosion? Will the NPS help to manage the risks associated with costal erosion?	Will it result in demand for higher defence standards that will impact on coastal processes?

Overarching/Other Energy NPS AoS Themes and Objectives	Nuclear NPS AoS Themes and Objectives (Amendments in bold red italics made as a result of public consultation; Numbers refer to those used in SEA Scoping Report March 2008)
SD Theme: Water Quality **AoS Objective:** 6. To protect and enhance surface (including costal) and groundwater quality (including distribution and flow).	**SD Theme: Water Quality & Resources** **AoS Objective:** 15. to avoid adverse impacts on surface water hydrology and channel geomorphology (including coastal geomorphology) 16. to avoid adverse impacts on surface water quality (including coastal and marine water quality) and assist achievement of Water Framework Directive objectives 17. to avoid adverse impacts on the supply of water resources 18. to avoid adverse impacts on groundwater quality, distribution and flow and assist achievement of Water Framework Directive objectives
Will the NPS protect and improve ground and surface water quality in line with Water Framework Directive requirements? Will the NPS avoid adverse effects on costal water and fisheries? Will the NPS safeguard and enhance the UK's water resources and maintain water abstraction within carry capacity? Will the NPS help to implement the Water Framework Directive?	Will it result in the increased sedimentation of watercourses? Will it adversely affect channel geomorphology? Will hydrology and flow regimes be adversely affected by water abstraction? Will it result in demand for higher defence standards that will impact on coastal processes? Can the higher defence standards be achieved without compromising habitat quality and sediment transport? Will it cause deterioration in surface water quality as a result of accidental pollution, for example spillages, leaks? Will it cause deterioration in coastal and/or marine water quality as a result of accidental pollution, for example spillages, leaks? Will it cause deterioration in surface water quality as a result of the disturbance of contaminated soil? Will it cause deterioration in coastal and/or marine water as a result of the disturbance of contaminated soil? Will it affect designated Shellfish Waters? Will it affect Freshwater Fish Directive sites? Will it increase turbidity in water bodies? Will it increase the temperature of the water in water bodies?

Overarching/Other Energy NPS AoS Themes and Objectives	Nuclear NPS AoS Themes and Objectives (Amendments in bold red italics made as a result of public consultation; Numbers refer to those used in SEA Scoping Report March 2008)
	Will it adversely affect water supply as a result of abstraction? ***Will it increase demand for water?*** Will it cause deterioration in groundwater quality as a result of accidental pollution, for example spillages, leaks? Will it cause deterioration in groundwater quality as a result of the disturbance of contaminated soil?
SD Theme: Traffic and Transport **AoS Objective:** To minimise the detrimental impacts of travel and transport on communities and the environment, whilst maximising positive effects	**SD Theme: Communities: Supporting Infrastructure** **AoS Objective:** 8. to avoid adverse impacts on the function and efficiency of the strategic transport infrastructure 9. to avoid disruption to basic services and infrastructure
7. Will the NPS significantly change national transport networks (e.g. a modal shift from road to rail)? Other localised issued have been scoped out of the appraisal. However, this will be reviewed as further information emerges.	Will it result in changes to services and service capacity in population centres? Will it result in the direct loss of strategic road/rail/air/port infrastructure? Will it result in increased congestion/pressure on key transport infrastructure? Will it result in loss or disruption to basic services and infrastructure ***(e.g. electricity, gas)?*** ***Will it place significant pressure on local/regional waste management facilities (non-nuclear waste)?***
SD Theme: Noise **AoS Objective:** To protect both human and ecological receptors from disturbing levels of noise.	**SD Theme:** **AoS Objective:**
8. Will the NPS seek to minimise any adverse effects of noise?	Guide question under Health & Well-being: *Will exposure to noise and vibration as a result of plant activities lead to physical and mental health impacts on nearby communities?*

Overarching/Other Energy NPS AoS Themes and Objectives	Nuclear NPS AoS Themes and Objectives (Amendments in bold red italics made as a result of public consultation; Numbers refer to those used in SEA Scoping Report March 2008)
SD Theme: Landscape, Townscape and Visual **AoS Objective:** 9. To protect and enhance landscape quality, townscape quality and to enhance visual amenity.	**SD Theme: Landscape** **AoS Objective:** 24. to avoid adverse impacts on nationally important landscapes 25. to avoid adverse impacts on landscape character, quality and tranquillity, diversity and distinctiveness
Will the NPS seek to protect and enhance the character of landscapes and townscapes (e.g. by promoting good design)? Will the NPS seek to protect wilderness and areas of high landscape value? Will the NPS give consideration to strategic views designated in LDFs and views from designated areas (e.g. AONBs)?	Will it adversely affect landscapes within or immediately adjacent to a National Park? Will it adversely affect landscapes in or immediately adjacent to an AONB or NSA? Will it adversely affect Heritage Coast or Preferred Conservation Zones? Will it adversely affect local landscapes/townscapes of value? Will it affect the levels of tranquillity in an area? Will it adversely affect the landscape character or distinctiveness? Will it result in increased levels of light pollution?

Overarching/Other Energy NPS AoS Themes and Objectives	Nuclear NPS AoS Themes and Objectives (Amendments in bold red italics made as a result of public consultation; Numbers refer to those used in SEA Scoping Report March 2008)
SD Theme: Archaeology and Cultural Heritage **AoS Objective:** 10. Protect and where appropriate enhance the historic environment including heritage resources, historic buildings and archaeological features.	**SD Theme: Cultural Heritage** **AoS Objective:** 22. to avoid adverse impacts on the internationally and nationally important features of the historic environment. 23. to avoid adverse impacts on the setting and quality of built heritage, archaeology and historic landscapes
Will the NPS have any direct, indirect or cumulative effects on sites of universal cultural heritage importance (e.g. World Heritage Sites)? Will the NPS have any direct, indirect or cumulative effects on other national or local designated sites (e.g. Scheduled Ancient Monuments (SAMs), listed buildings, registered battlefield sites etc)? Will the NPS protect and enhance the historic environment? Will the NPS have any potential impact on historic landscape character with landscapes designated as nationally important such as National Parks and AONBs as well as conservation areas? The potential direct and indirect effects on sites at a local and regional level have been scoped out of the appraisal. This decision will be reviewed as further information emerges.	Will it adversely affect historic sites of international/ national importance and their setting? Will it adversely affect other historic sites of known value? Will it adversely affect landscapes of historic importance?

Overarching/Other Energy NPS AoS Themes and Objectives	Nuclear NPS AoS Themes and Objectives (Amendments in bold red italics made as a result of public consultation; Numbers refer to those used in SEA Scoping Report March 2008)
SD Theme: Air Quality **AoS Objective:** 11. To protect and enhance air quality on local, regional, national and international scale.	**SD Theme: Air Quality** **AoS Objective:** 12. to avoid adverse impacts on air quality.
Will the NPS maintain and enhance air quality? Will existing areas of poor air quality be made worse?	Will it result in the release of low level radionuclides that may adversely affect human health or biodiversity? Will it contribute to an increase in the number or expansion of AQMAs?
SD Theme: Soil and Geology **AoS Objective:** 12. To promote the use of brownfield land and where this is not possible to prioritise the protection of geologically important sites and agriculturally important land.	**SD Theme: Soils, Geology & Land Use** **AoS Objective:** 19. to avoid damage to geological resources 20. to avoid the use of greenfield land and encourage the re-use of brownfield sites 21. to avoid the contamination of soils and adverse impacts on soil functions
Will the NPS promote the wise use of land? Will the NPS safeguard soils and geology from potential contamination?	Will it result in the compaction and erosion of soils? Will it lead to the removal or alteration of soil structure and function? Will it lead to the contamination of soils which would affect biodiversity and human health? Will it compromise the future extraction/use of geological/ mineral reserves? Will it result in the loss of agricultural land? Will it lead to damage to geological SSSIs and other geological sites? Will it result in the loss of Greenfield land? Will it adversely affect land under land management agreements?

Overarching/Other Energy NPS AoS Themes and Objectives	Nuclear NPS AoS Themes and Objectives (Amendments in bold red italics made as a result of public consultation; Numbers refer to those used in SEA Scoping Report March 2008)
SD Theme: Health and Well-Being **AoS Objective:** 13. To protect and enhance the physical and mental health of the population	**SD Theme: Human Health & Well-Being** **AoS Objective:** 6. to avoid adverse impacts on physical health 7. to avoid adverse impacts on mental health 11. to avoid the loss of access and recreational opportunities, their quality and user convenience
Will the NPS affect the physical health or well-being of the population? Will the NPS affect perceptions of risk? Will the NPS help to reduce health inequalities? Will the NPS affect recreational enjoyment of the countryside and coasts? There are a number of elements scoped out as they are location specific, e.g. will it encourage walking or cycling, will it affect an individual's access to health facilities and green spaces?	Will it adversely affect the health of local communities through accidental radioactive discharges or exposure to radiation. Will the storage of radioactive waste result in adverse physical and mental health effects for local communities? Will exposure to noise and vibration as a result of plant activities lead to physical and mental health impacts on nearby communities? Will it adversely affect the health of the workforce? Will the perceptions of adverse risk as a result of activities lead to adverse impacts on mental health for nearby communities? Will it result in the loss of recreational and amenity land or loss of access? Will it adversely affect the ability of an individual to enjoy and pursue a healthy lifestyle?
SD Theme: Equality **AoS Objective:** 14. To encourage equality and sustainable communities.	**SD Theme:** **AoS Objective:**
Will the NPS result in changes to community services or facilities? Will the NPS affect the level of people in fuel poverty? Will the NPS reduce inequalities?	Implicit within AoS Objective 5 – to encourage the development of sustainable communities (under SD Theme Communities: Population, Employment & Viability)
	SD Theme: Radioactive and Hazardous Waste This has a separate section in Nuclear AoS; cross-cutting effects are addressed in each topic that they are relevant to.

Findings of the AoS

3. Alternatives Assessment for the Nuclear NPS: Needs Alternatives

3.1 Introduction

3.1.1 Nuclear power stations have the potential to affect sustainable development. The nature and significance of these effects essentially depend upon if nuclear power stations are built, how many are built, where they are built and when they are built. The decision to prepare a draft Nuclear NPS, the way in which the draft Nuclear NPS is developed and its contents will have an impact upon the number, location and timing of any new nuclear power stations which might eventually be built by energy companies.

3.1.2 With regard to good policy and plan making, and in accordance with the requirements of the SEA Directive[35], a phased approach to assessing realistic options was taken for preparing the draft Nuclear NPS. It is not the purpose of the SEA or AoS to decide the alternatives to be chosen for plan; this is the role of the decision-makers preparing the plan. The AoS provides information on the relative performance of the reasonable alternatives for the plan and helps make the decision-making more transparent. The phased approach to options assessment was set out in the Update Report[36] and is summarised as follows:

- Need – do we need the Nuclear NPS?
- Process – how should the Nuclear NPS be developed?
- Location – where should the new nuclear power stations be built?

3.1.3 This chapter describes the AoS of the high level options for assessing whether we need the Nuclear NPS. The Government considered that there were three possible high level and realistic options for whether we need a Nuclear NPS:

- "**Nuclear NPS**" option: an NPS in line with Government policy;
- "**NPS that prohibits Nuclear**" option: an NPS that prohibits the construction of any new nuclear power stations and considers the alternative infrastructure that would take place if nuclear was not in the energy mix;
- "**No NPS**" option: construction of new nuclear power stations under a business as usual scenario where there is no Nuclear NPS to set the framework for development consents.

35 The SEA Directive requires that "…the likely significant effects on the environment of implementing the plan or programme, and reasonable alternatives taking into account the objectives and the geographical scope of the plan or programme are identified, described and evaluated." (Article 5.1) The Practical Guide to SEA advises that "only reasonable, realistic and relevant alternatives need be put forward" and that they should be "sufficiently distinct to enable meaningful comparisons" of their different effects on the environment.

36 DECC January 2009 Applying the Strategic Siting Assessment Criteria; an update to the study of the potential environmental and sustainability effects.

3.1.4 The Government examined these three high level options against the broader context of current UK energy policy. This assessment did not predict what might happen if the energy policy was redrawn or if a particular energy mix was prescribed other than to the extent set out in the three options defined earlier. The NPS options assessment drew upon various information including earlier consultations and was informed by findings of the AoS.

3.1.5 The AoS appraised these three options for the NPS using headline sustainable development (SD) topics appropriate for this high level strategic assessment. These broad sustainable development topics were collated from the AoS objectives for sustainability and the approach is described in more detail previously in Chapter 2 including Tables 2.2 to 2.6.

3.1.6 This chapter sets out the findings of the AoS in accordance with these broad SD topics for the three high level options and reports how these findings informed the options assessment carried out by Government. The following Chapter 4 describes the AoS of the options for how the draft Nuclear NPS should be developed (the process alternatives), and Chapter 5 describes the AoS of the locational options for the draft Nuclear NPS.

3.2 The Wider Context of UK Energy Policy

3.2.1 The objectives of the UK's energy policy are to tackle climate change by moving to a low carbon economy, ensure security of supply and address fuel poverty. In line with the Low Carbon Transition Plan (LCTP)[37], there is a need for the supply of electricity to be almost totally decarbonised by 2050[38]. Electricity generation currently accounts for around 37% of the UK's total CO_2 emissions and three quarters of the UK's electricity is currently generated using coal and gas[39], which produces CO_2 emissions and contribute to global warming.

3.2.2 Several factors make clear there will be a need for a significant amount of new electricity generation infrastructure for both renewable and conventional generation[40] in the energy supply mix by 2025.

3.2.3 A significant amount of existing generating capacity (around 22GW) is due to close by around 2025 either because it does not meet European emissions standards or because power stations are coming to the end of their natural operating lives. To meet the Government's objective to maintain energy security, and because electricity is an essential component of any modern society, there is a need to replace capacity as well

37 The UK Low Carbon Transition Plan, National Strategy for climate and energy, DECC, July 2009, http://www.decc.gov.uk/en/content/cms/publications/lc_trans_plan/lc_trans_plan.aspx

38 The UK has a legally binding target to cut emissions by 80% relative to 1990 levels by 2050. The Committee on Climate Change has stated that this reduction can only be achieved if the electricity generation is almost completely decarbonised by 2030.

39 Building a low carbon economy – the UK's contribution to tackling climate change, Committee on Climate Change, Dec 2008, p173 & p175 http://www.theccc.org.uk/pdf/TSO-ClimateChange.pdf

40 Fossil fuel carbon capture and nuclear generation.

as to meet expected increases in demand for electricity generation. The option of not doing so is not tenable because of the harmful impacts on human health as a result of interruptions to electricity supply[41]. Even with effective demand management[42], electricity is likely to be used more extensively for heat and transport, so more will probably be needed than today[43]. As a result, modelling for the Renewable Energy Strategy 2009[44] suggests that about 60GW of new capacity will be built by 2025. This figure for new capacity is greater than the 22GW of capacity due to be closed because some sources of renewable energy (for example wind turbines) are not available all the time.

3.2.4 The modelling suggests that of the 60GW that will come on to the system by 2025, there would be a split of around 35GW provided by renewables and 25GW of thermal generation capacity. This represents a very great increase on current levels of renewable capacity but renewable are not capable on their own of meeting our future needs for electricity generation and are therefore not a realistic alternative.

3.2.5 The Government has previously consulted upon whether energy companies should have the option of investing in new nuclear power stations and set out its policy in the Nuclear White Paper. Whether or not to build new nuclear power stations is a commercial decision that will be taken by energy companies. A number of factors influence the economic viability of nuclear power stations; these include the relative capital costs of new nuclear power stations compared to other generation technologies, fossil fuel prices and carbon prices. The analysis by Redpoint, as part of the Renewable Energy Strategy modelled the likely electricity mix up to 2030[45] under a number of scenarios including varying amounts of electricity generation coming from renewable sources and different fossil fuel and carbon prices. In all scenarios, excluding one of prolonged low fossil fuel and carbon prices, new nuclear power is economically viable.

3.2.6 The UK has a dynamic energy market influenced by Government policy measures and strategic interventions. The Government does not procure, build or run electricity generating stations. If nuclear power stations were not part of the energy mix it would be for private companies to bring forward proposals to build electricity generating infrastructure to fill any need for capacity. Private companies would choose to invest in the types of electricity generating infrastructure which offers the most attractive returns to them.

41 See part 3 of the Overarching NPS for Energy.

42 Measures such as channelling £3.2 billion to help households become more efficient, and rolling out smart meters in every home by 2020.

43 The UK Low Carbon Transition Plan, 2008.

44 The UK Renewable Energy Strategy, DECC, 2009, http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/res/res.aspx

45 Implementation of the EU2020 Renewable Target in the UK Electricity Sector: Renewable Support Schemes, Redpoint et al, 2008, www.decc.gov.uk/en/content/cms/consultations/cons_res/rescon_support.aspx

3.2.7 The Redpoint analysis[46] suggested that 9.6GW of new nuclear power capacity could be built between 2020 and 2030 at a rate of 1.6GW every two years and that the maximum likely contribution of nuclear to the energy mix in 2030 is likely to be similar to 2005. Given that modelling results are highly sensitive to the underlying assumptions used, it does not mean that only this amount of new nuclear power capacity will be built. Higher build rates have been achieved in France where 54 units came into operation between 1977 and 1993, an average of 3.2 units per year[47]. Energy companies have already announced their intentions to potentially develop up to 12.4GW of new nuclear power generation[48, 49, 50].

3.3 Assessment Approach

How we reach assumptions about the energy mix in the options

3.3.1 It is not possible to predict with 100% certainty what the energy mix would look like if nuclear were not part of the energy mix. To reach reasonable assumptions, modelling is used. This assessment refers to:

- modelling which was carried out by Redpoint to inform the Renewable Energy Strategy consultation in 2008[51];
- modelling which was carried out by Redpoint to see what might happen if nuclear were excluded from the energy mix[52]; and
- MARKAL modelling which was carried out to inform the Committee on Climate Change report "Building a low carbon economy – the UK's contribution to tackling climate change"[53].

3.3.2 In conducting the assessment, we have also drawn on the evidence and analysis set out in the Nuclear White Paper[54] where appropriate. We have also relied on more recent evidence and analysis to ensure our assessment is up-to-date.

46 Implementation of the EU2020 Renewable Target in the UK Electricity Sector: Renewable Support Schemes, Redpoint et al, 2008, www.decc.gov.uk/en/content/cms/consultations/cons_res/rescon_support.aspx

47 Nuclear Energy Association, Nuclear Energy Outlook 2008, NEA No. 6348, p318

48 http://www.rwe.com/web/cms/en/216362/rwe-npower/more-/our-business/nuclear-power/, http://pressreleases.eon-uk.com/blogs/eonukpressreleases/archive/2009/04/29/1382.aspx

49 http://www.centrica.co.uk/index.asp?pageid=217&newsid=1783

50 http://www.edfenergy.com/media-centre/press-news/EDF_Energy_welcomes_Government_announcement_on_nuclear_sites.shtml

51 Implementation of the EU2020 Renewable Target in the UK Electricity Sector: Renewable Support Schemes, Redpoint et al, 2008, www.decc.gov.uk/en/content/cms/consultations/cons_res/rescon_support.aspx

52 Implementation of the EU 2020 Renewable Target in the UK Electricity Sector: RO Reform, no new nuclear build sensitivities, Redpoint et al, 2008, www.energynpsconsultation.decc.gov.uk

53 Building a low-carbon economy – the UK's contribution to tackling climate change, The Committee on Climate Change, Dec 2008 – for a detailed explanation of MARKAL modelling see page 77, http://www.theccc.org.uk/pdf/TSO-ClimateChange.pdf

54 Meeting the Energy Challenge: A White Paper on Nuclear Power, BERR, January 2008, http://www.berr.gov.uk/files/file43006.pdf

3.4 Need Alternatives Considered

What are the need alternatives likely to mean in practice?

3.4.1 **A Nuclear NPS in line with Government policy** – will set a framework for the Infrastructure Planning Commission (IPC) to consider consenting of new nuclear power stations. Nuclear power stations will be built by energy companies. Assuming that private investment is forthcoming, the IPC would consider applications for new nuclear power stations using the NPS which sets out the national need and a list of potentially suitable sites which have been assessed against Strategic Siting Assessment criteria, Appraisals of Sustainability and Habitats Regulations Assessments. This will result in development consents being considered more quickly than if there were no NPS for the reasons given below. It should be noted that in the event that a development consent application for a new nuclear power station is submitted to the IPC for a site not listed in the Nuclear NPS, that application would need to be decided by the Secretary of State.

3.4.2 Applications in relation to sites listed in the NPS are likely to be decided more quickly than applications for other sites, since the former will already have been assessed at strategic level. The potentially shorter time to grant development consent and the more certain outcome that developers may expect for sites that are included on the Nuclear NPS may encourage applications for these sites in preference to sites not included on the NPS. The potentially shorter time to grant development consent and the more certain outcome that developers may expect for sites that are included in the Nuclear NPS may encourage applications for these sites in preference to sites not included in the NPS.

3.4.3 **A Nuclear NPS which prohibits the construction of any nuclear power stations** – this would mean that development consent would not be granted for any new nuclear power stations. The existing nuclear power stations would not be replaced when they come to the end of their operating lifetime. This would mean that any demand for electricity would have to be met by another type or types of generating infrastructure where new nuclear power stations are prohibited.

3.4.4 Redpoint's latest analysis[55] suggests that in a scenario of central fossil fuel and high fossil fuel prices, if nuclear power was excluded from the energy mix it would be replaced with new gas fired generation. This is supported by MARKAL modelling for the Committee on Climate Change (CCC) looking at the generation mix in 2030. The MARKAL modelling suggested that in the absence of new nuclear power, and where Carbon Capture and Storage (CCS) is not available at reasonable cost[56], then new generation capacity is likely to be predominantly gas fired power station with some renewables. In the assessment gas fired generation is referred to as CCGT (combined cycle gas turbine).

55 Implementation of the EU 2020 Renewable Target in the UK Electricity Sector: RO Reform, no new nuclear build sensitivities, Redpoint et al, 2008, www.energynpsconsultation.decc.gov.uk

56 The Government is consulting upon a framework for clean coal and proposals include a) providing financial support for up to four commercial-scale CCS demonstrations in Britain, including the CCS demonstration competition launched in 2007, covering a range of CCS technologies; b) requiring any new coal power station in England and Wales to demonstrate CCS on a defined part of its capacity; c) Requiring new coal power stations to retrofit CCS to their full capacity within five years of CCS being independently judged technically and economically proven and planning on the basis that CCS will be proven by 2020; d) Preparing for the possibility that CCS will not become proven as early as expected. http://decc.gov.uk/en/content/cms/consultations/clean_coal/clean_coal.aspx

3.4.5 **No Nuclear NPS** – this is the "business as usual" scenario which would mean that energy companies could still apply for development consent for new nuclear power stations. However, the Government would not produce an NPS. The IPC would consider an application for development consent and make a recommendation to the Secretary of State instead of making the decision themselves. The IPC would need to consider the application in the absence of a statement of national need for nuclear power, a list of potentially suitable sites and in the absence of specific planning guidance provided by the NPS. This would mean that nuclear power stations could still be built but it is doubtful that some of the benefits of the new planning regime would be realised. It is more difficult to assess what the likely number, timing and location of nuclear power stations in such a scenario might be although it is highly likely that development consent would take longer.

3.4.6 Under the Planning Act 2008, where there is no NPS in place and the IPC is acting as a recommending body with the Secretary of State taking decisions, the IPC is supposed to complete its report to the Secretary of State within nine months of starting its examination of the application. The Secretary of State has a further three months to make a decision to grant consent. This means that development consent could be granted in 12 months. However, the IPC has the power to extend the time it is given to examine the application. The Secretary of State also has the power to extend the three month period he is given to decide an application. This could result in delays in the planning process which would increase uncertainty for energy companies and make nuclear power a less attractive option. There would be a fossil fuel NPS and renewables NPS which would mean that CCGT power stations and renewables could be given development consent faster than nuclear power stations.

3.4.7 As highlighted above, it is unclear what the impact of no nuclear NPS would be on the exact number and timings of new nuclear capacity. In the absence of an NPS it could be likely that fewer new nuclear power stations would be built in the period 2020 to 2030 than with a Nuclear NPS because development consents would take longer and developers would have less certainty about how particular issues would be dealt with by the IPC. It may also lead to firms choosing to invest in other generation technologies than nuclear power.

3.5 Structure of the AoS

3.5.1 The sections below set out the findings of the AoS including the likely significant effects of the three options of **Nuclear NPS**, **NPS that prohibits Nuclear** and **No NPS** that are defined above. For each Sustainable Development (SD) topic, a comparison is made between the three high level options for the draft NPS as follows:

- any generic impacts of energy infrastructure under the relevant topic which would arise under all three options (such as generic impacts of nuclear power stations, CCGT power stations and renewable generating infrastructure);
- any different impacts of building new nuclear power stations under the relevant topic if there is a Nuclear NPS;

- any different impacts of building CCGT power stations and renewables under the relevant topic if there is NPS that prohibits Nuclear; and
- any different impacts of building new nuclear power stations, CCGT power stations and renewables under the relevant topic if there is No NPS.

3.6 Climate Change

Generic impacts

3.6.1 Electricity generating infrastructure can have both positive and negative effects on climate change.

3.6.2 During the construction of any type of energy infrastructure, carbon emissions will be produced through the manufacture of steel, concrete and other materials, and the transportation of these materials.

3.6.3 During operation, fossil fuel stations such as oil, gas and coal emit CO_2 into the atmosphere. By contrast, at the point of generating electricity, nuclear power stations and renewable technologies do not emit CO_2[57].

3.6.4 The UK has a legally binding target to cut emissions by 80% relative to 1990 levels by 2050. This is enshrined in the Climate Change Act 2008. The Committee on Climate Change has stated that this reduction can only be achieved if the electricity generation is almost completely decarbonised by 2030[58]. If the targets to cut emissions were to become even stricter, for example, as part of new international agreements, the decarbonisation of the electricity sector and the pace of change would become even more pressing.

3.6.5 Global and UK impacts of climate change are well documented[59]. The UK Climate Change predictions show that, for the UK, if emissions are not reduced it could mean increased risk of droughts, flooding, heat waves and species struggling to adapt[60].

57 Meeting the Energy Challenge: A White Paper on Nuclear Power, BERR, 2008.

58 Building a low-carbon economy – the UK's contribution to tackling climate change, The Committee on Climate Change, Dec 2008, p197, http://www.theccc.org.uk/pdf/TSO-ClimateChange.pdf

59 For more information about the global and UK impacts of climate change, see Fourth Assessment Report, Intergovernmental Panel on Climate Change 2007 http://www.ipcc.ch/publications_and_data/publications_and_data_reports.htm#1 and The Natural Environment: Adapting to Climate Change, Natural England 2008 http://www.naturalengland.org.uk/Images/NE118-MainSummary_tcm6-10445.pdf and Stern Review: The Economics of Climate Change, 2006, http://www.hm-treasury.gov.uk/stern_review_report.htm

60 The UK Low Carbon Transition Plan, National Strategy for climate and energy, DECC, July 2009, http://www.decc.gov.uk/en/content/cms/publications/lc_trans_plan/lc_trans_plan.aspx

The Nuclear NPS

3.6.6 Nuclear power is a low-carbon energy source[61]. During construction of new nuclear power stations there would be short term carbon emissions. The 2008 White Paper on Nuclear Power[62] reviewed the evidence on the lifecycle CO_2 emissions from nuclear power stations, (including the construction of power station and the mining and transportation of uranium) concluding that a range of 7-22g/kWh represented a prudent range. This estimate is in line with research published by the OECD and IAEA. Using this range, the annual reduction in CO_2 of displacing 1GW of gas fired plant with 1GW of nuclear power is between 2.41 and 2.54 million tonnes.

3.6.7 There is a risk that if investment in line with the Renewable Energy Strategy is not forthcoming, it will not be possible to substitute nuclear power (low-carbon generation) for renewables at short notice, given the long project lead times. The solution would be further investment in gas-fired power station, with concomitant increases in emissions. The generation mix is therefore a crucial driver of year by year emissions.

NPS that prohibits Nuclear

3.6.8 Based on the Redpoint analysis[63], the NPS that prohibits Nuclear option (nuclear power being replaced by gas) between 2020 and 2030 would lead to an additional 139 – 149 million tonnes of CO_2 being emitted[64].

3.6.9 To meet the UK's 2050 emissions reduction targets without nuclear power would require a large increase in other forms of electricity generation including wind power and coal with Carbon Capture and Storage (CCS). However, the alternative of CCS for power generation is not yet proven and it may not be deployed on a sufficient scale before 2025. The Overarching NPS for energy explains that CCS is needed to complement other forms of generation rather than being an alternative to them.

No NPS

3.6.10 The No NPS option would mean that there could be greater uncertainty in planning. This could result in delays in nuclear power stations being consented and make nuclear power a less attractive option for energy companies. Any CCGT power stations which are built instead of nuclear power stations would emit CO_2 during operation which would have a negative effect on climate change, although any renewables which came forward under this option would not. It is not possible to predict exactly what might happen under this scenario.

61 Sustainable Development Commission, The Role of Nuclear Power in a Low Carbon Economy, Paper 2: Reducing CO2 emissions – Nuclear and the Alternatives, March 2006, http://www.sd-commission.org.uk/publications/downloads/SDC-NuclearPosition-2006.pdf

62 Meeting the Energy Challenge: A White Paper on Nuclear Power, BERR, Jan 2008, http://www.berr.gov.uk/files/file43006.pdf

63 Implementation of the EU 2020 Renewable Target in the UK Electricity Sector: RO Reform, no new nuclear build sensitivities, Redpoint et al, 2008, www.energynpsconsultation.decc.gov.uk

64 This figure is reached by multiplying the annual carbon saving of 1GW nuclear by the estimated new build rate from Redpoint.

Summary Findings of the AoS

3.6.11 Of the three options, the Nuclear NPS option appears best able to contribute to the UK's goal of increasing the amount of electricity from low carbon sources. The No NPS option would create uncertainty and could delay deployment of new nuclear capacity. The indications from the Redpoint modelling are that if new nuclear is not deployed, additional CCGT power stations will be built instead. The economic modelling also suggests that with the NPS that prohibits Nuclear option, new CCGT power stations would be built leading to increased CO_2 emissions compared to the Nuclear NPS option. The CO_2 emissions from nuclear power are about the same as wind based generation technology, on reasonable assumptions, and are significantly lower than gas powered generation[65].

Government's preferred alternative

3.6.12 Having considered the findings of the AoS and other information, the Government's preferred alternative is to take forward the draft Nuclear NPS because new nuclear power stations can make a contribution to cutting CO_2 emissions alongside renewable and carbon capture and storage. It is imperative that action is taken now to tackle climate change otherwise the most dangerous impacts will not be avoided and there will be adverse environmental, economic and social consequences globally and for the UK.

3.7 Security of Energy Supply

3.7.1 Security of Energy Supply (also known as Energy Security or Security of Supply) is about making sure the UK has reliable, affordable, secure supplies of energy. In recognising that secure supplies can never be guaranteed, the approach is to identify and manage the risks to security of supply. Several factors influence security of energy supply:

- Firstly, there must be sufficient capacity in the energy system, so that there is a safety margin between likely demand and the physical ability to meet that demand. This ensures that supply is protected against unexpected events such as extreme weather and power station outages.
- Secondly, the capacity on the system, and the accompanying infrastructure, must be reliable enough to deliver energy when required.
- Thirdly, the range of energy sources should be diverse. Diversity can be technological (a wide range of generating technologies and fuels) and geographic (fuels imported from a wide range of countries, avoiding undue reliance on specific nations). A range of technologies and fuels reduces the impact that problems with one technology/ fuel can have on supply in general, thereby reducing the risk of costly interruptions. A diverse source of fuels also ensures that the UK is not dependent on particular countries for its fuel imports.

65 Meeting the Energy Challenge: A White Paper on Nuclear Power, BERR, January 2008, p48-53, http://www.berr.gov.uk/files/file43006.pdf

- Finally, there should be effective price signals that reflect the true costs to companies of generating energy and the value consumers attach to buying it. This enables the market to balance electricity supply and demand in the short term, and ensure timely investment in new capacity over the longer term.

3.7.2 While each of these factors is necessary to manage the risks of supply interruptions, they are not on their own sufficient to ensure secure supplies of electricity are available. For example, the intermittent nature of wind generation means sufficient supplies of electricity cannot be guaranteed at any point in time, regardless of the installed amount of installed wind generation capacity.

3.7.3 The security of the electricity system as a whole needs to be consistently maintained over time in order to accommodate fluctuations in the conditions that affect supply and demand of electricity throughout the electricity supply chain. This means that sufficient timely investment is required to accommodate growth in demand, replace retiring power stations and to maintain the reliability of infrastructure throughout the supply chain.

The Nuclear NPS

3.7.4 Having a Nuclear NPS will facilitate the construction and subsequent deployment of nuclear power stations in the energy mix. Having nuclear power in the UK electricity mix will help to ensure that it remains diverse, both in terms of technology and fuel source. Having a diverse mix of fuels and technologies to generate electricity increases the resilience of the system as it reduces exposure to the risks of supply interruptions and of sudden and large spikes in the electricity price, which can arise when the system is particularly dependent on a single technology or fuel.

3.7.5 Diversity of supply in electricity is maximized where the mix of technologies that energy companies can invest in have different characteristics. The characteristics of nuclear power are very different from those of conventional fossil fuel or renewables generation[66]. The presence of nuclear power in the mix therefore allows extra scope in managing risks to energy security. The characteristics of nuclear power that can affect energy security are set out below.

3.7.6 The UK is increasingly reliant on imports for electricity generation fuels. Long-term global fossil fuel reserves are declining, and there are concerns as to whether producer countries will make sufficient investments to exploit remaining reserves fully.

66 The Future of Nuclear Power – The Role of Nuclear Power in a Low Carbon UK Economy: Consultation Document, DTI, May 2007, p55, http://www.berr.gov.uk/files/file39197.pdf

3.7.7 Nuclear fuel supply is a stable and mature industry. The International Atomic Energy Agency (IAEA) have concluded that there are more than adequate uranium resources to supply the expected global expansion of nuclear power. Furthermore, uranium is currently mined in 19 different countries, and resources of economic interest have been identified in 25 more[67]. Nuclear power can therefore help spread the supply risks that could be associated with a particular fuel or region of the world, thus making the electricity system less vulnerable to supply interruptions.

3.7.8 The presence of nuclear power in the electricity mix could result in a reduced need for gas-fired power stations, and thereby reduce gas import requirements, which could be beneficial given that some gas supplies are concentrated in countries at greater risk of political instability. Moreover, the supply chains of nuclear fuel, gas and coal are not interdependent and an interruption in the supply of gas or coal is unlikely to affect the supply of uranium. Consequently, the option of including new nuclear power in a diverse mix increases the diversity of input fuels that we are reliant on and spreads the risks of fuel supply interruptions[68].

3.7.9 The input fuel costs of nuclear power are lower as a proportion of total cost than coal and gas-fired generation[69], and are also more stable[70]. Fuel costs make up 11% of total costs for nuclear power while fuel costs are the largest component of total costs for gas fired generation, estimated to be 71%[71]. Historically, gas-fired power stations have been seen as the marginal generation plant which sets the wholesale price of electricity. However, the cost profile of nuclear power with low operating costs and low long-run marginal costs means that nuclear power can effectively place downward pressure on long-run wholesale prices[72].

3.7.10 If future gas prices continue to be high and available fossil fuel resources become increasingly constrained, the costs of conventional fossil fuel based generation could increase, putting upward pressure on electricity prices. Similarly, higher carbon prices would undermine the economics of fossil fuel fired power stations, raising their generating costs. Nuclear power can therefore be beneficial in reducing our exposure to these risks of higher generation costs.

3.7.11 It is important to also recognise the limitations of nuclear power in ensuring security of supply. As a large amount of intermittent wind power comes on to the system over the coming years, it will therefore still be important to maintain fossil fuel power stations in the electricity mix in order to provide back-up generation.

67 NEA and IAEA, Uranium 2005: Resources, Production and Demand, 2006 (The 'Red Book').
68 The Future of Nuclear Power – The Role of Nuclear Power in a Low Carbon UK Economy: Consultation Document, DTI, May 2007, p56, http://www.berr.gov.uk/files/file39197.pdf
69 DTI Analysis, 2006.
70 IMF, Summary Volatility Statistics, March 2007.
71 The Future of Nuclear Power – The Role of Nuclear Power in a Low Carbon UK Economy: Consultation Document, DTI, May 2007, p57, http://www.berr.gov.uk/files/file39197.pdf
72 The Future of Nuclear Power – The Role of Nuclear Power in a Low Carbon UK Economy: Consultation Document, DTI, May 2007, p57, http://www.berr.gov.uk/files/file39197.pdf

3.7.12 Technical faults in a nuclear power station could result in a station being offline (as has occurred with some of the existing UK fleet). However, any new nuclear power stations that are built in the UK are likely to be evolutions of significantly more reliable designs.

NPS that prohibits Nuclear

3.7.13 The option of NPS that prohibits Nuclear would mean that nuclear power stations are not part of the UK's future energy mix, leaving the UK with a less diverse range of technologies and fuels to generate electricity. This lack of diversity would leave the UK more exposed to the risks of supply interruptions and of sudden and large spikes in the electricity price, which can arise when the system is particularly dependent on a single technology or fuel.

No NPS

3.7.14 If there is No NPS, some nuclear power stations might still come forward and make a contribution to the energy mix, but there would be greater uncertainty and it could make nuclear power a less attractive option. This means that fewer nuclear power stations could be built in comparison to the Nuclear NPS option and it would not play the same role in ensuring energy security.

Summary Findings of the AoS

3.7.15 On balance, the Nuclear NPS option is the one which will give the most certainty that nuclear power stations would be developed. This option, therefore, would make a bigger contribution to security of supply than the options of an NPS that prohibits Nuclear and No NPS. If the NPS that prohibits Nuclear option is chosen, then nuclear power could not make this contribution. If the No NPS option were chosen, there is a risk that there might be fewer new nuclear power stations.

Government's preferred alternative

3.7.16 Having considered the findings of the AoS and other information, the Government's preferred alternative is to take forward the draft Nuclear NPS. The Government believes that the Nuclear NPS will help the UK to maintain a diverse mix of electricity generating technologies with the flexibility to respond to future developments. Nuclear power can make an important contribution to managing energy security risks, and therefore to ensuring reliable, affordable, secure supplies of electricity. Therefore the Government believes that it should proceed with the Nuclear NPS.

3.8 The Economy

3.8.1 Assessing the effects of low-carbon (Nuclear NPS) electricity generation against gas-fired electricity generation (No Nuclear) on the economy is complex. The Committee on Climate Change attributes this complexity to four main factors:

- fossil fuel price volatility and uncertainty – when fossil fuel prices are low, all low-carbon alternatives face a cost penalty. With high fossil fuel prices, technologies such as nuclear and renewables are cost effective without any policy intervention. Further, price volatility and uncertainty is expected to continue into the future; different stages of technological development – relative cost figures often depend on comparisons of actual costs of one (mature) technology (for example, nuclear) against estimated future costs of another (for example, CCS);
- long-term cost trends – estimated future costs of renewables and new nuclear generation power stations, and of CCS depend on assumptions about future cost reduction potential – minor changes in assumptions can dramatically shift the relative cost of different technologies; and
- short-term cost trends and supply bottlenecks – supply bottlenecks drive up prices (for example, recent increases in wind turbines and solar photovoltaic panels, increased costs of new nuclear and fossil fuel build, although these may ease or disappear with time. Estimates of relative technology costs are therefore sensitive to when the costs were calculated and assumptions about future supply bottlenecks. This can result in overstating costs of already deployed technologies (for example, wind or nuclear) against speculative technologies (for example, CCS).

Nuclear NPS

3.8.2 Redpoint modelling suggests that new nuclear is economically viable (including decommissioning and long-term waste disposal costs) in most scenarios. New nuclear viability is primarily driven by the relative capital costs of different technologies and fossil fuel and carbon prices.

3.8.3 Historically, the levelised[73] cost of renewables energy is higher than that of nuclear or fossil fuel generation[74]. However, while the levelised cost of renewables is higher than other forms of generation, they are expected to fall as technologies are deployed more widely[75].

73 Levelised cost is a measure used to calculate the cost of electricity generating technologies. The capital cost is added to operating costs (and back end costs in the case of nuclear) and divided by the amount of electricity the power station is expected to generate during its lifetime. It is usually expressed as cost per kWh or MWh.

74 It should also be noted that the 2008 Redpoint modelling demonstrates that meeting the 2020 renewables target results in a net present value welfare loss for the period 2008-2030 compared to the status quo. Estimates under different schemes range between negative £30-35 billion for the 32% renewables generation scenario. The 2008 Redpoint report argues that the additional resource costs (e.g. back-up generation, balancing, grid expansion and so on) significantly outweigh the savings in terms of CO2 emissions avoided. The risk of 'spill' periods also increases with higher renewables deployment.

75 Building a low-carbon economy, The Committee on Climate Change. (2008) p192, http://www.theccc.org.uk/pdf/TSO-ClimateChange.pdf

3.8.4 The Committee on Climate Change argue that although the future path of fossil fuel prices is inherently uncertain, under high fossil fuel price scenarios, nuclear power is fully economic compared to coal and gas generation even before the impact of a high carbon price, and even more so given the possible range of future carbon prices. Nuclear power will reduce future reliance on imported gas.

3.8.5 Two main economic arguments are usually made against new nuclear build; high decommissioning and waste disposal costs, and limited uranium supplies. Evidence from the Committee on Climate Change suggests that the £80billion decommissioning and waste disposal costs from the previous nuclear programme are often cited in the economic case against nuclear. The Committee on Climate Change argues, however, that the vast majority of this cost was incurred during military research in the 1940s to 1960s, and through the operation of Magnox reactors; these are not relevant to future costs[76]. The £3.4billion decommissioning costs estimated for the ten advanced gas-cooled reactors are more relevant, and costs for latest generation stations may be lower still.

3.8.6 New nuclear power build[77] is likely to result in increased employment during construction and operation of new power station. It should be noted, however, that employment opportunities would also exist in alternative sources of energy supply. It is therefore hard to determine the scale of net increase in employment that would result from investment in new nuclear capacity over and above other forms of generation capacity.

3.8.7 It is difficult to determine the net effect of jobs in the wider economy that any new electricity generation might have. However the construction and operation of different types of power stations can have different local employment impacts. As an illustration, a 1.6GW nuclear plant could employ up to 4000 people during construction and 500 when operational. A 1.3GW CCGT power station could employ around 1000 people during construction and 40 during operation.

NPS that prohibits Nuclear

3.8.8 Redpoint[78] have carried out analysis on the impact of excluding new nuclear from the electricity generation mix up to 2030. Under a scenario of central fossil fuel and carbon prices it is estimated that excluding new nuclear results in a net welfare loss to the economy of approximately £10 billion. This is primarily due to relatively low cost nuclear generation being replaced with higher cost alternatives as well as the reduced value of the carbon dioxide emissions savings that would be available from nuclear power stations.

76 Building a low-carbon economy, The Committee on Climate Change. (2008) p188, http://www.theccc.org.uk/pdf/TSO-ClimateChange.pdf

77 Costs of nuclear deployment can be reduced if multiple new nuclear stations are built rather than one or two.

78 Implementation of the EU 2020 Renewables Target in the UK Electricity Sector: RO Reform. No new nuclear sensitivities. 2009.

3.8.9 Modelling for the Committee on Climate Change report using MARKAL, finds that if CCS were unavailable at reasonable cost out to 2050, then a significant expansion of nuclear power (to nearly 40 GW by 2050)[79] and some further expansion of renewables would be the least-cost option to meet emissions reductions of 80%, with an additional loss in economic surplus of £17.5bn (real 2000 prices, discounted out to 2050). If nuclear as well as CCS were not available, the modelling suggest that 80% (or even 90%) emissions reductions would still be attainable, but only at substantial additional cost, with the loss in economic surplus increasing a further £79.2bn[80].

3.8.10 The construction, operation and decommissioning of CCGT power stations and renewables generating infrastructure would result in employment. It should be noted, however, that employment opportunities would also exist in alternative sources of energy supply. It is therefore hard to determine any net increase in employment that would result from investment in CCGT and renewables over and above other forms of generation capacity

No NPS

3.8.11 The impact of No NPS is expected to be similar to the Nuclear NPS, although there is no certainty about the number of new nuclear power stations which might be built.

Summary Findings of the AoS

3.8.12 It is difficult to determine if one option will result in more employment than another. Nuclear is an economically viable form of low carbon electricity generation even when the costs of decommissioning and waste disposal are taken into account.

Government's preferred alternative

3.8.13 The Government believes that having new nuclear power stations could significantly reduce the costs of meeting emissions reductions targets especially if CCS is not available at reasonable cost in the future.

3.9 Health and Safety (Population, Human Health)

Generic impacts

3.9.1 There are generic, occupational health and safety risks associated with large scale construction of any kind of energy infrastructure. However, these can be appropriately managed through health and safety measures and there is legislation in place to regulate this. During construction, there are likely to be emissions to air from traffic and construction activity (including dust) and noise which can have an adverse impact on health. However these effects can be mitigated through the development process, for example, by using cleaner fuels in construction equipment or damping down the construction site on a regular basis to minimise dust, or quieter plant selection and limitation of construction working hours to minimise noise. (Emissions to air are also discussed in the section on Air Quality).

79 Building a low-carbon economy, The Committee on Climate Change, Dec 2008, Chapter 5, http://www.theccc.org.uk/pdf/TSO-ClimateChange.pdf

80 Building a low-carbon economy, The Committee on Climate Change, Dec 2008, Chapter 5, http://www.theccc.org.uk/pdf/TSO-ClimateChange.pdf

The Nuclear NPS

3.9.2 The Nuclear NPS would result in new nuclear power stations being constructed. This would increase the risk of exposure to ionising radiation for workers and the public, associated with the operation, decommissioning of the nuclear power station, the storage, transportation and disposal of radioactive waste (compared to the other options of *NPS that prohibits nuclear* and *No NPS*). However, the impact of routine radioactive discharges is small and subject to strict regulation.

3.9.3 The overall safety of nuclear power installations is dependent upon good design and operation and is driven by a robust regulatory regime. The work undertaken to date by the HSE as part of the Generic Design Assessment (GDA) has provided an overview of the fundamental acceptability of the proposed reactor design within the overall, UK regulatory regime. For all reactors being considered the key preliminary conclusion of the GDA was that there are no safety or security shortfalls that would be so serious as to rule out the eventual construction of the reactors in UK licensed sites. The next stage of the GDA will be to review in more detail the claims of each of the vendors in respect of safety issues.

3.9.4 As part of the site licensing process, a potential operator will be required to satisfy HSE that the nuclear facility is designed and can be operated such that several levels of protection and defence are provided against significant faults or failures, that accident management and emergency preparedness strategies are prepared and that all reasonably practicable steps have been taken to minimise the radiological consequences of an accident[81].

3.9.5 The site licensing process will require consideration of whether there is adequate protection against exposure to ionising radiation and radioactive contamination both in normal and accident conditions to protect both workers and members of the public.

3.9.6 The UK has a strict regulatory framework to restrict routine discharges from nuclear power stations and direct radiation exposures to workers and the general public[82]. The aim is to reduce potential health impacts to acceptable levels and ensure that radiation doses are well within internationally agreed limits. These limits are underpinned by obligations under the Euratom Treaty[83]. The UK is also a signatory to the North Sea Conference and OSPAR (Oslo-Paris Convention) which both set legal requirements for discharges of radioactivity to the North Sea, including the UK's coastal waters. OSPAR is implemented through the UK Discharge Strategy to ensure our OSPAR regulations are met.

81 HSE (2006) Safety Assessment Principles for Nuclear Facilities.

82 As laid out in the Ionising Radiations Regulations, 1999, the Radioactive Substances Act 1993 and Environment Act 1995.

83 Council Directive 96/29/Euratom of 13 May 1996, laying down basic safety standards for the health protection of the workforce and general public against the dangers of ionising radiation. Official Journal of the European Communities, (L159 29.6.1996, p.1).

3.9.7 HSE's Nuclear Installations Inspectorate (NII) works alongside the Environment Agency and the Scottish Environment Protection Agency, which regulate liquid or gaseous radioactive discharges and the disposal of solid radioactive waste, to protect against the health impacts of radiation exposure. The regulators require the operators to ensure that the exposures of workers and public from radioactivity from nuclear sites are kept not only below stringent legal limits but are as low as is reasonable achievable.

3.9.8 Any new nuclear power stations will need authorisation, under the Radioactive Substances Act 1993, from the relevant environment agency before making any discharges of radioactivity into the environment or disposals of radioactive waste.

3.9.9 The Government and industry have an emergency preparedness framework in place to mitigate health effects in the unlikely event of major accidental releases of radiation into the environment. This framework includes detailed site-specific plans for each nuclear facility. The plans are tested regularly through exercises, some of which involve the Government and simulated media involvement.

3.9.10 The nuclear environmental regulatory agencies are responsible for ensuring that new nuclear power station designs can meet high environmental standards and use the best available techniques (BAT) to achieve this, as required by the OSPAR Convention. Through the Generic Design Assessment process, the Environment Agency will ensure that this requirement is considered at an early stage. This ensures that the most modern techniques to minimise radioactive discharges can be incorporated into the designs of the stations. The application of BAT would ensure that discharges from new nuclear power stations constructed in the UK would not exceed the levels of comparable power stations across the world.

3.9.11 The Health Protection Agency regularly reviews the radiation exposure of the UK population. The HPA has assessed the average dose to a member of the general public from all sources of radioactivity and calculates that this is 2.7mSv per year, 84% of which is from natural sources[84].

3.9.12 There is a statutory annual dose limit of 1mSv to members of the public from activities covered by the Ionising Radiations Regulations 1999[85] and the Radioactive Substances Direction 2000[86].

3.9.13 The environment agencies in the UK run a number of monitoring programmes to provide an independent check on the impacts of radioactive discharges. In 2007, radiation doses to adults and children living around nuclear sites remained well below the national and European limit, which is 1mSv[87] per year.

84 Ionising Radiation Exposure of the UK Population: 2005 Review, HPA-RPD-001.

85 This includes all activities carried out under a nuclear site licence issued by the NII under the Nuclear Installations Act 1965. A full list of activities that are covered is at Regulation 6 and Schedule I of the Ionising Radiations Regulations (SI:1999/3232).

86 The Radioactive Substances (Basic Safety Standards) (England and Wales) Direction 2000 for EA, The Radioactive Substances (Basic Safety Standards) (Scotland) 2000 for SEPA.

87 Radioactivity in Food and the Environment, 2007. RIFE-13, Environment Agency, Scottish Environment Protection Agency, Northern Ireland Environment Agency, Food Standards Agency, 2008, http://www.food.gov.uk/multimedia/pdfs/publication/rife13summary.pdf

3.9.14 Under UK law, all employers are responsible for protecting their employees against exposure to radiation in accordance with strict dose limits under the Nuclear Installations Act 1965 and Ionising Radiations Regulations 1999. These limits reflect the recommendations of the International Commission for Radiological Protection for an individual dose limit for radiation workers of 100mSv, averaged over five years, giving an annual limit of 20mSv. Doses are minimised by shielding workers from the sources of radiation and operators carry out regular detailed reviews of performance in this area.

3.9.15 The Committee on Medical Aspects of Radiation in the Environment (COMARE), a scientific advisory committee providing independent authoritative expert advice on all aspects of health risk to humans exposed to natural and man-made radiation, has, for over twenty years, investigated the incidence of childhood cancer and other cancers around nuclear sites starting with the Sellafield site in 1986.

3.9.16 COMARE has published a series of reports on topics related to exposure to radiation. Its view is that there is no evidence for unusual aggregations of childhood cancers in populations living near nuclear power stations in the UK.

3.9.17 COMARE's tenth report considered the incidence of childhood cancer around nuclear installations. These were divided into nuclear power generating stations and other nuclear sites. The results for the power generating stations supported the conclusion that 'there is no evidence from this very large study that living with 25km of a nuclear generating site in Britain is associated with an increased risk of childhood cancer'.

3.9.18 COMARE's tenth report did however conclude that the situation for the other nuclear sites is more complicated. Studies confirmed previous COMARE findings of excess childhood cancers in Seascale near Sellafield, Thurso near Dounreay and around Aldermarston, Burghfield and Harwell. Historically, Sellafield is the UK nuclear site with the largest of all radioactive discharges. COMARE's fourth report, which concentrated on Sellafield and childhood leukaemia in Seascale, concluded that 'on current knowledge, environmental radiation exposure from authorised or unplanned releases could not account for the excess' [of leukaemia and other cancers].

3.9.19 In its eleventh report COMARE examined the general pattern of childhood leukaemia in Great Britain and concluded that many types of childhood cancers 'have been shown not to occur in a random fashion'. It is also stated that 'The results of analyses ...suggest that there is no general clustering around nuclear installations.'

3.9.20 Following the KiKK study on childhood leukaemia around German nuclear power plants, COMARE requested that a reanalysis of the UK childhood cancer data used in COMARE's tenth report be carried out using the same methodology as the KiKK study as far as possible. This reanalysis – the Bithell paper – was published in December 2008. It showed that the conclusions of the COMARE tenth report remained valid when applying the KiKK methodology and did not support the findings of the KiKK study.

3.9.21 The KiKK study gave the results on childhood cancer in the vicinity of 16 German nuclear power plants from a dataset established by the German Childhood Cancer Registry, which included over 1500 childhood cancer cases from 1980 to 2003. In comparison, the dataset used for COMARE's tenth report and the subsequent Bithell paper contained over 32,000 cases of childhood cancer from 1969 to 1993. This is a verified national database and is believed to be the largest national database on childhood cancer in the world. The size of the database used by COMARE therefore gives considerable confidence in the results of the tenth report. In this context, the HPA and the German Commission on Radiological Protection have commented on the very low levels of radiation around nuclear power stations.

3.9.22 COMARE is currrently undertaking a further review of the incidence of childhood cancer around nuclear power stations, with particular reference to the KiKK study and COMARE's 10th and 11th reports. COMARE hope that the outcome of their review will be available at the start of 2010. COMARE is also keeping the incidence of childhood leukaemia and other cancers in the vicinity of Sellafield and Dounreay under surveillance and periodic review.

3.9.23 Flooding and coastal erosion could have a major bearing on the safety of a nuclear power station. Nuclear power stations are likely to be sited on coastal or estuarine locations because of the requirements for cooling water. If development of a nuclear power station caused flooding elsewhere, this could also have impacts on health and safety. A developer would have to demonstrate that the site of the nuclear power station could be protected from flooding (including storm surge, tsunami and flash floods) and coastal erosion for the lifetime of the site, taking into account the effects of climate change.

3.9.24 Finally, before the UK can adopt any new class or type of practice involving the use of ionising radiation, it must first be 'Justified', i.e. it must be demonstrated that any benefits resulting from its introduction outweigh the associated health detriment. European Council Directive 96/29/Euratom of 13 May 1996 (the Basic Safety Standards Directive) requires Member States to ensure that all new classes or types of practice resulting in exposure to ionising radiation are justified in advance of being first adopted or first approved by their economic, social or other benefits in relation to the health detriment they may cause. This process is known as Regulatory Justification and the Secretary of State for Energy and Climate Change is consulting on a proposed decision in relation to the Regulatory Justification of certain types of nuclear reactor. That process will involve an assessment of whether the economic, social or other benefits of those reactor types outweigh any potential health detriments.

3.9.25 The basic safety standards for the protection of the workforce and general public against the dangers of ionising radiation set out in the Directive are further enforced before, during and after operation of nuclear power stations, including the management and disposal of waste by the UK's regulatory framework. This aims to reduce potential health impacts to acceptable levels and ensure that radiation doses are within internationally agreed limits.

NPS that prohibits Nuclear

3.9.26 If there is no nuclear power, CCGT power stations and some renewables are likely to be built instead. Noise of wind turbines is localised and can be mitigated through careful planning and design. CCGT power stations emit NOx which is a contributor to ground level ozone which can cause respiratory problems. However NOx emissions will need to be within legal limits and there is a system of regulation in place to minimise health risks.

No NPS

3.9.27 In this scenario, the impacts are likely to be similar to the Nuclear NPS scenario and NPS that prohibits Nuclear options. New nuclear power stations could still be built although there might be fewer. There could also be CCGT power stations and renewables although it is difficult to predict how many.

3.9.28 Flooding and coastal erosion could have a major bearing on the safety of any nuclear power station which are built under this option. Nuclear power stations are likely to be sited on coastal or estuarine locations because of the requirements for cooling water. If development of a nuclear power station caused flooding elsewhere, this could also have impacts on health and safety. A developer would have to demonstrate that the site of the nuclear power station could be protected from flooding (including storm surge, tsunami and flash floods) and coastal erosion for the lifetime of the site, taking into account the effects of climate change.

Summary Findings of the AoS

3.9.29 The generic health and safety impacts from construction and non-radioactive emissions to air during construction and decommissioning would be broadly similar for all three options. The scale of impacts would depend upon the size of development. In terms of the risk posed by radioactive emissions, the system of regulation in place in the UK means that new nuclear power stations (under the Nuclear NPS and No NPS options) would pose a very small risk to health.

Government's preferred alternative

3.9.30 Having considered the findings of the AoS and other information, the Government's preferred alternative is to take forward the Nuclear NPS. As previously set out in the Nuclear White Paper, the Government believes that the risks to health from routine and accidental radioactive discharges are small because of the regulatory system. The Government is currently consulting on its proposed decision in relation to Regulatory Justification of various types of nuclear reactor. That process will assess whether the potential health impacts of these reactors are outweighed by their social, economic or other benefits. At a project level, a developer will need to comply with any relevant health and safety legislation to protect workers. They will also need to ensure that radioactive discharges are within statutory limits. The developer will also have to demonstrate that the site can be protected from flooding for the lifetime of the site, taking into account the effects of climate change. The developer will also have to demonstrate that the development will not result in unacceptable flood risk elsewhere. This should ensure that the risks to health and safety are minimised.

3.10 Radioactive waste

Generic impacts

3.10.1 New nuclear power stations will produce radioactive waste which needs to be managed.

3.10.2 New nuclear power stations will produce low level waste (LLW), liquid and gaseous discharges, and non-radioactive wastes. Arrangements already exist for the effective management and disposal of wastes in these categories, as demonstrated by the experience of dealing with such wastes from existing nuclear power stations.

3.10.3 New nuclear power stations will also produce intermediate level waste and spent fuel (higher activity waste) and geological disposal is the way higher activity wastes will be managed in the long term. This will be preceded by safe and secure interim storage until a geological disposal facility can receive waste. The Government set out a framework to implement this policy in the Managing Radioactive Waste Safely (MRWS) White Paper published in June 2008[88].

3.10.4 Radioactive waste will need to be transported. There is an effective regulatory framework in place that ensures that these risks are minimised and sensibly managed by industry[89]. The UK has robust legislative and regulatory systems in place for the transport of radioactive wastes, including higher activity wastes.

The Nuclear NPS

3.10.5 The Nuclear NPS would facilitate the construction of new nuclear power stations. This would mean that radioactive waste would be produced (in addition to waste from existing stations) which will have to be managed.

3.10.6 The sustainability of the arrangements for managing radioactive waste, spent fuel and hazardous wastes from new nuclear power stations is appraised in Chapter 6 of this Main AoS Report which considers the following waste streams:

- Spent Fuel;
- Intermediate Level Waste (ILW);
- Low Level Waste (LLW);
- Gaseous and Liquid Radioactive Discharges;
- Non Radioactive Hazardous Wastes.

3.10.7 The effects of waste management may arise at a nuclear power station site or offsite at other locations where packaging or disposal of waste is undertaken. There may also be effects associated with the transport of waste between nuclear power stations and waste management sites.

88 Managing Radioactive Waste Safely: a framework for Implementing Geological Disposal www.decc.gov.uk/mrws

89 Meeting the Energy Challenge: A White Paper on Nuclear Power, BERR, Jan 2008, p82, http://www.berr.gov.uk/files/file43006.pdf

3.10.8 In line with Government policy on the management of higher level waste, this appraisal considers a Geological Disposal Facility (GDF) as the final destination for spent fuel and ILW. However, the appraisal presented in this section is not a detailed assessment of this facility. It is expected that as the concept design and location are finalised, Strategic Environmental Assessments and Environmental Impact Assessments[90] for a GDF will be completed.

NPS that prohibits Nuclear

3.10.9 NPS that prohibits Nuclear would mean that no radioactive waste would be produced.

No NPS

3.10.10 The No NPS option would mean that some nuclear power stations might still be developed. These would produce radioactive waste which would need to be managed.

Summary Findings of the AoS

3.10.11 The Appraisal of Sustainability has identified potential effects associated with waste arising from new nuclear power stations. In particular some potential negative effects have been identified associated with the management of Spent Fuel and ILW requiring interim storage at nuclear power station sites. However, these effects are considered to be of minor strategic significance and similar in nature to the effects produced by other aspects of new power station development.

3.10.12 One minor negative effect from the management of Spent Fuel, which is considered to be of potentially greater significance, is the effect on flood risk. This arises from the possible need to design and maintain flood protection measures for the life of the interim storage of Spent Fuel which may extend the lifetime of the site beyond what would otherwise be required.

3.10.13 However, there may be an option to remove Spent Fuel from power station sites for interim storage at an offsite facility before it is deposited in a GDF. If interim storage is provided at power stations, it may be possible to mitigate the effects on flood risk through appropriate design, construction and management of flood protection measures.

3.10.14 In the event that there is a substantial number of new nuclear power stations built in the UK, the UK inventory of spent fuel will increase, but will depend on the number of new nuclear power stations constructed and operated. Estimates of the amount of spent fuel that would be generated by a 10GW programme of new power stations operating for 60 years indicate that this would increase by between 50-55% the amount of Spent Fuel and High Level Waste (HLW) to be disposed of in a GDF. Existing plans and programmes are in place to manage the legacy inventory of spent fuel, and new nuclear power stations will need to be accounted for in these plans. It is recognised that some impacts cannot be fully disassociated from the development and implementation of strategies to address UK legacy radioactive waste, and a new build programme may integrate into these where appropriate.

90 NDA Consultation on a Framework for Sustainability Appraisal and Environmental Assessment for Geological Assessment for Geological Assessment, www.nda.gov.uk/documents/upload/NDA-Consultation-on-a-Framework-for-Sustainability-Appraisal-and-Environmental-Assessment-for-Geological-Disposal-August-2008.pdf

3.10.15 The UK Nuclear Industry draft LLW Strategy[91] for LLW may have a positive influence by reducing legacy LLW volumes, and also in facilitating the management of predicted LLW arising from the new nuclear power stations.

3.10.16 The appraisal also notes that the impacts associated with interim storage facilities for ILW and spent fuel, and with a GDF, will be fully assessed as part of project level EIAs once site specific designs and proposals are developed.

Government's preferred alternative

3.10.17 The Government's preliminary view is that it is satisfied that effective arrangements will exist to manage and dispose of the waste that will be produced from new nuclear power stations when needed. From time to time, new evidence and material relevant to the disposal of wastes from new nuclear power stations may come to light. The Government will therefore keep the waste assessment under review and will consider whether any new evidence or material provide grounds for revisiting the conclusions.

3.11 The Natural Environment (Biodiversity, Flora, Fauna, Air, Landscape)

Generic impacts

3.11.1 All electricity generating technologies result in effects upon the natural environment. These effects will vary depending upon the particular technology, where it is situated and the size of the development. The impacts described below are applicable in all three options of Nuclear NPS, NPS that prohibits Nuclear and No NPS.

3.11.2 Some of these effects are short term and common to all types of infrastructure. During construction, there are likely to be emissions from traffic and construction activity, including dust which can have an adverse impact on air quality and noise which can have an adverse impact on the noise environment. However these effects can be mitigated through the development process, for example, by using cleaner fuels in construction equipment or damping down the construction site on a regular basis to minimise dust and by quieter plant selection and limitation of construction working hours to limit noise.

3.11.3 All thermal power stations (nuclear power, gas, oil, coal) require cooling – either through cooling towers or cooling water. Where cooling water is used, large volumes are extracted and the water is discharged back. Cooling water can have adverse impacts both through abstraction of water and discharge. Abstraction may result in fish being entrained with the cooling water although there are technologies available to mitigate this.

3.11.4 When water is discharged back from the power station, it can affect aquatic ecosystems when the water pumped out is warmer than the receiving water body or if the salinity level is different –this may result in changes to the aquatic ecology through death of organisms or reduction in dissolved oxygen concentrations. Cooling water may also contain low doses of biocide at certain periods of the year to prevent fouling of the cooling water pipelines by molluscs and vegetation. Biocides can change aquatic ecology through the death of non-target organisms.

91 UK Nuclear Industry LLW Strategy http://www.nda.gov.uk/loader.cfm?csModule=security/getfile&pageid=29908

3.11.5 There is a regulatory framework in place to minimise the risks of adverse impacts of water abstraction and discharge on the environment.

3.11.6 To protect the power station sites against flood risk, new coastal and fluvial flood defence assets may be required. These may modify coastal and estuarial hydrodynamics and sediment transport with attendant ecosystem impacts. Wind generation has little, if any, impact upon water. Flood defences require planning consent and there may be conditions attached to the granting of consent, including the possible need for mitigation and compensation for impacts on the natural environment.

3.11.7 Construction of any type of power station and ancillary infrastructure (such as transmission lines and pylons) has the potential to have an adverse impact on biodiversity and ecosystem services. Construction activities could lead to noise and visual disturbance which could, for example, have an adverse impact on breeding birds. There could be loss, alteration, fragmentation or damage to habitats through direct land take. There are methods to avoid or reduce significant ecological impacts which will be explored at the project level, when the applicant has detailed information to design a bespoke package of mitigation measures tailored to suit local ecological conditions.

3.11.8 Developers will also need to comply with a number of European Directives which aim to protect the natural environment. These include the Water Framework Directive, the Bathing Water Directive, the Shellfish Water Directive, the Freshwater Fish Directive, the Habitats Directive, the Birds Directive, the Air Quality Directive, the Environmental Noise Directive and the Environmental Impact Assessment Directive. Developers will also need to comply with the forthcoming Marine Policy Statement.

The Nuclear NPS

3.11.9 A Nuclear NPS could, in the short term, result in localised effects on air quality during construction, from traffic and construction activity, including dust which can have an adverse impact on local air quality although these are similar to the effects that would arise if alternative forms of energy development were pursued.

3.11.10 During operation nuclear power stations emit radioactive discharges to air. These discharges are small and must be within regulatory limits[92]. However, during operation, nuclear power stations do not produce significant emissions to air of CO_2, nitrogen oxides (NOx) or particulate matter.

3.11.11 During operation, there may also be some minor emissions caused by ancillary equipment, such as back up diesel generators, but these would only be used intermittently and any emissions would have to be within the required environmental permits. The transport of fuel onto the site and transport of waste off the site would also cause emissions although the number of journeys is likely to be small. Private vehicles used by workers would also cause some small emissions. During decommissioning, there would be effects similar to those caused during construction.

92 More information on radioactive discharges can be found on The Environment Agency's website www.environment-agency.gov.uk

3.11.12 The accidental release of any radioactive emissions into the air could cause a significant adverse impact on the natural environment. However, before a site licence is granted, the regulators would need to be satisfied that the risks associated with accidental releases are as low as reasonably practicable and within the relevant radiological limits.

3.11.13 A Nuclear NPS is likely to result in some adverse impacts on biodiversity and ecosystem services, particularly during the construction and operational phases of new nuclear power stations. This could include impact upon sites of ecological importance through habitat loss, disturbance, reduction in fish migration, changes in water quality (including temperature), potential bioaccumulation and coastal squeeze,[93] although there could also be potential mitigations. A new nuclear power station will require buildings to house the reactor, turbine, generator, cooling water pump house or cooling towers, control buildings and service and maintenance facilities[94].

3.11.14 The Nuclear NPS has the potential to result in adverse impacts on water because new nuclear power stations are likely to use cooling water. The extraction of water from the natural environment and discharge of heated cooling water to the environment can affect water quality, biodiversity and fisheries. Nuclear power stations use larger volumes of cooling water than other thermal power stations[95]. Some new designs of nuclear power station have a higher thermal efficiency which may lead to lower cooling water needs[96]. The amount of cooling water required will also depend on the type of cooling system chosen and would be less for cooling towers than for direct cooling. Flood defences for nuclear power stations would need to be in place for longer than at CCGT power stations because of the longer operating and decommissioning timescales of nuclear power stations. Construction of new nuclear power stations is expected to take 5 or 6 years. The operating lifetime of a new nuclear power station will be around 60 years whilst the duration of decommissioning is estimated to be around 30 years. On site interim storage of spent fuel may need to continue for about 100 years after the end of power station operation. (It is therefore possible to envisage a scenario in which onsite interim storage might be required for around 160 years from the start of the power station's operation, to enable an adequate cooling period for fuel discharged following the end of the power station's operation. However, this is based on some conservative assumptions and there are a number of factors that could reduce or potentially increase, the total duration of onsite spent fuel storage). The operating lifetime of a CCGT power station is around 30 years with decommissioning taking around 18-36 months. The exact impact of the flood defences will depend upon the design which will not be known until the project level.

93 The progressive reduction and loss of coastal habitat area and natural features which can arise if the natural landward migration of a habitat under sea level rise is prevented by man-made defences and structures.

94 The Future of Nuclear Power – The Role of Nuclear Power in a Low Carbon UK Economy: Consultation Document, DTI, May 2007, p149, http://www.berr.gov.uk/files/file39197.pdf

95 Barsak and Kilpatrick, Energy Impacts on Georgia's Water Resources, University of Georgia 2003.

96 The Future of Nuclear Power – The Role of Nuclear Power in a Low Carbon UK Economy: Consultation Document, DTI, May 2007, p51, http://www.berr.gov.uk/files/file39197.pdf

NPS that prohibits Nuclear

3.11.15 The NPS that prohibits Nuclear option could also result in short term localised effects, on air quality during construction, which are similar to the Nuclear NPS and No NPS options. Under the NPS that prohibits Nuclear alternative, there would be a gradual reduction in nuclear power stations (closing at the end of their operating lifetimes) which may be replaced by new gas CCGT plant and renewables. One consequence of this would be that, in the long term, more pollutants (relative to the other options) would be released into the atmosphere. This is because CCGT power stations emit CO_2 and NOx (although new technologies may help mitigate this). Renewable technologies, such as wind, do not emit pollutants to air although biomass power stations emit particulate matter and NOx. Biomass power stations also emit CO_2 but are considered carbon neutral because burning the biomass releases the carbon which was stored as the biomass grew. Energy from waste plants are also considered carbon neutral despite emissions of CO_2 although not all fuel for energy from waste power stations is renewable. Private vehicles used by workers at power stations would also cause some small emissions as would transport of materials on and off site during operation.

3.11.16 Similar impacts on biodiversity would also occur in the case of NPS that prohibits Nuclear and the Nuclear NPS because the infrastructure which would be built instead of nuclear power stations could also have adverse impacts on biodiversity and ecosystem services. CCGT power stations have similar impacts on biodiversity and ecosystem services to nuclear power stations. CCGT power stations also require cooling water (unless cooling towers are utilised) and there would be potential impacts from abstraction and discharge of cooling water similar to the impacts under the Nuclear NPS option. However, it should be noted that the volumes of cooling water required by a CCGT power station are less than for an equivalent sized nuclear power station. Renewables generation, such as wind farms, do not require cooling water.

3.11.17 CCGT power stations might also require flood defences to protect the site although they would need to be maintained for shorter period than a nuclear power station because the operating lifetime is shorter.

3.11.18 The amount of land take required for one CCGT station is also smaller than the amount of land required for a nuclear power station (CCGT stations with CCS would require additional land). A CCGT power station will require permanent buildings for a turbine hall, exhaust gas stacks, storage facilities, cooling water pump house or cooling towers, water processing power station and administrative buildings. Renewable infrastructure, such as wind farms can require more land than either CCGT power stations or nuclear power stations. The impacts of CCS technology on the natural environment are unknown. Tidal power stations can also have adverse impacts on biodiversity and ecosystem services.

No NPS

3.11.19 The No NPS option would have similar effects to the Nuclear NPS and NPS that prohibits Nuclear options. Nuclear power stations could still be built although there may be fewer. These would have an impact on the natural environment as would any CCGT or renewables which came forward.

Summary Findings of the AoS

3.11.20 During construction and decommissioning, the short term effects on air quality are similar for the three options. However, these are short term, localised, there are possible mitigations and these effects are not considered to be significant.

3.11.21 It is during operation that the differences become apparent. There would be more adverse impacts from the NPS that prohibits Nuclear option because the CCGT stations would emit NOx although if there was some additional renewables generation in place of nuclear power, this would not occur (wind power causes no emissions to air during operation although biomass power stations emit NOx and particulate matter.

3.11.22 The effects on biodiversity and ecosystem services are not significantly different across all three alternatives. All have the potential to adversely impact upon biodiversity and ecosystem services if appropriate mitigations are not put in place.

3.11.23 Similar effects on water are expected for all the alternatives where thermal generation power stations are built, whilst recognising that CCGT power stations require less cooling water than equivalent sized nuclear power stations. This would not be the case for any renewables generation that might result from the NPS that prohibits Nuclear and No NPS options. However, the scale of any impacts would depend upon the size and location and detail of any developments.

Government's preferred alternative

3.11.24 Having considered the findings of the AoS and other information, the Government's preferred alternative is to take forward the Nuclear NPS. With the exception of radioactive waste, the impacts on the natural environment of constructing new nuclear power stations would not be significantly different to constructing CCGT stations or renewables generation. During operation emissions from nuclear power stations would be lower than emissions from CCGT power stations. Therefore the Government believes it should proceed with the Nuclear NPS. At a project level, an Environmental Impact Assessment and Habitats Regulations Assessment will be required when an application for development consent is submitted to the IPC. This will help to ensure that appropriate mitigations are considered and implemented.

3.12 The Built Environment (Landscape, Cultural Heritage and Material Assets)

Generic impacts

3.12.1 All types of thermal power stations and renewable generation infrastructure have the potential to have an adverse impact on landscape[97] and cultural heritage. The scale of such projects means that they will often be visible within many miles of the site of the proposed infrastructure. The impact will be determined by the size of the development and the location – for example, a power station in an Area of Outstanding Natural Beauty may have more of a visual impact than a power station in an industrial area. The overall size of the development will be dependent upon the technology and design. Cooling towers and exhaust stacks (if these are required) have the most obvious impact on landscape and visual amenity.

97 Landscape in this assessment also includes townscape and seascape.

3.12.2 There will be short term effects, for example, during construction where earthworks may be required to prepare a site and movements of construction traffic could result in localised noise impacts. These can adversely affect the tranquillity of an area.

3.12.3 Longer term effects will result from the permanent buildings[98] and ancillary infrastructure such as the transmission system which all centralised electricity generation requires. Pylons can be a prominent feature on the landscape.

3.12.4 Energy infrastructure can also have adverse impacts upon cultural heritage. For example, construction works could lead to the direct loss of archaeological remains, an adverse impact upon historic landscapes or changes to the setting of heritage resources. Longer term impacts could result from the presence of a development altering the aesthetics of the surrounding area.

The Nuclear NPS

3.12.5 A Nuclear NPS could result in adverse impacts on the landscape and cultural heritage from the short term impacts arising from construction, as described above. Longer term impacts on landscape and cultural heritage could be caused by permanent buildings. For example, one nuclear power station will require buildings to house the reactor, turbine, generator, cooling water pump house or cooling towers, control buildings and service and maintenance facilities[99]. There could also be new overhead transmission lines and pylons.

NPS that prohibits Nuclear

3.12.6 The NPS that prohibits Nuclear option could also to result in similar adverse impacts on landscape if CCGT power stations and renewable infrastructure are built. Short term impacts on construction will be similar to the Nuclear NPS option, as will long term impacts. For example, one fossil fuel station will require permanent buildings for a turbine hall, exhaust gas stacks, storage facilities, cooling water pump house or cooling towers, water processing power station and administrative buildings. Coal-fired and biomass co-fired generating stations will require more space than other types of fuel and space will also be needed for other bulk material storage such as ash and gypsum prior to disposal.

3.12.7 Renewable generating infrastructure can also have an adverse impact on landscape. Modern commercial-scale wind turbines have a tip height of around 130 metres and can have significant impacts on the landscape.

No NPS

3.12.8 The No NPS option would have similar effects to the Nuclear NPS and NPS that prohibits Nuclear options. Nuclear power stations could still be built although there may be fewer. These would have an impact on the built environment as would any CCGT or renewables which came forward.

98 "Permanent building" means a building which will be present for the lifetime of the power station.

99 The Future of Nuclear Power – The Role of Nuclear Power in a Low Carbon UK Economy: Consultation Document, DTI, May 2007, p149, http://www.berr.gov.uk/files/file39197.pdf

Summary Findings of the AoS

3.12.9 The impacts on landscape and cultural heritage of the three options would not be significantly different. Nuclear power stations, CCGT power stations and renewables generating infrastructure can all have adverse impacts. The size of the impacts will depend upon the size of the development and this will be assessed at the project level.

Government's preferred alternative

3.12.10 Having considered the findings of the AoS and other information, the Government's preferred option is to take forward the Nuclear NPS. The Government considers that a Nuclear NPS would not result in significantly worse impacts on landscape and cultural heritage than the options of NPS that prohibits Nuclear and No NPS. The exact scale of the impacts on landscape and cultural heritage, and possible mitigations, will not be known until the project level. Each application for development consent will require an Environmental Impact Assessment where these issues will be explored in more detail.

3.13 Summary of Assessment of Needs Alternatives

Overall Findings of the AoS

3.13.1 On balance, and on the basis of the above assessment, the preferred alternative is the Nuclear NPS in line with Government policy. This is based on the case for nuclear power in relation to other alternatives, and the effect it might have on the long-term ability of the UK to meet its emission reduction targets and maintain its security of supply. If nuclear power proves economically competitive in a low carbon economy, then its contribution to a sustainable future should be viable.

Government's preferred alternative

3.13.2 After having considered the sustainability impacts of constructing energy infrastructure in line with a Nuclear NPS, NPS that prohibits Nuclear and No NPS, the Government has concluded that the Nuclear NPS is the preferred option to take forward.

3.13.3 As stated in the Nuclear White Paper, the Government believes that, with the exception of radioactive waste, the environmental impacts of new nuclear power stations would not be significantly different to those of other forms of electricity generation[100]. In terms of CO_2, NOx and particulate matter emissions, the construction and operation of new nuclear power stations in accordance with a Nuclear NPS would result in lower emissions during operation than would result from CCGT power stations built under the NPS that prohibits Nuclear option and any CCGT power stations which came forward under the No NPS option.

3.13.4 The Nuclear NPS option would

- not result in significant emissions of CO_2, NOx and particulate matter to the atmosphere;
- improve the UK's security of supply, and would reduce the UK's reliance on imported gas;

100 Meeting the Energy Challenge: A White Paper on Nuclear Power, BERR, January 2008, p103.

- deliver low-carbon electricity at least cost, thereby contributing to emissions reduction targets and the fight against climate change;
- not be subject to fossil fuel price volatility; and
- not result in greatly increased risks to health and safety due to the strict regulatory regime in place.

3.13.5 In relation to the radioactive wastes the draft Nuclear NPS states that the Government is satisfied that effective arrangements will exist to manage and dispose of the waste that will be produced from new nuclear power stations will produce.

3.13.6 The NPS that prohibits Nuclear option would:

- make the UK reliant on renewables and CCS technologies for reducing carbon emissions;
- increase the risk of the UK not meeting its carbon reduction targets;
- make the UK reliant on a smaller number of technologies which may undermine security of supply;
- expose the UK to higher risk of electricity supply interruptions; and
- incur higher costs to deliver the same amount of electricity.

3.13.7 New nuclear power stations are needed because:

- nuclear power is a proven technology and has the benefits of being low-carbon with lifecycle CO_2 emissions in the range of 7-22g/kWh, about the same as those of wind generated electricity[101]; and
- they are capable of increasing diversity and reducing our dependence on any one technology or country for our energy or fuel supplies;

3.13.8 Failure to meet this need for new nuclear power generation will increase the risk of the Government not meeting its energy and climate change goals, encompassing economic, environmental and social objectives, which are aimed at achieving a better quality of life for all, now and in the future.

3.13.9 Failure to grant timely development consent for new nuclear power stations would significantly increase the risk of the UK failing to meet its CO_2 reduction targets, because of the greater reliance being placed on fewer technologies, some of which have yet to be proven on a commercial scale[102].

3.13.10 The Government concluded that the preferred option is to prepare a draft Nuclear NPS in line with Government policy. The following Chapter 4 sets out the findings of the AoS for alternatives for the process of developing the NPS.

101 Meeting the Energy Challenge: A White Paper on Nuclear Power, BERR, January 2008, p58.

102 Meeting the Energy Challenge: A White Paper on Nuclear Power, BERR, Jan 2008, p17, http://www.berr.gov.uk/files/file43006.pdf

4. Alternatives Assessment for the draft Nuclear NPS: Process Alternatives

4.1 Process Alternatives Considered

4.1.1 Having decided to proceed with a draft Nuclear NPS, the contents of the draft Nuclear NPS will influence the number, location and timing of any new nuclear build. The Government has a choice about the way in which it develops the Nuclear NPS. The realistic and meaningful options were set out in the Update Report[103] and are summarised as follows:

- B1: a Nuclear NPS that includes siting criteria only and no list of sites;
- B2: a Nuclear NPS that includes a list of sites and no siting criteria;
- B3: a Nuclear NPS that includes siting criteria and a list of sites; and
- B4: a Nuclear NPS that includes siting criteria and a list of sites but restricts the sites considered to those in the vicinity of existing nuclear power stations.

4.2 Assumptions Made in the AoS Assessment, What are the Process Alternatives Likely to Mean in Practice?

4.2.1 A number of assumptions have been made in assessing the likely significant sustainability effects of the four process options for the draft Nuclear NPS.

4.2.2 Alternative B1 – the IPC would consider applications for development consent with an NPS which sets out the national need and a list of siting criteria but not the list of nominated sites. This would result in later and smaller scale deployment of new nuclear build than an NPS including a list of sites (Option B3), as it could take longer to bring a site forward for development. It may also reduce the chances of sites being brought forward at all. The inclusion of siting criteria should assist in the identification of suitable sites, but in the absence of a list of potentially suitable sites, strategic, cumulative and synergistic effects would not be assessed. This could lead to the inadequate consideration of alternative sites, with potentially long-term negative effects. Overall, Alternative B1 could result in a greater level of uncertainty about where sites would be developed and would allow less consideration of interactions between sites.

4.2.3 Alternative B2, in which a list of nominated sites is presented without any siting criteria, is likely to result in later and smaller scale deployment of new nuclear build, as planning regulations would require the nominated sites to be subject to a (later) strategic siting assessment. Further, there would be no way of knowing how sites not included would be assessed by Government. Excluding siting criteria may also allow non-suitable sites to be included. However, publishing a list of nominated sites would enable the strategic, cumulative and synergistic effects to be assessed.

103 DECC January 2009 Applying the Strategic Siting Assessment Criteria; an update to the study of the potential environmental and sustainability effects.

4.2.4 Alternatives B3 and B4 represent a Nuclear NPS in which both siting criteria and a list of nominated sites are included; in the case of B4, the list of sites is restricted to those in the vicinity of existing nuclear power stations. It has been assumed that both option B3 or B4 will lead to the earlier and larger scale deployment of new nuclear power stations than would be the case for B1 or B2. This is because the planning process would be shorter, the sites would already have been subject to strategic scrutiny, significant information would already be available and, in the case of B4, there may be local support for development in these areas. The application of siting criteria would also help avoid the selection of those sites which could have adverse sustainability effects. This would also allow for potential cumulative and synergistic effects to be examined, thereby minimising the potential negative effects and maximising the potential positive effects. In the case of B4, this would have long-term positive effects by protecting the natural and built environment, and may allow for the protection of areas that would otherwise have been considered for new nuclear build. Alternative B4 may however result in fewer new nuclear power stations being built, as new build could only occur in the vicinity of existing nuclear power stations.

4.3 Findings

4.3.1 The following table summarises the appraisal of the significant sustainability effects of alternatives B1 to B4. This appraisal has been carried out using the headline Sustainable Development (SD) topics used for the appraisal of needs alternatives in Chapter 3 and which are described in Chapter 2. Table 4.1 identifies the main differences between the process alternatives in the light of the assumptions presented above.

Table 4.1 Likely Significant Sustainability Effects of the Process Alternatives

Topics	Significant sustainability effects of the process alternatives
Climate Change	In the short-term, construction of nuclear power stations and ancillary developments would lead to an increase in CO_2 emissions (as with constructing any power station). **Alternatives B3** and **B4** will assist the UK in its climate change goals. **Alternative B4** could reduce the need for ancillary development such as new access roads and transmission infrastructure which could, in their construction, lead to increased CO_2 emissions. **Alternative B4** could result in greater carbon reduction benefits during the construction phase. **Alternative B4** could, however, limit the number of nuclear power stations which might be developed and the amount of low-carbon electricity which is produced in the long-term.

Topics	Significant sustainability effects of the process alternatives
Security of Energy Supply	**Alternative B1** could adversely affect security of supply in the long-term. **Alternative B2** could adversely affect security of supply in the long-term. **Alternative B3** could have a positive impact on security of supply in the long-term. By reducing the potential number of sites for new nuclear build, **Alternative B4** could adversely affect security of supply in the long-term.
Health and Safety (population, human health)	**Alternative B1** could reduce the level of certainty of the likely human health and well-being effects of developing new nuclear power stations across the UK. For example, it would not be possible to assess the potential effects of a nominated site on the nearby population and communities. However, the UK has strict, independent, safety and environment protection regimes for nuclear power which fulfil the requirements of the Euratom Treaty with regard to radiation protection. Any new nuclear power station will be subject to safety licensing conditions and will have to comply with the safety and environmental conditions set by the regulators in their licences and authorisations. This would apply to all alternatives and would ensure that human health and well-being issues are considered. However, Alternative B1 would not subject them to the same degree of strategic scrutiny. **Alternative B2** could reduce the level of certainty of the likely human health and well-being effects of developing new nuclear power stations across the UK. All sites developed would be subject to the UK's strict regulatory regimes. **Alternative B3** could help to increase certainty and understanding of the likely human health and well-being effects that would occur at a strategic level. However, all sites developed would be subject to the UK's strict regulatory regimes. **Alternative B4** could help to increase certainty and understanding of the likely human health and well-being effects that would occur at a strategic level. This alternative could also result in a better understanding of how human health and well-being had historically been affected at, and in, the vicinity of the existing sites. This could help to inform future judgments. Although these experiences could also be applied when trying to understand the human health and well-being effects of potential locations for new nuclear power stations in entirely new areas.
Radioactive Waste Generation	**Alternative B3** is likely to lead to the earlier and larger scale deployment of new nuclear power stations. This would mean that radioactive waste from the new build programme will begin to be generated at an earlier date and that more radioactive waste in total may be produced, if more nuclear power stations are developed.

Topics	Significant sustainability effects of the process alternatives
The Natural Environment	**Alternative B1** could result in adverse long-term effects on the natural environment and reduce the level of certainty about the effects that are likely to be the most significant. **Alternative B2** could result in new nuclear build being located at inappropriate sites which could have long-term negative effects on the natural environment. **Alternative B3** could have long-term positive effects by helping to protect the natural environment. **Alternative B4** could have long-term positive effects for the natural environment. The development of new nuclear power station sites at or in the vicinity of existing sites might help to reduce some of the adverse environmental effects on the natural environment that could occur if sites other than existing nuclear power stations were selected. This could also lead to indirect protection of other areas of value at other locations across the UK, by focussing further development around existing sites. However since the development of some of the existing nuclear power station sites some additional internationally and nationally designated ecological sites have been identified. Careful design and siting would be needed to ensure that adverse effects did not occur as a result of the construction of new nuclear power stations at the existing sites. There could also be a greater likelihood of brownfield rather than greenfield sites being developed which would help to reduce the likelihood of loss of biodiversity, infiltration capacity and the introduction of contamination into such areas.

Topics	Significant sustainability effects of the process alternatives
The Built Environment	**Alternative B1** could provide less direction to the IPC in terms of strategic site suitability. This could increase development costs as there would still be a need to assess strategic suitability issues when development consent is sought for individual sites. While this alternative would not prevent a developer from putting forward an application for development consent on an individual site, there may be advantages in terms of greater planning certainty and reduced risk in putting forward a planning application on a site which is listed in the Nuclear NPS. This option may also result in adverse long-term effects on landscape and cultural heritage and reduce the level of certainty about the effects that are likely to be the most significant. **Alternative B2** could reduce uncertainty for developers, and may also reduce the burden on the IPC when they have to make decisions about site specific applications for development consent, as the sites developed would be listed in the Nuclear NPS. This could also result in new nuclear build being located at inappropriate sites which could have long-term negative effects on landscape and cultural heritage. **Alternative B3** could have benefits as it would reduce the burden on the IPC, thereby reducing the length and cost of planning inquiries, as the sites likely to be developed would be listed in the Nuclear NPS. Early assessment of specific sites listed on the NPS could also have long-term positive effects by helping to identify and protect the landscape and cultural heritage. **Alternative B4** could potentially reduce the capital cost involved in developing new nuclear power stations for developers. This alternative, by including a list of sites in the NPS, could also potentially help reduce uncertainty for developers and may reduce the burden on the IPC when they have to make decisions about site specific applications for development consent, as the sites would be listed in the NPS.

Topics	Significant sustainability effects of the process alternatives
The Built Environment continued	The use of existing sites could result in a greater degree of certainty about the effects on the landscape and cultural heritage because there would be an understanding of how the environment had previously been affected by such development. This could help also to protect other areas of the UK from being disturbed by such development and the overall landscape effect might be reduced, as the focus would be on developing those areas of land that had already been affected by existing nuclear power stations. Availability of sites is a key issue for developers seeking to build new nuclear power stations in the UK.

4.3.2 On the basis of the above assessment the preferred alternative is B3. This alternative combines siting criteria and a list of nominated sites and would therefore provide a structured and robust means of subjecting potential new nuclear power station sites to strategic scrutiny and sustainability appraisal. Further, an assessment of alternative sites would be undertaken, and the publication of a list of potentially suitable sites would enable the potential cumulative and synergistic effects of the sites to be assessed. In addition, the list of sites would have undergone a strategic level assessment which could reduce the likelihood of adverse sustainability effects occurring and provide a means of enabling such effects to be avoided or mitigated.

4.3.3 This would reduce uncertainty and the length of time for a planning application as it would list sites which have been assessed at a strategic level. This would also allow for greater and earlier new nuclear build thereby contributing to meeting the Government's climate change and security of supply objectives at least cost.

4.3.4 Alternative B4 uses the same approach as Alternative B3 but would apply the criteria only to existing nuclear power station sites. We recognise that there are significant sustainability benefits associated with taking only existing sites forward in terms of the ancillary developments needed. However, by limiting new nuclear power stations to existing sites, some potentially suitable sites could be excluded from the selection process leading to an incomplete assessment of alternative sites. In addition, competition may be restricted in nuclear energy generation, which could lead to inefficiencies.

4.3.5 Therefore, the Government concluded that a draft Nuclear NPS should be developed in line with Government policy and that the Nuclear NPS should take the form of B3 and include siting criteria and a list of sites. The following Chapter 5 sets out how the Government has considered where nuclear power stations should be located.

5. Location Alternatives

5.1 Introduction

5.1.1 Government has considered where new nuclear power stations should be located through the Strategic Siting Assessment process. Sites were nominated by third parties and the Government has assessed them against SSA criteria and taken account of the Appraisal of Sustainability and Habitats Regulations Assessment in reaching a decision about their potential suitability. The Appraisals of Sustainability reports for the sites considered potentially suitable by the SSA process are set out in Annexes A to J.

5.1.2 It was considered that the criteria themselves constituted reasonable alternatives with regard to the SEA Directive and therefore, the draft criteria were subject to AoS using the framework of AoS objectives. The findings of this appraisal were reported in the Environmental and Sustainability Report[104] in July 2008. Three criteria for the SSA were amended as a result of the public consultation and these were reappraised using the AoS framework and reported in the Update Report[105] in January 2009. The SSA process is summarised here in this AoS Report and the findings of the AoS of the criteria are also summarised within this Main AoS Report.

5.2 Findings of the AoS

The Strategic Siting Assessment Process (SSA) and Criteria

5.2.1 The SSA is a process developed for identifying and assessing the strategic suitability of nominated sites to be operational by the end of 2025. The SSA process comprises a number of stages:

- development of the SSA criteria and the process for identifying and assessing potentially suitable sites;
- the Government proposed to invite third parties to nominate sites which they consider to be suitable for the construction of new nuclear power stations; and
- nominated sites were to be assessed for potential suitability using the SSA criteria.

5.2.2 These proposals for the SSA process and the draft SSA criteria were subject to public consultation and in July 2008 the draft SSA criteria were published alongside environmental and sustainability studies that appraised the potential effects of the draft SSA criteria.

104 BERR July 2008 Applying the proposed Strategic Siting Assessment Criteria: A study of the potential environmental and sustainability effects.

105 DECC January 2009 Applying the Strategic Siting Assessment Criteria; an update to the study of the potential environmental and sustainability effects.

5.2.3 The draft proposed SSA criteria comprised a list that were variously exclusionary, discretionary or flagged for local consideration summarised as follows:

- Criteria related to nuclear safety: seismic risk: capable faulting; flooding; tsunami, storm surge, coastal processes; proximity to hazardous facilities and operations; proximity to civil aircraft movements; demographics, proximity to military activities.
- Criteria related to environmental protection: internationally and nationally designated sites of ecological importance.
- Criteria related to operational requirements: size of site; access to suitable sources of cooling water.
- Local criteria related to nuclear safety: non-seismic ground conditions; meteorological conditions; proximity to civil aircraft movements, mining, drilling and other underground operations; emergency planning.
- Local criteria related to societal issues: significant infrastructure/resources.
- Local criteria related to operational requirements: access to transmission infrastructure.

Appraisal of Environmental and Sustainability Effects

5.2.4 The Scoping Report (March 2008)[106] set out the proposed framework for appraisal including a review of relevant plans and programmes, the baseline situation against which the appraisal would be made, a list of SEA objectives and decision aiding questions that would be used to consider the likely effects of the proposed SSA criteria on environmental and sustainability factors relevant to the development of a draft Nuclear NPS. The framework of objectives for the appraisal was set out previously in Chapter 2 in Tables 2.2 to 2.6.The details of the findings of the appraisal are set out in the Environmental and Sustainability Report (July 2008). It was acknowledged that the appraisal was a strategic assessment since at that stage it was not known where the new nuclear power stations might be suitable for building. The main findings of the study were reported in two ways:

- Effects of the collective proposed SSA criteria on each environmental/sustainability objective; and
- Effects of the individual proposed SSA criteria on each environmental/sustainability objective.

5.2.5 Where any likely significant adverse effects were identified, the study suggested measures to mitigate the effects by amendments to the wording of the criteria, proposals to remove or add new criteria, and considerations to be taken into account at a later stage when the sites were nominated.

106 BERR (March 2008) Consultation on Strategic Environmental Assessment for proposed National Policy Statement for new nuclear power, URN 08/680QAN, http://www.berr.gov.uk/files/file45240.pdf

5.2.6 The studies concluded that:

- the proposed SSA criteria were broadly in line with sustainability and environmental objectives;
- the discretionary nature of some criteria means that adverse environmental effects cannot be ruled out at the strategic level; and
- certain local level impacts are not addressed by the SSA but it is made clear that these would be addressed through EIAs accompanying individual planning applications.

The Update Report

5.2.7 As a result of the public consultation responses, the Government made a small number of amendments to the proposed SSA criteria. Generally these changes related to a change in classification, for example, from a national exclusionary criterion to one that will be considered at the local level. It was considered that some criteria are more appropriately assessed at the local level, recognising that assessment at the strategic level is not capable of adequately addressing these issues.

5.2.8 The key amendments to the SSA criteria proposed as a result of the consultation were as follows:

- Size of site to accommodate operation: previously included size of site to accommodate construction and decommissioning which was amended to be flagged for local consideration;
- seismic risk (vibratory ground motion): change from exclusionary to flag for local consideration;
- capable faulting: change from exclusionary to flag for local consideration; and
- tsunami, storm surge and coastal processes; tsunami and storm surge to be merged with flood risk and coastal processes to become a separate criterion.

5.2.9 These amended SSA criteria were appraised strategically using the environmental and sustainability objectives and the sustainability effects of the changes were generally found to be neutral or minor. Therefore, it was concluded that the changes did not materially change the conclusions reached in the environmental and sustainability study that the proposed SSA criteria are broadly in line with the principles.

5.3 The AoS of Sites included in the draft Nuclear NPS

5.3.1 The agreed SSA criteria were applied to the 11 sites that were nominated into the selection process. One nominated site, Dungeness, did not pass the SSA discretionary criteria on biodiversity and there were concerns about flood risk and coastal processes. The Government therefore decided that Dungeness would not be included in the draft Nuclear NPS.

5.3.2 The Government also commissioned an Alternative Sites Study to ensure that potential alternative sites were given due consideration. The study drew on a number of information sources to identify sites that might be "worthy of further consideration" by the Government to determine whether these sites were suitable for the deployment of new nuclear power stations by 2025. Three sites were identified through this process; Druridge Bay in Northumberland, Kingsnorth in Kent, and Owston Ferry in Lincolnshire. A site AoS and HRA was undertaken for each of these sites, the findings of which are available separately. **After further assessment the Government's preliminary view is that none of these three sites should be considered as reasonable alternatives to the sites that have been nominated, and therefore should not be included in the Nuclear NPS. This is because the Government considers that these sites are not credible for deployment by the end of 2025. The full details of the Government's assessment is set out in individual site summaries in the draft Nuclear NPS.**

5.3.3 The ten sites that were considered potentially suitable and were included in the NPS were appraised as part of the AoS of the Nuclear NPS. The findings of the site level appraisals for these sites are given in the site level AoS Reports (Annexes A – J) and are summarised in Chapter 7 of this Main AOS Report.

6. Radioactive Waste, Spent Fuel and Hazardous Waste

6.1 Introduction

6.1.1 The draft Nuclear NPS sets out the Government's view on the arrangements for the management and disposal of the waste that will be produced from new nuclear power stations in accordance with the Government policy stated in the Nuclear White Paper that: "before development consents for new nuclear power stations are granted, the Government will need to be satisfied that effective arrangements exist or will exist to manage and dispose of the waste they will produce".

6.1.2 New nuclear power stations will produce a range of different waste streams. Assuming that there will be no reprocessing of spent fuel from new nuclear power stations, as set out in the Nuclear White Paper, the Nuclear NPS identifies "higher activity wastes" as being spent fuel and intermediate level waste (ILW). New nuclear power stations will also produce other waste streams: low level waste (LLW), liquid and gaseous discharges and non-radioactive wastes.

6.1.3 This chapter of the AoS appraises the sustainability of the arrangements for managing both the higher activity wastes and other radioactive and hazardous wastes and considers the following waste streams:

- Spent Fuel;
- Intermediate Level Waste (ILW);
- Low Level Waste (LLW);
- Gaseous and Liquid Radioactive Discharges;
- Non Radioactive Hazardous Wastes.

6.1.4 The management of non-radioactive, non-hazardous waste is detailed in the site level AoSs (see Annexes A – J) under the AoS topic for Communities: Supporting Infrastructure. The key findings are summarised in Chapter 7 of this Main AoS report under this topic.

6.1.5 The findings of the appraisals of sustainability of the management of radioactive waste, spent fuel and hazardous wastes are summarised in this chapter and are supported by additional technical information on waste management that is included in Annex K that accompanies this Main AoS Report. Each waste stream is appraised in turn and any recommendations in relation to management of radioactive or hazardous wastes are presented at the end of each section. These recommendations are repeated in the section of Chapter 7 that deals with radioactive and hazardous waste.

6.1.6 In the absence of reprocessing, spent fuel is considered to be waste for the purposes of this Appraisal. The impacts of radioactive wastes that may arise from new nuclear power stations are dependent on the inventory of wastes generated. An estimate of the inventory of radioactive waste arising from new nuclear power stations and the legacy waste already generated is presented in Annex K: Section 1 – Baseline information.

6.1.7 The management of radioactive waste, spent fuel and hazardous waste is a cross-cutting activity and there may be effects on a number of the objectives for sustainability as defined within the AoS framework (detailed previously in Section 2.4 of this Main AoS). The appraisal of each of the waste streams has been undertaken using the sustainable development topics and AoS objectives set out in Table 2.2.

6.1.8 The effects of waste management may arise at a nuclear power station site or offsite at other locations, where management or disposal of waste is undertaken. There may also be effects associated with the transport of waste between nuclear power stations and waste management sites. The current appraisal has distinguished between effects arising at nuclear power stations and in the course of transport of waste from these sites and those effects arising at the locations where waste is disposed. This distinction is intended to assist in separating:

- Effects arising at nuclear power stations or in the transport of waste from them that are relevant to the draft Nuclear NPS and that have led to recommendations for further consideration by the IPC when considering applications for development consent for new nuclear power stations, from
- Effects arising at the locations where waste is disposed of offsite, that are noted for the consideration of those responsible for the design and consenting processes for these waste management facilities.

6.1.9 In line with Government policy on the management of higher activity waste, this appraisal considers a Geological Disposal Facility (GDF) as the final destination for new build spent fuel and ILW. However, the appraisal presented in this section is not a detailed assessment of this facility. It is expected that as the concept design and location are finalised, Strategic Environmental Assessments and Environmental Impact Assessments[107] for a GDF will be completed.

6.2 Policy Context

6.2.1 This section considers the UK policy context as it relates to radioactive and hazardous waste. It identifies key significant policy objectives at the national level that need to be considered for the strategic appraisal of radioactive waste. Annex K: Section 2 presents a summary of the significant national and international policy and legislation in relation to radioactive and hazardous waste and provides context to the AoS of waste. The key sustainability objectives drawn from this review of relevant plans, programmes and environmental objectives are summarised in Table 6.1 that need to be taken into account during the AoS for each of the waste streams considered.

107 NDA document – Geological Disposal: A strategy for Sustainability Appraisal and Environmental Assessment, www.nda.gov.uk/documents/upload/Geological-Disposal-A-Strategy-for-Sustainability-Appraisal-and-Environmental-Assessment-July-2009.pdf

Table 6.1 Key sustainability objectives for waste management

Relevant national policy documents	Key objectives for sustainability
Spent Fuel	
The Future of Nuclear Power[108] The MRWS White Paper[109] Consultation on Funded Decommissioning Programme Guidance for New Nuclear Power Stations[110]	Safe and secure interim storage systems that are technically capable of being maintained or replaced to last for at least 100 years from the time the waste is first emplaced[111]
Intermediate level waste (ILW)	
The MRWS White Paper[112] Consultation on Funded Decommissioning Programme Guidance for New Nuclear Power Stations[113] The Future of Nuclear Power[114]	Safe and secure interim storage systems that are technically capable of being maintained or replaced to last for at least 100 years from the time the waste is first emplaced[115] Application of the waste management hierarchy[116]
Low level waste (LLW)	
Policy for Long-Term Management of Solid LLW in the United Kingdom[117] Low Level Waste: Draft Nuclear Industry LLW Strategy[118]	Application of the waste management hierarchy[119] Preservation of disposal capacity at Low Level Waste Repository in west Cumbria Application of BPEO/BPM or BAT[120] to reduce waste arisings

108 http://www.berr.gov.uk/files/file39197.pdf
109 Managing Radioactive Waste Safely: a Framework for Implementing Geological Disposal www.decc.gov.uk/mrws
110 Consultation on Funded Decommissioning Programme Guidance for New Nuclear Power Stations http://www.berr.gov.uk/files/file44486.pdf
111 http://www.berr.gov.uk/files/file44486.pdf It should be noted that operators will be obliged to maintain their interim stores until the date or dates specified in the schedule agreed with the Government for when the Government will take title to and liability for each operator's intermediate level waste and spent fuel. In any event, the Government considers that waste can and should be stored in safe and secure interim storage facilities until a geological disposal facility becomes available.
112 See footnote 109.
113 See footnote 110.
114 http://www.berr.gov.uk/files/file39197.pdf
115 See footnote 110. It should be noted that operators will be obliged to maintain their interim stores until the date or dates specified in the schedule agreed with the Government for when the Government will take title to and liability for each operator's intermediate level waste and spent fuel. In any event, the Government considers that waste can and should be stored in safe and secure interim storage facilities until a geological disposal facility becomes available.
116 A hierarchical approach to minimise the amount of waste requiring disposal. The hierarchy consists of non-creation where practicable, minimisation of arisings where the creation of waste is unavoidable, recycling and reuse, and only then disposal.
117 Policy for the long term management of solid low level radioactive waste in the United Kingdom www.decc.gov.uk/en/content/cms/whatwedo/uksupply/energymix/nuclear/radioactivity/waste/low/low.aspx
118 Draft NDA UK Nuclear Industry LLW Strategy www.nda.gov.uk/documents/upload/UK-Strategy-for-the-Management-of-Solid-Low-Level-Radioactive-Waste-from-the-Nuclear-Industry-Consultation-Document-June-2009.pdf
119 See footnote 116.
120 The Government through guidance to the EA is replacing BPM / BPEO in England and Wales with Best Available Techniques (BAT).

Relevant national policy documents	Key objectives for sustainability
Liquid and gaseous radioactive discharges	
Establishment of Basic Safety Standards[121] Radioactive Substances (Basic Safety Standards) (England and Wales) Direction 2000[122] UK Strategy for radioactive discharges[123] OSPAR Commission, The Convention for the Protection of the Marine Environment of the North-East Atlantic[124]	Dose limit of 1mSv/y to the public from all manmade sources of radioactivity The conservation of the marine ecosystems and safeguarding of human health in the North-East Atlantic by preventing and eliminating pollution; by protecting the marine environment from the adverse effects of human activities; and by contributing to the sustainable use of the seas
Non-radioactive hazardous waste	
Nuclear Sector Plan[125] Waste Strategy for England[126] National Waste Strategy for Wales[127]	Minimise and manage solid waste[128] Secure investment in infrastructure needed to divert waste from landfill and for the management of hazardous waste[129]

121 The basic safety standards of 13th May 1996 are focussed on the new scientific findings in radiological protection contained in the ICRP Publication 60. The member states of the EU are obliged to enact the required national legal and administrative regulations to implement the Euratom basic safety standard by 13th May 2000.

122 Establishes doses to individuals from a defined sources; 0.3 mSv per year from any new source, 0.5 mSv per year for the discharges from any single site. www.decc.gov.uk/en/content/cms/whatwedo/uksupply/energymix/nuclear/radioactivity/government/legislation/eudirectives/eudirectives.aspx

123 The UK's revised Strategy for Radioactive Discharges was published in July 2009. The revised strategy is an update on the 2001-2020 strategy issued in 2002 and demonstrates how the Government will continue to implement the OSPAR Strategy for radioactive substances, UK Strategy for Radioactive Discharges 2006-2030 www.decc.gov.uk/en/content/cms/whatwedo/uksupply/energymix/nuclear/radioactivity/government/discharges/strategy/strategy.aspx

124 Report by the United Kingdom on Intentions for Action at the National Level to Implement the OSPAR Strategy with Regard to Radioactive Substances, http://www.defra.gov.uk/environment/marine/ospar.htm

125 http://publications.environment-agency.gov.uk/pdf/GEHO1208BPDD-e-e.pdf

126 www.defra.gov.uk/ENVIRONMENT/WASTE/strategy/index.htm

127 Wise about Waste: The National Waste Strategy for Wales Part One June 2002 www.cymru.gov.uk/desh/publications/enviroprotect/wasterecycle/wisewaste/pt1e.pdf;jsessionid=c769Kt0ZWFYrkqd106Q0GRScWxyynJDJbJN2T1SyLxSWgdHgj7qG!-327878142?lang=en

128 http://publications.environment-agency.gov.uk/pdf/GEHO1208BPDD-e-e.pdf, page 37.

129 www.defra.gov.uk/ENVIRONMENT/WASTE/strategy/index.htm Page 29.

6.3 Appraisal of Sustainability

6.3.1 Each waste stream has been appraised using the AoS appraisal framework. The appraisals are based on the inventory of radioactive waste presented in Annex K: Section 1 Annex K presents the appraisal matrices for each waste stream showing how sustainability has been appraised against the AoS topics for each of the main project phases: construction, operation and decommissioning.
The appraisal for each waste stream is presented under the following headings:

- Definition of waste type;
- Baseline;
- Waste management implications of the Nuclear NPS;
- Findings of the appraisal for nuclear power station sites;
- Considerations for offsite waste management facilities;
- Recommendations.

6.4 Spent Fuel

Definition

6.4.1 Spent fuel is defined in regulation as "nuclear fuel that has been irradiated in and permanently removed from a reactor core; spent fuel may either be considered as a usable resource that can be reprocessed or be destined for final disposal with no further use foreseen and treated as radioactive waste"[130]. The Government has stated that the building of new nuclear power stations in the UK should proceed on the basis that spent fuel will not be reprocessed and therefore for the purposes of this assessment, spent fuel is treated as waste[131].

Baseline

6.4.2 The baseline UK inventory for spent fuel possibly requiring disposal in a GDF, without the development of any new nuclear power stations, is presented in the MRWS White Paper[132] as 11,200m^3, representing 2.3% of the total volume of legacy waste and 51.6% of the radioactivity[133]. This figure is based on a number of assumptions and is taken as indicative of the existing legacy amounts, but recognising that it may change over time. In addition to spent fuel, the legacy inventory also includes a substantial amount of High Level Waste (HLW), which is the result of the reprocessing of spent fuel. HLW will also need to be disposed of in a GDF.

130 Atomic Energy and Radioactive Substances, The Trans-frontiers Shipment of Radioactive Waste and Spent Fuel Regulations 2008, Statutory Instruments 2008 No. 3087.

131 Meeting the Energy Challenge: A White Paper on Nuclear Power, BERR, January 2008, http://www.berr.gov.uk/files/file43006.pdf page 31.

132 Managing Radioactive Waste Safely: a Framework for Implementing Geological Disposal Table 1, page 20. www.decc.gov.uk/mrws.

133 The waste inventory presented in the Managing Radioactive Waste White Paper (DEFRA et al, June 2008) was developed from the 2007 UK Radioactive Waste Inventory and the baseline inventory for high activity wastes present by CoRWM (CoRWM, July 2005) and included the total amounts of radioactive wastes and other materials that could possibly be regarded as waste in the future.

Waste management implications of the Nuclear NPS

6.4.3 There is uncertainty around the quantity of spent fuel that might be produced by a new nuclear programme. The volume of spent fuel produced by a single new nuclear power station depends on a number of factors, including the capacity of the plant, its operational lifetime and various other operational considerations (including burn-up).

6.4.4 The Consultation on the Future of Nuclear Power contained some figures on the impact of a new build programme on the "footprint" of geological disposal facilities. In relation to spent fuel, it was estimated that a new build programme equivalent to 10 AP-1000s would increase the footprint of a dedicated HLW/spent fuel geological disposal facility by around 90%[134].

6.4.5 More recent work by NDA means it is now possible to update this estimate . NDA has, as part of their disposability assessments under the Generic Design Assessment (GDA) process[135], which reported its findings to the "Requesting Parties"[136], produced estimates for the lifetime spent fuel for the new nuclear power station designs being appraised in the GDA process[137]. NDA has considered the potential impact on the size of a GDF of the disposal of spent fuel from a single new nuclear reactor and from a 10GW new nuclear programme. 10GW equates to nine AP-1000 reactors and six EPR reactors.

6.4.6 The NDA has estimated that an AP-1000 operating for 60 years would give rise to an estimated 640 disposal canisters[138], requiring an area of approximately 0.11km^2 for the associated disposal tunnels. A fleet of nine such reactors would require an area of approximately 1km^2, excluding associated service facilities. This represents approximately 6% of the area required for legacy HLW and spent fuel per reactor, and approximately 55% for the illustrative fleet of nine AP-1000 reactors.

6.4.7 The NDA has estimated that an EPR operating for 60 years would give rise to an estimated 900 disposal canisters, requiring an area of approximately 0.15km^2 for the associated disposal tunnels. A fleet of six such reactors would require an area of approximately 0.9km^2, excluding associated service facilities. This represents approximately 8% of the area required for legacy HLW and spent fuel per reactor, and approximately 50% for the illustrative fleet of six EPR reactors.

134 The Future of Nuclear Power: Consultation document 2007, page 135. http://www.berr.gov.uk/files/file39197.pdf

135 Through the GDA process the nuclear regulators are assessing the safety, security and environmental impact of power station designs, including the quantities and types of waste that are likely to arise, their suitability for storage, transport and their disposability. More information about GDA is available at the HSE's new nuclear power stations website http://www.hse.gov.uk/newreactors/index.htm

136 The term "requesting party" is used in relation to the GDA process to identify the organisation requesting acceptance for a design through GDA. This request will normally originate from a reactor vendor, however this may also be done as a vendor/operator partnership. Consequently, the term `requesting party' is used to identify the organisation seeking the design acceptance and to distinguish it from a nuclear site licence applicant.

137 Summary Disposability Assessment for the AP-100. http://www.nda.gov.uk/documents/upload/TN-17548-Generic-Design-Assessment-Summary-of-DA-for-Wastes-and-SF-arising-from-Operation-of-APPWR-October-2009.pdf
Summary Disposability Assessment for the EPR. http://www.nda.gov.uk/documents/upload/TN-17548-Generic-Design-Assessment-Summary-of-Disposability-Assessment-for-Wastes-and-Spent-Fuel-arising-from-Operation-of-the-EPWR.pdf

138 The reference design currently being used by NDA RWMD for the purposes of estimating the costs of a geological disposal facility envisages spent fuel being encapsulated in copper canisters prior to disposal. The capacity of a copper canister is four PWR spent fuel assemblies. See page 71 of the MRWS White Paper for more on this.

6.4.8 In the White Paper on Nuclear Power[139] the Government states that progress towards geological disposal should be coupled with a programme of safe and secure interim storage and stated that: "In accepting CoRWMs recommendations in 2006 the Government[140] stated that progress towards geological disposal should be coupled with a programme of safe and secure interim storage and that the design of new stores will allow for a period of interim storage of at least 100 years to cover uncertainties associated with the implementation of a geological repository".

6.4.9 The White Paper on Nuclear Power[141] stated that "Having reviewed the arguments and evidence put forward, the Government believes that it is technically possible to dispose of new higher-activity radioactive waste in a geological disposal facility and that this would be a viable solution and the right approach for managing waste from any new nuclear power stations. The Government considers that it would be technically possible and desirable to dispose of both new and legacy waste in the same geological disposal facilities and that this should be explored through the MRWS programme". This appraisal has been undertaken on this basis.

6.4.10 The MRWS White Paper[142] stated that "a robust programme of interim storage must play an integral part in the long-term management strategy and believes this will provide an extendable safe and secure means to hold waste for as long as it takes to identify a site and to construct a geological disposal facility".

6.4.11 For the purposes of this assessment, final disposal of new nuclear spent fuel is considered to be in a GDF following a period of interim storage at the site of a new nuclear power station. A number of interim storage systems are available, including wet storage, dry storage in vaults and dry storage in casks, and are proven internationally[143]. Wet and dry interim storage, and transport to a GDF has been appraised, where appropriate. Conditioning and packaging of the spent fuel for final disposal will either be performed locally at the new nuclear power station or at a central facility that may be at the site of a GDF. It is expected that detailed site specific plans for the spent fuel will be presented by potential operators of new nuclear power stations for assessment by regulators and planning authorities.

6.4.12 New nuclear power stations are designed to extract more energy from the fuel than previous PWR designs (for example Sizewell B) by leaving it in the reactor for increased irradiation, otherwise known as "burn-up". As a result of this, the inventory of long lived radionuclides in an individual fuel element increases, although comparatively fewer spent fuel elements will require to be managed. In addition,

139 Meeting the Energy Challenge: A White Paper on Nuclear Power, BERR, January 2008, http://www.berr.gov.uk/files/file43006.pdf page 94

140 Response to Report and Recommendations from CoRWM http://mrws.decc.gov.uk/en/mrws/cms/Home/WhatistheGo/WhatistheGo.aspx

141 Meeting the Energy Challenge: A White Paper on Nuclear Power, BERR, January 2008, http://www.berr.gov.uk/files/file43006.pdf page 27

142 Managing Radioactive Waste Safely: a Framework for Implementing Geological Disposal, page 24. www.decc.gov.uk/mrws

143 See page 11 of "The arrangements for the management and disposal of waste from new nuclear power stations: a summary of evidence", which is being published alongside the NPS consultation.

radioactive decay will cause the fuel to be thermally hot and this has implications for storage durations and a GDF design. Following discharge from the reactor spent fuel has to be cooled. Initially this cooling will be in a water filled pool. After a period of pool storage, operators might then transfer their spent fuel to dry storage casks for the remainder of the period of on-site interim storage.

Findings of the appraisal for nuclear power station sites

6.4.13 The appraisal of Spent Fuel using the AoS framework is shown on the appraisal matrices in Annex K: Section 3 and is summarised on Table 6.2. This appraisal covers the construction, operation and decommissioning of spent fuel management facilities, in particular interim storage facilities at a power station site and for transport of the waste offsite for disposal at a GDF.

6.4.14 Some potential significant negative effects associated with the management of spent fuel have been identified. However, these are considered to be of minor strategic significance and similar in nature to the effects produced by other aspects of new power station development. Moreover, although the impacts of waste management are generic, the significance of the effect produced, for example on landscape, will depend on local conditions at each site being developed. This uncertainty is reflected in the appraisal matrix (Table 6.2). The minor negative effects include:

- Effects on air quality during construction and decommissioning due to emissions from construction plant and vehicle movements;
- Effects on biodiversity and ecosystems during construction directly from land take and indirectly from disturbance, air and water quality changes;
- Effects on climate change during construction and decommissioning due to emissions of greenhouse gases from construction plant and vehicle movements;
- Effects on cultural heritage and landscape due to land take and above ground construction;
- Effects on soils, geology and land use due to alteration of soil structure and loss of agricultural or Greenfield land, although these latter effects are site-specific;
- Minor negative effects on water quality during operation and decommissioning due to risk of flooding of the interim storage facilities, leading to possible deterioration in the condition of the stored canisters.

6.4.15 One minor negative effect, which is considered to be of potentially greater significance, is the effect on flood risk. The effect on flood risk occurs during the operation of spent fuel interim storage facilities, due to the long period over which these facilities might need to be in operation. Because the effect on flood risk arises after the end of operation of the power station, this effect has been allocated to the decommissioning phase, although it will last for longer than the period of decommissioning of the power station.

Table 6.2: Summary of the Significance of Potential Strategic Sustainability Effects: Spent Fuel

Sustainable Development Themes:	Significance of potential Strategic effect at each Development stage:		
	Construction	Operation	Decommissioning
Air Quality	–?	0	–?
Biodiversity and Ecosystems	–?	+?	+?
Climate Change	–?	+?	–?
Communities: Population, Employment and Viability	+	+	+
Communities: Supporting Infrastructure	0	0	0
Human Health and Well-Being	0	0	0
Cultural Heritage	–?	–?	–?
Landscape	–?	–?	–?
Soils, Geology and Land Use	–?	–?	–?
Water Quality and Resources	–?	–?	–?
Flood Risk	0	0	–

Key: Significance and Categories of Potential Strategic Effects	
++	Development would resolve an existing sustainability problem; effect considered to be of regional/national/international significance
+	No sustainability constraints and development acceptable; effect considered to be of regional/national/international significance
0	Neutral effect
–	Potential sustainability issues, mitigation and/or negotiation possible; effect considered to be of regional/national/international significance
– –	Development problematical because of known sustainability issues: mitigation or negotiation difficult and/or expensive; effect considered to be of regional/national/international significance
Uncertainty	
?	Where the significance of an effect is particularly uncertain, for example because insufficient information is available at the plan stage to fully appraise the effects of the development or the potential for successful mitigation, the significance category is qualified by the addition of ?

6.4.16 It may be possible to mitigate the effects on flood risk through appropriate design, construction and management of flood protection measures. There may also be an option to remove spent fuel from power station sites for interim storage at an offsite facility before it is deposited in a GDF.

6.4.17 Further assessment will be required at the design, development and planning stage where detailed site-specific proposals for spent fuel management will be made for new nuclear power stations.

6.4.18 The interim storage of spent fuel is an established technology and the MRWS White Paper outlines the concept for UK facilities[144]. Within this, and the current regulatory framework, each developer is responsible for the design of such facilities at a site specific level. It is at this local site specific level that a full understanding of the impacts can be identified, minimised and mitigated.

6.4.19 The appraisal has identified a range of measures that might be taken to mitigate the effects of the management of Spent Fuel and these are reported in Section 3 in Annex K.

Considerations for offsite waste management facilities

6.4.20 In addition to the effects at site level, the draft Nuclear NPS will require additional capacity to be provided at a GDF for the spent fuel arising from the new nuclear power stations. As noted in paragraph 6.4.3 above, disposing of the spent fuel from a 10GW programme of new nuclear power stations in a GDF would require an underground area that equates to 50-55% of the area that will be required for the disposal of legacy spent fuel and HLW.

6.4.21 The Generic Design Assessment includes an assessment of the disposability of the higher activity wastes that will be produced by new nuclear power stations. In a Position Statement produced in February 2009[145], NDA said that early results had not identified any issues which are not being addressed for the existing legacy wastes and nuclear materials[146].

6.4.22 The extant regulatory framework will ensure that the impacts associated with the design and construction of interim storage facilities and a GDF are minimised and mitigated appropriately. The potential effects of the additional inventories of spent fuel on the collective community well-being of potential GDF host communities will be addressed through the MRWS programme.

144 Managing Radioactive Waste Safely: a Framework for Implementing Geological Disposal www.decc.gov.uk/mrws

145 NDA Position Statement issued in February 2009: http://www.nda.gov.uk/documents/upload/RWMDPP01-Management-of-wastes-from-new-nuclear-power-stations-position-statement-February-2009-v1.pdf

146 See footnote 145.

Recommendations

6.4.23 The effects of constructing, operating and decommissioning an interim waste storage facility for spent fuel, including the transport of waste from the site, will need to be part of the assessment of the development consent for each new power station. The contribution due to the interim storage of spent fuel will also need to be taken into account in the radiological and other assessments for granting a site licence.

6.4.24 The effects of the substantial additional volume of spent fuel due to the Nuclear NPS should be taken into account in the evaluation of the impacts of a GDF.

6.5 Intermediate Level Waste (ILW)

Definition

6.5.1 ILW is defined as waste "with radioactive levels exceeding the upper boundaries for low level wastes, but which do not require heating to be taken into account in the design of storage and disposal systems"[147].

Baseline

6.5.2 The baseline UK inventory for ILW provisionally requiring disposal is presented in the MRWS White Paper[148] as 364,000m^3, representing 76.3% of the total volume of legacy waste (excluding LLW suitable for disposal at LLWR) and approximately 2.5% of the radioactivity[149]. This figure is based on a number of assumptions and is taken as indicative of the existing legacy amounts, but recognising that it may change over time[150].

Waste management implications of the Nuclear NPS

6.5.3 ILW will be generated from general operations and decommissioning of new nuclear stations and may include treatment of radioactive effluents from operations, and metal items such reactor components following decommissioning. ILW can also arise from the reprocessing of spent fuel but the Government has stated in the Nuclear White Paper that: "Our view remains that in the absence of any proposals from industry, new nuclear power stations built in the UK should proceed on the basis that spent fuel will not be reprocessed"[151].

147 Command 2919 Review of Radioactive Waste Management Policy Final Conclusions July 1995.

148 Managing Radioactive Waste Safely: a Framework for Implementing Geological Disposal Table 1, page 20. www.decc.gov.uk/mrws

149 The waste inventory presented in the MRWS White Paper was developed from the 2007 UK Radioactive Waste Inventory and the baseline inventory for high activity wastes present by CoRWM and included the total amounts of radioactive wastes and other materials that could possibly be regarded as waste in the future.

150 See footnote 148.

151 Meeting the Energy Challenge: A White Paper on Nuclear Power, BERR, January 2008, http://www.berr.gov.uk/files/file43006.pdf page 31.

6.5.4 The NDA has estimated the amount of ILW that would be generated by new nuclear power stations of the AP-1000 type and EPR type being considered in the Generic Design Assessment (GDA). This assessment has indicated that to dispose of the ILW arising from a 10GW programme of new power stations operating for 60 years in a GDF would require an underground area that equates to less than 10% of the area that will be required for the disposal of legacy ILW[152].

6.5.5 The White Paper on Nuclear Power[153] stated that: "Having reviewed the arguments and evidence put forward, the Government believes that it is technically possible to dispose of new higher-activity radioactive waste in a geological disposal facility and that this would be a viable solution and the right approach for managing waste from any new nuclear power stations. The Government considers that it would be technically possible and desirable to dispose of both new and legacy waste in the same geological disposal facilities and that this should be explored through the Managing Radioactive Waste Safely programme". Higher-activity wastes include ILW and this appraisal has been undertaken on this basis.

6.5.6 In accepting CoRWM's recommendations in 2006, the Government[154] stated that progress towards geological disposal should be coupled with a programme of safe and secure interim storage and that: "The design of new stores will allow for a period of interim storage of at least 100 years to cover uncertainties associated with the implementation of a geological repository."

6.5.7 Site specific plans for ILW management should fully consider the application of the waste management hierarchy, and BAT[155,156] to minimise local impact.

Findings of the appraisal for nuclear power station sites

6.5.8 The appraisal of ILW using the AoS framework is shown on the appraisal matrices in Annex K: Section 4 and is summarised on Table 6.3. This appraisal covers the construction, operation and decommissioning of facilities, in particular interim storage, for managing ILW at a power station site and for transport of the waste offsite for disposal at a GDF.

152 Summary Disposability Assessment for the AP-1000 page 4. Summary Disposability Assessment for the EPR page 6.
153 Meeting the Energy Challenge: A White Paper on Nuclear Power, BERR, January 2008. http://www.berr.gov.uk/files/file43006.pdf page 27.
154 Response to Report and Recommendations from CoRWM http://mrws.decc.gov.uk/en/mrws/cms/Home/WhatistheGo/WhatistheGo.aspx
155 Environment Agency. Radioactive Substances Regulation Environmental Principles. http://publications.environment-agency.gov.uk/pdf/GEHO0709BQSB-e-e.pdf
156 Environment Agency. Radioactive Substances Regulation: Assessment of Best Available Techniques http://publications.environment-agency.gov.uk/pdf/GEHO0709BQSA-e-e.pdf

6.5.9 Some potential significant negative effects associated with the management and storage of ILW have been identified. However, these are considered to be of minor strategic significance and similar in nature to the effects produced by other aspects of new power station development. Moreover, although the impacts of waste management are generic, the significance of the effect produced, for example on landscape, will depend on local conditions at each site being developed. This uncertainty is reflected in the appraisal matrix (Table 6.3). The minor negative effects identified are similar to those for Spent Fuel and include:

- Effects on air quality during construction and decommissioning due to emissions from construction plant and vehicle movements;
- Effects on biodiversity and ecosystems during construction directly from land take and indirectly from disturbance, air and water quality changes;
- Effects on climate change during construction and decommissioning due to emissions of greenhouse gases from construction plant and vehicle movements;
- Effects on cultural heritage and landscape due to land take and above ground construction;
- Effects on soils, geology and land use due to alteration of soil structure and loss of agricultural or greenfield land, although these latter effects are site-specific;
- Minor negative effects on water quality during operation and decommissioning due to risk of flooding of the interim storage facilities, leading to possible deterioration in the condition of the stored waste.

Table 6.3: Summary of the Significance of Potential Strategic Sustainability Effects: Intermediate Level Waste

Sustainable Development Themes:	Significance of potential Strategic effect at each Development stage:		
	Construction	Operation	Decommissioning
Air Quality	–?	0	–?
Biodiversity and Ecosystems	–?	+?	+?
Climate Change	–?	+?	–?
Communities: Population, Employment and Viability	+	+	+
Communities: Supporting Infrastructure	0	0	0
Human Health and Well-Being	0	0	0
Cultural Heritage	–	–	–?
Landscape	–	–	–?
Soils, Geology and Land Use	–?	–?	–?
Water Quality and Resources	–	–	–?
Flood Risk	0	0	–

Key: Significance and Categories of Potential Strategic Effects	
++	Development would resolve an existing sustainability problem; effect considered to be of regional/national/international significance
+	No sustainability constraints and development acceptable; effect considered to be of regional/national/international significance
0	Neutral effect
–	Potential sustainability issues, mitigation and/or negotiation possible; effect considered to be of regional/national/international significance
– –	Development problematical because of known sustainability issues: mitigation or negotiation difficult and/or expensive; effect considered to be of regional/national/international significance
Uncertainty	
?	Where the significance of an effect is particularly uncertain, for example because insufficient information is available at the plan stage to fully appraise the effects of the development or the potential for successful mitigation, the significance category is qualified by the addition of ?

6.5.10 Whilst potential impacts have been identified with the management of ILW arising from new nuclear power stations these will be managed within the planning and legislative framework for new nuclear power stations. The construction of interim storage facilities will have similar impacts to those identified for spent fuel and may affect soils, landscape and climate change but this will be a minor component of the overall nuclear power station development. Site specific assessment will seek to minimise and mitigate impacts.

6.5.11 The appraisal has identified a range of measures that might be taken to mitigate the effects of the management of ILW and these are reported in Section 4 in Annex K. A key mitigation measure is the application of the waste management hierarchy and BAT by developers at the local site level to minimise the impact of ILW.

6.5.12 At this stage of the sustainability assessment process, no significant residual adverse effects associated with ILW have been identified that cannot be managed by developers of new nuclear power stations and through the existing policy frameworks.

Considerations for offsite waste management facilities

6.5.13 The disposal of the additional volumes of ILW from new nuclear power stations to a GDF will have a minor impact on the overall facility size. The size of a GDF is expected to be dominated by legacy ILW, HLW and both legacy and new nuclear spent fuel.

Recommendations

6.5.14 The effects of constructing, operating and decommissioning an interim waste storage facility for ILW, including the transport of waste from the site, will need to be part of the assessment of the development consent for each new power station. The contribution due to the interim storage of ILW will also need to be taken into account in the radiological and other assessments for granting a site licence.

6.5.15 The effects of the small additional volume of ILW due to the Nuclear NPS should be taken into account in the evaluation of the impacts of a GDF.

6.6 Low Level Waste

Definition

6.6.1 Low Level Waste is defined as "radioactive waste having a radioactive content not exceeding four gigabecquerels per tonne (GBq/te) of alpha or 12GBq/te of beta/gamma activity"[157].

6.6.2 Figure 6.1 provides an indication of the range of the levels of radioactivity within the LLW category.

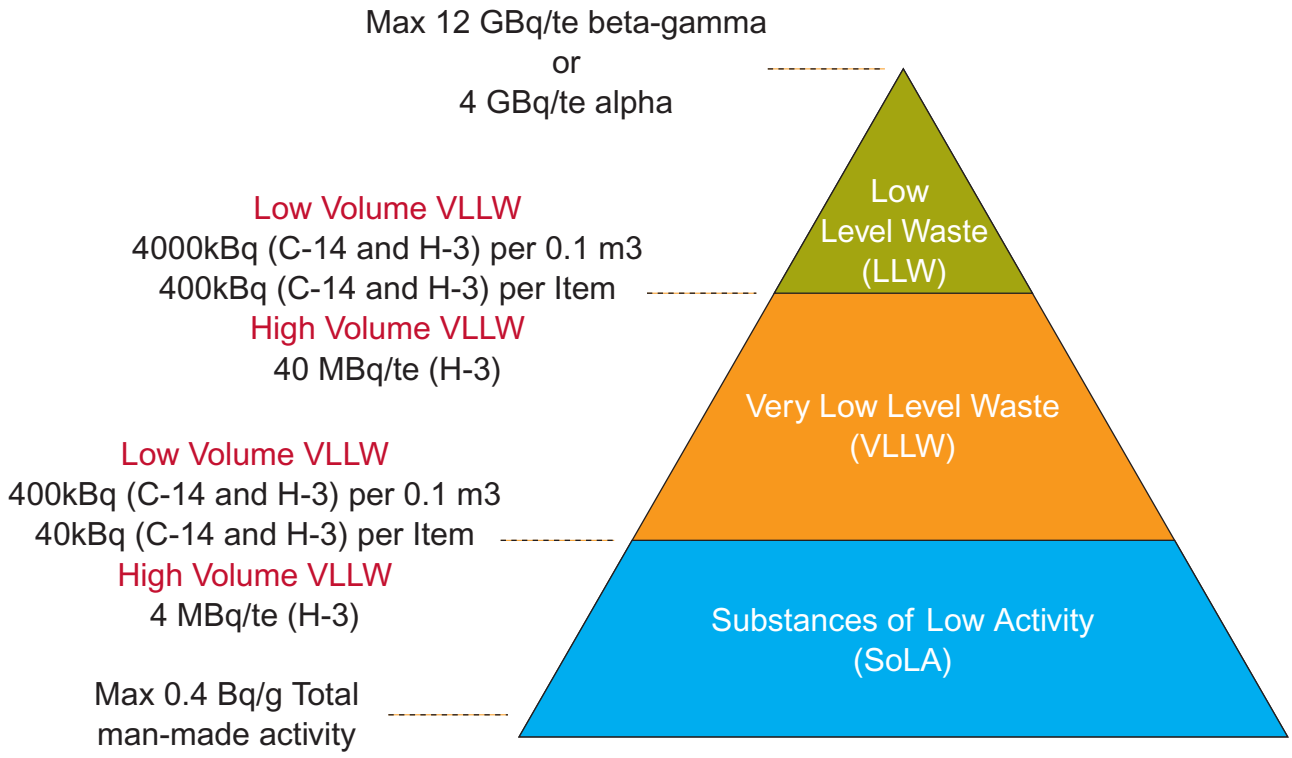

Figure 6.1: Definition of Low Level Waste

6.6.3 This Appraisal of Sustainability considers all activity ranges, where appropriate, within the LLW category and discharges of radioactive material to air, water and soil associated with solid LLW disposal from new nuclear power stations.

Baseline

6.6.4 The UK radioactive waste inventory 2007 estimates that LLW makes up some 90% of the total volume of the UK's existing or committed radioactive waste but contains less than 0.0003% of the total radioactivity[158].

157 Policy for the long term management of solid low level radioactive waste in the United Kingdom www.decc.gov.uk/en/content/cms/whatwedo/uksupply/energymix/nuclear/radioactivity/waste/low/low.aspx

158 www.nda.gov.uk/ukinventory

Waste management implications of the Nuclear NPS

6.6.5 LLW is radioactive waste, which poses a comparatively low risk to human health. There are established and proven management routes for the treatment and disposal of LLW. LLW is the largest contributor in terms of volume of waste from the nuclear industry. LLW contains materials such as contaminated soils, protective equipment, building rubble and steel items such as ducting, piping and reinforcement materials. These wastes are produced through the dismantling and demolition of nuclear facilities as well as during routine operations, and will be generated by new nuclear power stations[159].

6.6.6 The Low Level Waste Repository (LLWR) near the village of Drigg in West Cumbria is a key asset in the UK and making best use of this is an essential component of the NDA's draft UK nuclear industry LLW strategy[160]. This assessment recognises that the LLWR is currently the only national engineered LLW disposal facility in the UK[161]. The LLW facility at Dounreay was another important route for LLW disposal until recently due to reaching capacity. An application for a proposed new LLW facility at Dounreay was granted conditional planning consent on 13th January 2009[162].

6.6.7 LLW arrives at the LLWR in containers of various sizes, either following processing mainly at the WAMAC facility at Sellafield or directly from consigners. Containerised wastes are then grouted and placed into engineered concrete vaults[163].

6.6.8 The NDA has produced a draft LLW Strategy[164] and LLW Management Plan[165]. In its draft UK nuclear industry LLW Strategy, the NDA has stated that its strategy for the management of solid LLW from the nuclear industry[166] will provide continued capability and capacity for the safe and secure management of LLW in the UK. The strategy is also seeking to promote alternatives to direct disposal at the LLWR. The strategy will do this through:

- Application of the waste management hierarchy;
- Best use of existing facilities;
- Development and use of new fit for purpose disposal routes.

159 Draft NDA UK Nuclear Industry LLW Strategy pg 13-14 www.nda.gov.uk/documents/upload/UK-Strategy-for-the-Management-of-Solid-Low-Level-Radioactive-Waste-from-the-Nuclear-Industry-Consultation-Document-June-2009.pdf
160 http://www.nda.gov.uk/loader.cfm?csModule=security/getfile&pageid=29908 page 8, 33.
161 See footnote 158.
162 http://www.dounreay.com/waste/radioactive-waste/low-level-waste/new-low-level-waste-facilities
163 Draft NDA UK Nuclear Industry LLW Strategy pg 33 www.nda.gov.uk/documents/upload/UK-Strategy-for-the-Management-of-Solid-Low-Level-Radioactive-Waste-from-the-Nuclear-Industry-Consultation-Document-June-2009.pdf
164 See footnote 162.
165 www.llwrsite.com/UserFiles/File/LowLevelWasteStrategyGroup/UKNuclearIndustryLLWManagementPlan-Rev0-July2009.pdf
166 Draft NDA UK Nuclear Industry LLW Strategy pg 22 Key Themes www.nda.gov.uk/documents/upload/UK-Strategy-for-the-Management-of-Solid-Low-Level-Radioactive-Waste-from-the-Nuclear-Industry-Consultation-Document-June-2009.pdf

6.6.9 The impact of this strategy will be to reduce the quantities of LLW disposed to the LLWR and similar facilities and the increased availability of alternative waste treatment and disposal routes. For the purposes of this assessment it is anticipated that LLW from new nuclear power stations will be managed in this context and overall arisings minimised.

6.6.10 The Consultation on Funded Decommissioning Programme Guidance included a Base Case to assist with the estimation of the the costs of waste management and decommissioning[167]: In relation to LLW, the Base Case assumes that "LLW will be disposed of promptly after it has been generated in a suitable facility. Disposal will be at the facility currently operating in West Cumbria or a successor facility". This is the assumption used in this assessment.

6.6.11 New nuclear power stations are not anticipated to generate LLW during construction, as they are not expected to be built on the site of radioactively contaminated land. This will be dependent upon the land allocated for each new build development. Development on radioactively contaminated land may result in the generation of LLW from remediation activities. If such radioactive waste is generated this would require transport to treatment or disposal facilities in accordance with the UK's National LLW Strategy. This will be subject to site-specific assessment at the new nuclear power station sites.

Findings of the appraisal for nuclear power station sites

6.6.12 The appraisal of LLW using the AoS framework is shown on the appraisal matrices in Annex K: Section 5 and is summarised on Table 6.4.

167 http://www.berr.gov.uk/files/file44486.pdf. Section 4.1.9.

Table 6.4: Summary of the Significance of Potential Strategic Sustainability Effects: Low Level Waste

Sustainable Development Themes:	Significance of potential Strategic effect at each Development stage:		
	Construction	Operation	Decommissioning
Air Quality	0	–?	–?
Biodiversity and Ecosystems	–	+?	+?
Climate Change	–?	–?	–?
Communities: Population, Employment and Viability	0?	0?	0?
Communities: Supporting Infrastructure	0	0	0
Human Health and Well-Being	0	0	0
Cultural Heritage	0	0	0
Landscape	0	0	0
Soils, Geology and Land Use	0	0	0
Water Quality and Resources	0	–?	–?
Flood Risk	0	0	0

Key: Significance and Categories of Potential Strategic Effects	
++	Development would resolve an existing sustainability problem; effect considered to be of regional/national/international significance
+	No sustainability constraints and development acceptable; effect considered to be of regional/national/international significance
0	Neutral effect
–	Potential sustainability issues, mitigation and/or negotiation possible; effect considered to be of regional/national/international significance
– –	Development problematical because of known sustainability issues: mitigation or negotiation difficult and/or expensive; effect considered to be of regional/national/international significance
Uncertainty	
?	Where the significance of an effect is particularly uncertain, for example because insufficient information is available at the plan stage to fully appraise the effects of the development or the potential for successful mitigation, the significance category is qualified by the addition of ?

6.6.13 The impact of LLW from new nuclear power stations is small in relation to the impact of legacy HLW, ILW and LLW and spent fuel from both legacy and new build.

6.6.14 At this stage of the sustainability assessment process, no significant residual adverse effects associated with LLW have been identified that cannot be managed by developers of new nuclear power stations and through the existing policy frameworks.

Considerations for offsite waste management facilities

6.6.15 LLW for the new build programme is a contributor to the overall capacity requirements at the LLWR. This will have a small impact on LLW disposal capacity management plans, and will impact on the drivers for additional or new LLW disposal facilities over the medium term. This is being addressed by the NDA through their National LLW Strategy programme[168].

6.6.16 The local application by developers of the LLW policy including the waste management hierarchy, BPEO/BPM or BAT[169], to new nuclear power stations and the implementation of waste management innovation will minimise the volumes of LLW disposed of at the LLWR.

Recommendations

6.6.17 The effect of the relatively small additional volume of LLW from new nuclear power stations developed in accordance with the Nuclear NPS should be taken into account in the planning for LLW disposal capacity that the NDA undertake through their National LLW Strategy programme.

168 http://www.llwrsite.com/UserFiles/File/LowLevelWasteStrategyGroup/LLWStrategy-StrategicReviewSummary.pdf

169 The EA is proposing to replace BPEO / BPM with Best Available Technique (BAT).

6.7 Gaseous and Liquid Radioactive Discharges

Scope of appraisal

6.7.1 Gaseous and liquid radioactive discharges are generated at all stages of the nuclear fuel cycle:

1. Uranium Mining;
2. Uranium Enrichment;
3. Fuel Fabrication;
4. Reactor Operation (including operational solid radioactive waste disposal);
5. ILW /Spent Fuel Storage;
6. Reactor Decommissioning (including decommissioning solid radioactive waste disposal);
7. ILW/Spent Fuel Disposal.

6.7.2 This assessment considers the discharges from stages 4 to 7 of the reactor fuel cycle. The Government has stated that the building of new nuclear power stations in the UK should proceed on the basis that spent fuel will not be reprocessed[170] and this assessment has been made on that basis.

Waste management implications of the Nuclear NPS

6.7.3 The radioactivity in gaseous and liquid discharges associated with Reactor Operation (iv) and ILW/Spent Fuel Storage (v) will dominate the discharges associated with the reactor fuel cycle for new build in the UK. They will arise primarily from release of fission and activation products in gaseous (for example halogens, noble gases), particulate (for example metallic fission and activation products) and liquid (from for example tritiated water formed during coolant conditioning and degassing in the case of Light Water Reactors) as well as from fuel movements and other ancillary operations.

6.7.4 The radioactivity in liquid and gaseous discharges associated with Reactor Decommissioning (vi) and ILW/Spent Fuel Disposal (vii)[171] also originate primarily from activation and fission products. Levels of radioactivity are generally lower than in stages (iv) and (v) because of decay of short lived isotopes and loss of volatile species such as iodine, xenon and krypton prior to stages vi and vii commencing.

6.7.5 Gaseous and liquid radioactive discharges may also be associated with LLW management and disposal.

6.7.6 Where this accords with BAT, the discharges in iv to vii of the nuclear fuel cycle and LLW management and disposal will be filtered and treated and only very small quantities will be permitted to be discharged into the environment in accordance with the authorisations that must be obtained from the EA under the Radioactive Substances Act 1993. The treatment of liquid and gaseous wastes means that a majority of the radioactivity is captured and contained as solids (for example in filters, resins etc), and thereby considered in other sections of this assessment.

170 Meeting the Energy Challenge: A White Paper on Nuclear Power, BERR, January 2008, http://www.berr.gov.uk/files/file43006.pdf page 31.

171 Considered during emplacement and over the life of the facility including failure of containment (over long periods of time).

Findings of the appraisal for nuclear power station sites

6.7.7 The appraisal of gaseous and liquid discharges using the AoS framework is shown on the appraisal matrices in Appendix K: Section 6 and is summarised on Table 6.5.

Table 6.5: Summary of the Significance of Potential Strategic Sustainability Effects: Gaseous and Liquid Radioactive Discharges

Sustainable Development Themes:	Significance of potential Strategic effect at each Development stage:		
	Construction	Operation	Decommissioning
Air Quality	0	0	0
Biodiversity and Ecosystems	–?	+?	+?
Climate Change	0	0	0
Communities: Population, Employment and Viability	0	0	0
Communities: Supporting Infrastructure	0	0	0
Human Health and Well-Being	–	–	–
Cultural Heritage	0	–?	0
Landscape	0	–?	0
Soils, Geology and Land Use	0	0	0
Water Quality and Resources	–?	0	0
Flood Risk	0	0	0

Key: Significance and Categories of Potential Strategic Effects	
++	Development would resolve an existing sustainability problem; effect considered to be of regional/national/international significance
+	No sustainability constraints and development acceptable; effect considered to be of regional/national/international significance
0	Neutral effect
–	Potential sustainability issues, mitigation and/or negotiation possible; effect considered to be of regional/national/international significance
– –	Development problematical because of known sustainability issues: mitigation or negotiation difficult and/or expensive; effect considered to be of regional/national/international significance
Uncertainty	
?	Where the significance of an effect is particularly uncertain, for example because insufficient information is available at the plan stage to fully appraise the effects of the development or the potential for successful mitigation, the significance category is qualified by the addition of ?

6.7.8 All impacts from gaseous and liquid radioactive discharges can be adequately controlled under existing legislation. At this stage of the sustainability assessment process, no significant residual adverse effects associated with gaseous and liquid radioactive discharges have been identified that cannot be managed by developers of new nuclear power stations through the existing policy and regulatory frameworks.

Considerations for offsite waste management facilities

6.7.9 The additional quantities of Spent Fuel, ILW and LLW that might be generated by new nuclear power stations for disposal at a GDF or LLW repository may contribute to additional gaseous and liquid radioactive discharges at these sites. It is expected that the effects of the additional waste from new nuclear power stations on gaseous and liquid radioactive discharges at the waste management facilities can be adequately controlled under existing legislation.

Recommendations

6.7.10 Gaseous and liquid radioactive discharges at nuclear power station sites will be controlled in accordance with permits which must be obtained from the Environment Agency under the Radioactive Substances Act 1993. In considering whether to consent these discharges, the Environment Agency will take into account all radioactive discharges arising from reactor construction, operation and decommissioning including the management of Spent Fuel and ILW arising from reactor operation.

6.7.11 In considering whether to consent gaseous and liquid radioactive discharges at sites receiving radioactive waste from new nuclear power stations (e.g. GDF or LLW disposal site(s)), the Environment Agency will take account of the additional quantities of radioactive waste arising from new nuclear power stations.

6.8 Non-Radioactive Hazardous Waste

Definition

6.8.1 'Hazardous waste' is waste with one or more properties that are hazardous to health or to the environment[172].

6.8.2 Categories or generic types of hazardous wastes as well as the properties of hazardous waste are listed in the European Commission's Hazardous Waste Directive[173].

6.8.3 Controls are implemented by the Hazardous Waste Regulations[174] and waste is defined as hazardous on the basis of:

- Waste listed as hazardous waste in the list of wastes;
- Any other waste stream that the Secretary of State determines as hazardous; or
- A specific batch of waste that the Secretary of State determines to be classified as hazardous.

6.8.4 The EU Waste Framework Directive[175] when formally adopted will establish EU-wide targets for reuse, recycling and recovery of 70% of construction and demolition waste by 2020. This requirement is expected to apply to the construction of new nuclear power stations.

Baseline

6.8.5 Non-radioactive hazardous waste is produced from operating and maintaining both the "conventional" side of the new nuclear power station and the "nuclear island", and this may include waste pond water, laboratory chemicals, and lubricating and fuel oils. Such waste requires management and disposal in accordance with the regulatory framework.

6.8.6 Current UK hazardous waste arisings from all sectors is approximately 6.4 million tonnes, of this 45% is subject to treatment, 19% recycled or reused and 13% emplaced in landfill[176]. The 2007 Nuclear Sector Plan Environmental Performance Report notes that the nuclear sector produced approximately 26,796 tonnes of non-radioactive hazardous waste of which 14,616 tonnes is asbestos (and this is not expected to be generated in new nuclear power stations). The report further notes that 9% of all hazardous waste is recycled or reused[177]. Therefore the nuclear sector is a minor contributor to the overall UK hazardous waste arisings and whilst the impact of new nuclear powers will be dependent on the number constructed and operated, it is probable that the overall impact will be negligible.

172 www.defra.gov.uk/Environment/waste/topics/hazwaste/
173 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31991L0689:EN:HTML
174 www.opsi.gov.si/si2005/20050894.htm
175 Detailed within Waste Strategy Annual progress report www.defra.gov.uk/environment/waste/strategy/documents/waste-strategy-report-08-09.pdf
176 http://www.environment-agency.gov.uk/static/documents/Research/ew_haz_waste_07__2152763.xls
177 http://publications.environment-agency.gov.uk/pdf/GEHO1208BPDD-e-e.pdf

Waste management implications of the nuclear NPS

6.8.7 The construction, operation and decommissioning of new nuclear power stations will generate non-radioactive hazardous waste. Hazardous waste volumes are anticipated to be minor in the context of current UK arisings and impacts from this waste can be adequately controlled under current legislation, including the application of Best Available Technique (BAT), and within existing hazardous waste infrastructure and capacity. Uncertainty exists as volumes will be dependent on the number of new nuclear power stations constructed and operated. The nuclear industry currently recycles and reuses a proportion of hazardous waste arisings and the Nuclear Sector Plan establishes an objective to improve recycling rates in the sector[178]. In this context and at this stage of the sustainability assessment process, no significant residual adverse effects associated with non radioactive hazardous waste have been identified that cannot be managed by developers of new nuclear power stations and through the existing policy and regulatory frameworks.

Findings of the appraisal for nuclear power station sites

6.8.8 The appraisal of non-radioactive hazardous waste using the AoS framework is shown on the appraisal matrices in Appendix K: Section 6 and is summarised on Table 6.6.

6.8.9 The construction, operation and decommissioning of new nuclear power stations will generate non-radioactive hazardous waste. These wastes will be similar to those generated by non-nuclear industries. It is expected that such arisings will be managed within the current regulatory framework.

178 http://publications.environment-agency.gov.uk/pdf/GEHO1208BPDD-e-e.pdf; Objective 2 minimise and manage solid waste, page 37.

Table 6.6: Summary of the Significance of Potential Strategic Sustainability Effects: Non-radioactive Hazardous Waste

Sustainable Development Themes:	Significance of potential Strategic effect at each Development stage:		
	Construction	Operation	Decommissioning
Air Quality	0	0	0
Biodiversity and Ecosystems	0	0	0
Climate Change	0	0	0
Communities: Population, Employment and Viability	0	0	0
Communities: Supporting Infrastructure	0	0	0
Human Health and Well-Being	0	0	0
Cultural Heritage	0	0	0
Landscape	0	0	0
Soils, Geology and Land Use	0	0	0
Water Quality and Resources	0	0	0
Flood Risk	0	0	0

Key: Significance and Categories of Potential Strategic Effects	
++	Development would resolve an existing sustainability problem; effect considered to be of regional/national/international significance
+	No sustainability constraints and development acceptable; effect considered to be of regional/national/international significance
0	Neutral effect
–	Potential sustainability issues, mitigation and/or negotiation possible; effect considered to be of regional/national/international significance
– –	Development problematical because of known sustainability issues: mitigation or negotiation difficult and/or expensive; effect considered to be of regional/national/international significance
Uncertainty	
?	Where the significance of an effect is particularly uncertain, for example because insufficient information is available at the plan stage to fully appraise the effects of the development or the potential for successful mitigation, the significance category is qualified by the addition of ?

6.8.10 Site waste management plans are now mandatory in England and Wales for construction projects over £300,000. Such plans will be required during the construction and decommissioning phases of new nuclear power stations and will seek to prevent and minimise hazardous waste arisings.

6.8.11 The construction sector is the largest single source of waste arisings and is the largest single contributor towards hazardous waste accounting for 32% of total arisings (1.7 million tonnes)[179,180]. Whilst the construction and decommissioning of new nuclear power stations will generate hazardous waste, the volumes generated will not be significant in the context of current hazardous waste arisings and therefore, no significant effects are considered to arise from the Nuclear NPS.

Considerations for offsite waste management facilities

6.8.12 The management of the small volumes of non-radioactive hazardous waste arising from the Nuclear NPS are not expected to raise any significant issues for the facilities that will handle this waste.

Recommendations

6.8.13 The disposal of non-radioactive hazardous waste in accordance with current legislation, including the application of the principle of Best Available Technique (BAT), should be considered as part of the project level Environmental Assessment/ Sustainability Appraisal and site permitting processes for new nuclear power stations.

6.9 Summary of findings

6.9.1 The Appraisal of Sustainability has identified potential effects associated with waste arising from new nuclear power stations. In particular some potential negative effects have been identified associated with the interim storage of spent fuel and ILW at nuclear power station sites. However, these effects are considered to be of minor strategic significance and similar in nature to the effects produced by other aspects of new power station development.

6.9.2 One minor negative effect from the management of spent fuel, which is considered to be of potentially greater significance, is the effect on flood risk. This arises from the possible need to design and maintain flood protection measures for the life of the interim storage of spent fuel which may extend the lifetime of the site beyond what would otherwise be required.

6.9.3 However, there may be an option to remove spent fuel from power station sites for interim storage at an offsite facility before it is deposited in a GDF. If interim storage is provided at power stations, it may be possible to mitigate the effects on flood risk through appropriate design, construction and management of flood protection measures.

179 www.defra.gov.uk/ENVIRONMENT/WASTE/strategy/index.htm

180 Draft NDA UK Nuclear Industry LLW Strategy www.nda.gov.uk/documents/upload/UK-Strategy-for-the-Management-of-Solid-Low-Level-Radioactive-Waste-from-the-Nuclear-Industry-Consultation-Document-June-2009.pdf

6.9.4 New nuclear power stations built in the UK will increase the inventory of spent fuel and ILW for disposal, but the scale of this increase will depend on the number of new nuclear power stations constructed and operated. It is estimated that to dispose of the spent fuel arising from a 10GW programme of new power stations operating for 60 years in a GDF would require an underground area that equates to 50-55% of the area that will be required for the disposal of legacy HLW and spent fuel. Plans and programmes to manage the legacy inventory of HLW and spent fuel will need to take account of spent fuel from new nuclear power stations. It is recognised that some impacts cannot be fully disassociated from the development and implementation of strategies to address UK legacy radioactive waste, and a new build programme may integrate into these where appropriate. For ILW, it is estimated that to dispose of the ILW arising from a 10GW programme of new power stations operating for 60 years in a GDF would require an underground area that equates to less than 10% of the area that will be required for the disposal of legacy ILW.

6.9.5 The UK Nuclear Industry draft LLW Strategy[181] for LLW may have a positive influence by reducing legacy waste volumes, and also in facilitating the management of predicted LLW arising from the new nuclear power stations.

6.9.6 The appraisal also notes that the impacts associated with interim storage facilities for ILW and spent fuel and impacts associated with a GDF will be fully assessed as part of project level EIAs once site specific designs and proposals are developed.

181 UK Nuclear Industry LLW Strategy http://www.nda.gov.uk/loader.cfm?csModule=security/getfile&pageid=29908

7. Key findings of the AoS of the draft Nuclear NPS with Potentially Suitable Sites

7.1 Introduction

Context

7.1.1 This chapter sets out a summary of the findings of the Appraisal of Sustainability of the draft Nuclear NPS. As described earlier in Chapter 2, the AoS framework of sustainability objectives was the basis for appraising the sites that were found satisfactory with regard to the exclusionary criteria in the Strategic Siting Assessment process. The detailed findings of the appraisals for those sites that were considered potentially suitable by the SSA process are set out individually in each of the AoS Annexes A-J. Summaries of the key findings of the AoS for each site are set out later in this Chapter 7. One nominated site, Dungeness, was not identified as a potentially suitable site through the SSA process.

7.1.2 The draft Nuclear NPS has the potential to have positive and/or negative effects on communities and the environment. Some of these potential effects[182] are common to all new nuclear power stations, for example, the generation of low carbon electricity. The significance of such effects and the possibilities for mitigating any potentially adverse effects depends upon the number of new nuclear power stations built.

7.1.3 Similarly, potential effects associated with the requirement for water for cooling are common to all new nuclear power stations. However, the significance of such effects and the possibilities for mitigating any adverse effects depends upon the detailed design together with the characteristics and sensitivities of the local communities and environment where the new stations are proposed to be built. This will be examined as part of the detailed studies carried out for project level EIAs that will be required to accompany applications to the IPC for development consent for new nuclear power stations.

Significance of Effects

7.1.4 The individual AoSs of the potentially suitable sites listed in the draft NPS examined likely significant effects that were of national or international importance, for example, internationally protected nature conservation sites such as Special Protection Areas (SPAs) under the Habitats Directive, and objectives for good chemical and ecological water quality under the Water Framework Directive[183] and other relevant European Directives. The individual site AoSs also considered potential likely significant effects that are of more local or regional importance, for example, a County Wildlife Site or regional/sub-regional objectives for regeneration and economic development. Thus the site level AoSs recognised two categories of significance of effects:

182 In this AoS, adverse and negative are used interchangeably to describe effects; similarly for beneficial and positive effects.
183 Water Framework Directive (2000/60/EC).

Strategic (regional, national and international importance) – likely significant effects are described and mitigation possibilities suggested for any significant adverse effects (presented in section 6 of each site AoS Report); and

Local – details are available to inform the IPC and others of issues that are likely to arise at the next stage of planning and assessment processes (discussed in section 5 of each site AoS Report).

7.1.5 Strategically significant effects of the sites were taken into account in considering the interactions between topics and the potential cumulative effects of the draft Nuclear NPS at the national level. Locally significant effects of the sites were taken into account in considering the interactions between topics and the potential cumulative effects of the sites locally, sub-regionally and regionally.

Inter-relationships of Effects

7.1.6 Many of the topics for sustainable development that are relevant to the appraisal of a draft Nuclear NPS are inter-related, particularly between biodiversity, climate change, water, human health and well-being, and communities – their viability (employment and population) and their supporting infrastructure including basic services. Each topic was appraised separately and the detailed findings of these appraisals are provided in AoS Appendices A1 – A12. Summaries of the findings are set out in the sections following in this Chapter 7. The key inter-relationships between topics are discussed where most relevant in each topic and the overall findings are also summarised in a section at the end of this Chapter 7.

Levels of Analysis

7.1.7 Thus the findings of the AoS reflect analysis at different levels as follows:

- the likely significant cumulative effects of building a number of new nuclear power stations, i.e. generally at the national level and by sustainability topic;
- the likely strategically significant effects of each site and their cumulative effects by sustainability topic at the regional or sub-regional level;
- the likely strategic and locally significant effects for each site with their inter-relationships and cumulative effects.

Consultation

7.1.8 During the preparation of the draft NPS, the AoS was subject to ongoing liaison with the statutory environmental bodies[184], the relevant regulators[185], and other Government departments.

184 Environment Agency (England, Wales), English Heritage, Natural England, the Department of the Environment (Northern Ireland), Historic Scotland, Scottish Natural Heritage, the Scottish Environment Protection Agency, Cadw, and the Countryside Council for Wales (CCW).

185 Department of Health, Health Protection Agency, Nuclear Installations Inspectorate.

Presentation of Findings

7.1.9 **By Topic:** Radioactive and hazardous waste is considered separately and the findings of the appraisal are summarised in Chapter 6 and Annex K. For each detailed sustainability topic in Appendix 1, the findings of the AoS are presented according to the following approach which reflects the requirements of the SEA Directive:

- an introduction setting out the definitions and characteristics of the topic;
- a policy context with the key sustainability objectives that are relevant to the appraisal;
- the scope of the appraisal;
- the current situation and the likely evolution without the draft Nuclear NPS;
- the likely effects of the draft Nuclear NPS nationally and by each site;
- a summary and recommendations for the developing draft NPS.

7.1.10 **By site:** For each detailed site report presented in the Annexes A-J, the findings of the AoS are presented according to the approach below in order to reflect the requirements of the SEA Directive:

- an introduction explaining the AoS and draft Nuclear NPS so that each report may be read separately;
- a description of the nominated site proposals;
- a policy context at the regional and any relevant sub-regional levels;
- a characterisation of the site and surrounding area including the current baseline situation and likely evolution of the area without the proposals;
- the likely effects of each site proposal including possibilities for mitigating any potentially significant adverse effects;
- a summary including any key issues that were recommended for the draft NPS to reflect as particular considerations for the IPC to take into account when determining individual planning applications for new nuclear power stations.

7.1.11 **AoS Recommendations:** The AoS was carried out in an iterative and ongoing way with the draft NPS process so that the findings could inform the development of the draft NPS. This was particularly with regard to identifying any significant adverse effects and possibilities for mitigation that could inform the draft NPS and its guidance on impacts for the IPC when considering applications for development consent. The key recommendations from the AoS findings and the key resultant changes to the draft NPS are set out in Appendix 2. Where possible, the Government incorporated recommendations from the AoS and comments from the statutory consultees. In this chapter, the key recommendations are summarised at the end of each topic section and appear in italics.

Structure of this Chapter

7.1.12 Therefore, this chapter summarises the AoS findings by topic and by site; it is structured as follows:

- summary of findings by sustainable development topic (details set out in Topic Summaries A1-A11 in Appendix 1);
- key interactions and cumulative effects between topics;
- summary of generic findings for the sites (details set out in Annexes A-J);
- summary of key findings specific to each potentially suitable site;
- an overall summary of AoS findings.

7.2 Summaries by Sustainable Development Topic

Climate Change (Mitigation)

7.2.1 The operation of nuclear power stations is a low carbon energy source and associated with lower greenhouse gas (GHG) emissions when compared to fossil fuel facilities. The AoS identified that there are likely to be positive effects on this sustainability objective and the significance of these effects will increase with the number of nuclear power stations in operation. Climate change adaptation is cross-cutting and covered where relevant within the following sections on biodiversity and flood risk.

7.2.2 The AoS noted that the UKCIP scenarios project until 2100 and that for nuclear projects having a longer life of approximately 160 years, the data source would need to be the IPCC Assessment Reports and updated reports/scenarios as necessary. The AoS also noted that minor levels of GHG emissions may arise from the transport of goods and workers, particularly during the construction phase; the significance of this depends upon the relative sustainability of local/regional transport services.

7.2.3 *The AoS suggested that the draft NPS could advise the IPC that nuclear power generation is associated with relatively low levels of GHG emissions, particularly when compared with conventional fossil fuel generation. The AoS identified overall that there are likely to be significant positive effects that will contribute to meeting the UK climate change commitments.*

Biodiversity and Ecosystems

7.2.4 The draft Nuclear NPS was also subject to Habitats Regulation Assessment (HRA) and the details of the findings are presented in a separate Main HRA Report and individual site HRA reports. The Main HRA Report also sets out the Government's Imperative Reasons of Overriding Public Interest (IROPI) for why the plan should proceed given the findings presented. The HRA recommended that further project level HRAs should be required and the draft Nuclear NPS requires that for new nuclear power stations any development consent will be required to be supported by a detailed HRA at the project level, including Appropriate Assessment where necessary. The findings of these assessments have been incorporated into the AoS reports.

7.2.5 A number of common implications for biodiversity of international, national and local importance were identified including potential adverse effects from water discharge, abstraction and quality; habitat and species loss and fragmentation; coastal squeeze; disturbance events (noise and visual); and air quality. These are most likely to be significant during the construction and operational stages of the power stations, and could also be significant during decommissioning.

7.2.6 There is the possibility of mitigating certain potential adverse effects on biodiversity, for example through project design to avoid sensitive areas; Environmental Management Plans to avoid or minimise disturbance to wildlife, and minimise risks of pollution; and habitat retention and species protection measures on site. The significance of impacts and the potential effectiveness of mitigation proposals can only be determined with detailed baseline studies to inform further ecological studies at each site as part of the project level EIAs that will be carried out as part of the applications to the IPC for development consent.

7.2.7 At a national level, potential negative cumulative effects were identified for the internationally protected shingle habitat 'perennial vegetation of stony banks'[186], which occurs within a number of European sites in close proximity of the nominated new nuclear sites at Heysham, Sizewell and Wylfa.

7.2.8 Certain species would be subject to cumulative effects from the development of more than one potentially suitable site nationally, including important assemblages of breeding, over-wintering and passage birds (such as breeding Little Tern (at five sites) and over-wintering Redshank (at four sites)); fish species (such as Atlantic Salmon (at four sites) and Sea and River Lamprey (at three sites)); and other species of European importance (such as Natterjack Toad) along the Cumbrian coast, and Otter (at three sites). It was recommended by the AoS that detailed baseline studies into the nationally and internationally important species that may be affected will need to be undertaken by developers to inform assessments of the cumulative ecological effects at the project level, and taken into account by the IPC in decision-making.

7.2.9 Potentially significant negative cumulative effects for biodiversity were identified in the North West and South West England regions, as a number of European sites are likely to be affected by more than one new nuclear power station. At the local level and for all sites, potential cumulative effects have been identified with other plans and projects, especially with other energy proposals including tidal, wave, biomass, and wind farm projects. Proposed projects including Britain's Energy Coast Masterplan (in the North West region) and some of the options for Severn Tidal Power (in the South West region), are considered particularly significant for biodiversity in conjunction with proposed new nuclear development in these areas. Mitigation measures are recommended within the site HRA and AoS reports and it is considered that these may help address the significant adverse effects identified on European and nationally designated sites and local biodiversity, if the measures are implemented effectively. At this strategic level, uncertainties remain as to whether mitigation will be wholly effective, and that only at the project level of assessment (i.e. project level EIA and

186 Listed as habitat feature 1220 in Annex 1 of European Habitats Directive.

HRA to support applications to the IPC for development consent) can a conclusion of no adverse effect on the integrity of European sites and associated biodiversity be made with confidence. Overall, it is concluded that, at this stage, it is considered likely that there will be strategically significant and adverse effects on biodiversity at the international, national and local levels, but that the significance of such effects can only be confirmed through assessments undertaken at the project level.

7.2.10 *The AoS recommends that the draft NPS should advise the IPC that the significance of biodiversity effects can only be determined through project level studies and guide the IPC to the findings of the site level AoSs and site HRAs to help scope the studies needed for the project level EIAs and HRAs. The AoS recommends that the NPS should draw attention to the IPC of potential cumulative effects of new nuclear sites in the North West and South West regions with other potential developments.*

7.2.11 *Overall the AoS found that there are likely to be significant adverse effects on national and European sites of biodiversity value and that the effectiveness of mitigation possibilities is uncertain and needs to be evaluated at the project level assessments. The AoS also found that there are likely to be significant adverse effects on the wider biodiversity at the local level and that these need to be evaluated during the project level EIAs. The AoS identified overall that the there are likely to be significant adverse effects on biodiversity of local and European importance.*

Communities: Population, Employment and Viability, Supporting Infrastructure

7.2.12 The sustainability and viability of communities is associated with a number of inter-related factors including a flourishing and diverse economy, good transport, and good services. The relevance of these factors for the draft Nuclear NPS depends upon the scale and locational characteristics of the proposed new power stations.

7.2.13 There are likely to be positive effects for employment locally and associated economic benefit through the use of supporting services, particularly during the construction phase and this could be of regional significance. During the operational phase and in the longer term, the effects of the draft NPS are likely to contribute significantly to the development of jobs nationally in the nuclear and associated industries, including enhancement of training and skills, and provision of goods and services to the nuclear industry.

7.2.14 As with any large scale construction project, there is the potential for short term negative effects during construction if a number of sites were developed at the same time with the risk of a shortage of construction workers, local communities disturbed by an incoming workforce, and additional pressures placed on local services. However, there are possibilities for mitigating such effects depending upon local circumstances and needs.

7.2.15 Similarly, there are likely to be negative effects on transport at the local level and at regional/national networks under current stress. The significance depends upon the location and for some areas there will be opportunities to mitigate impacts during the construction and decommissioning phases by using rail and/or maritime freight. The AoS suggested that the draft NPS could advise the IPC that there may be adverse effects on regional transport networks. However, as this is generic to all significant energy infrastructure and EN-1 Overarching Energy NPS now includes references to Transport Assessments.

7.2.16 Non-radioactive wastes may place a demand on local facilities. This is unlikely to be significant with effective implementation of operational waste management plans. There may be potential for minor positive effects locally through generation of secondary aggregates during demolition at sites where existing facilities are being decommissioned. Potentially negative cumulative effects may result from waste disposal from the clusters of sites in Cumbria and in the South West region.

7.2.17 The opportunities for upskilling, education and supporting industries are likely to be more significant if there were a cluster of new nuclear power stations, particularly for the North West Region and with some similar benefits possible for the South West and the East of England Regions. The effects of the draft Nuclear NPS in combination with other renewable energy projects is likely to contribute positively to objectives for regional economic development. However, there is the potential for negative cumulative effects on tourism objectives in Cumbria, including the Lakes District National Park, due to visual impacts and the public perception of additional nuclear power stations in the sub-region.

7.2.18 *The AoS recommends that the draft Nuclear NPS should advise the IPC of the potential enhancement for positive economic development effects, and that cumulative positive effects are likely to be more significant regionally where there are clusters of potentially suitable sites. Overall the AoS found that there are likely to be significant beneficial effects on employment and viability for communities.*

Health and Well-Being

7.2.19 Health is wider than just absence of disease and our health can be affected by a complex interaction between various factors, such as our personal behaviour and lifestyles, our living and working conditions, the condition of our communities, and our access to health and other services. The AoS identified the generic implications for health and well-being from new nuclear power stations including:

Radiation from permitted discharges and potential hazards from accidental emissions;

- Safety and security;
- Employment;
- Emissions to water and air;
- Noise;
- Accessibility to green space and exercise.

7.2.20 The health factors that are relevant and their implications for the draft Nuclear NPS depend upon the type, scale (both the size/output of the individual power stations and the overall number of stations built), detailed design, and locational characteristics of the proposed developments. Radiological effects, from permitted radioactive discharges and the risk from accidents, together with the long term characteristics of nuclear projects that include the provision for radioactive waste management (see Chapter 6), are particular technology specific issues for health and well-being.

7.2.21 Radioactivity occurs naturally, for example, naturally occurring radon gas is the major source of radiation exposure to the general population in the UK and many other countries[187]. The potential for radioactive emissions of radiation from the nuclear power industry is regulated in the UK through a strict framework[188] to minimise potential health effects to workers and the general public by ensuring that radiation doses are well within internationally agreed limits. This also includes an emergency preparedness framework in the unlikely event of a major accidental release of radiation into the environment.

7.2.22 The predicted effects of the draft NPS on radiological health issues are likely to be neutral since the strict regulatory mechanisms controlling nuclear power will provide the same level of protection to people's health as exists at present. The draft Nuclear NPS sets out that the existing regulatory systems for operation of nuclear power stations will continue to apply to the new build so that potential effects associated with safety, security, and radiation doses to the public and workers will be dealt with through the current nuclear licensing and health protection systems.

7.2.23 Regulatory Justification has been undertaken by the Government[189]. Regulatory Justification is a high-level, generic assessment and as such it would not usually take into account the number of nuclear power stations that would be built following a Regulatory Justification decision. However, the Secretary of State, in the interests of addressing any concern that the number of nuclear power stations built might increase the risk of radiological health detriment to members of the public, asked the HPA to review the position. On the basis of HPA's advice, the Secretary of State has considered the potential collective dose to the public based on current data associated with the Sizewell B reactor, which has an operating regime and technology similar to those likely to be used by new nuclear power stations. A collective dose is the total of predicted individual doses over exposed populations and times and when divided by the number of people can be used to estimate a per-caput dose. The Secretary of State is satisfied that if 20 equivalent reactors were built, meeting the current regulatory constraints on doses to members of the public, then the annual per caput dose to the UK population would be at the microsievert (abbreviated as μSv, a level of dose) level or less – a thousand times less than the current annual dose limit for members of the public of 1mSv. The Secretary of State is satisfied that the number of new nuclear power stations to be built in the UK is therefore not relevant to the Regulatory Justification decision.

187 http://www.bre.co.uk/radon/maps.html
188 Ionising Radiations Regulations 1999; Radioactive Substances Act 1993 and Environment Act 1995.
189 http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/nuclear/new/reg_just/reg_just.aspx

7.2.24 The AoS recommends that the draft NPS should consider suggesting that the IPC and regulatory authorities pay particular consideration to clusters of new nuclear power stations, with regard to possible cumulative effects of routine discharges. This is in particular for the potential concentration of up to four new stations in the North West with three in Cumbria and in combination with the existing operations. In doing so they should take into account that the law[190] which limits radiation to which members of the public are exposed from all sources[191] of 1mSv per year, applies to the cumulative effects of planned exposures. Therefore the radiation to which people living near to a new nuclear power station are exposed would have to be less than 1mSv per year, taking into account exposures from any other nearby sites and any past controlled releases. Public perceptions of health risks may be mitigated by continued engagement during the ongoing assessment processes.

7.2.25 There are significant health benefits to be realised from having a reliable and secure supply of energy. Indirect negative effects on health and well-being of not having a secure energy supply are likely from the possible closure of businesses, reduced employment, strain on services and potential loss of viability of communities.

7.2.26 Significant positive health and well-being effects associated with increased long term employment and enhanced community prosperity were identified for each potentially suitable site. Generally this is significant at the local or sub-regional scales and is dependent on employment being secured for local people.

7.2.27 The positive indirect effects on health and well-being from securing long term employment and community viability, often in rural areas where communities are under stress, are likely to be more significant in the North West region and Cumbria where there is the potential for up to four new nuclear power stations and opportunities for developing wider expertise and supporting services to the nuclear industry.

7.2.28 The potential for loss of recreational land and access is likely to be significant at the local levels for most of the sites and will be dealt with during the project level Environmental Impact Assessments (EIAs). However, the cumulative effects of up to four new power stations in the North West region could have a wider effect on the public perception of the recreational tourism industry in the area and the AoS recommends that the draft NPS guidance to the IPC will need to consider the relative benefits of the nuclear power and tourism industries and seek to minimise negative effects.

7.2.29 Overall, there are health benefits to be realised from having a reliable and secure supply of energy. The AoS also identified that there are indirect positive health effects associated with enhanced prosperity and long-term employment opportunities; this will only be significant for local communities if employment is secured for local people. Any indirect effects on supporting services, associated infrastructure, and health inequalities are not significant at the national scale and will be addressed during the project level assessments; this includes the negative local effects from noise and

190 Ionising Radiations Regulations 1999, Statutory Instrument 1999 No. 3232 http://www.opsi.gov.uk/si/si1999/19993232.htm
191 excluding medical exposures of patients and natural background radiation.

disturbance associated with the construction of many major infrastructure projects. Nuclear power stations are often located in rural areas on the coast with potential conflicts for recreation and amenity.

7.2.30 *The AoS recommends that the draft NPS should guide the IPC to consider requesting a sustainability statement / assessment for each application to ensure full consideration is given to sustainable communities and interactions between a range of sustainability issues, including the wider determinants of health. The NPS should highlight to the IPC that there may be beneficial effects for health and well-being from secure long term employment and community viability arising from new nuclear power stations. The AoS also recommends that the draft NPS should advise the IPC that nuclear power stations are often located in rural areas on the coast with potential conflicts for recreation and amenity (and their subsequent impacts on health and well-being).*

Cultural Heritage

7.2.31 Effects within the footprints of the sites are associated with the disturbance or loss of any cultural heritage features present as a result of ground works and excavations. Mitigation measures are the minimisation of the footprints and the avoidance of disturbance to features, where possible, during the planning and design stage. This is informed by detailed investigations during the project level EIA stage and watching briefs during excavations and ground works.

7.2.32 Effects outside the footprints of the sites are due to impacts on the settings of nearby cultural heritage features within a landscape context. These impacts are highly dependent on distance and effects of scale can result in a reduced amenity value for that feature. Mitigation may be very difficult or impossible to achieve. Disturbance effects may also impact on the amenity and setting of cultural heritage features outside the footprint of the nominated site, particularly during the construction phase, but can be controlled and minimised through good environmental site practices.

7.2.33 The predicted effects of the draft Nuclear NPS on cultural heritage are likely to be negative throughout all phases of development and are associated with the location and scale of development at the sites. The significance of these effects will depend on the importance of the cultural heritage features, their location within the site or their setting relative to the site. Effects are likely to be felt at a local or regional scale, depending on distances, sight-lines, topography and the ability to mitigate. For one site, Bradwell, there are considered to be major negative effects due to the negative effects on the settings of nearby nationally scheduled monuments and listed buildings. However, mitigation could be applied by siting the proposed facility close to the existing power station on the western side of the site.

7.2.34 Cumulative effects of local or regional significance may arise where sites are in close proximity to each other or are in combination with other major development and infrastructure projects, potentially affecting the same cultural heritage features.

7.2.35 *The AoS recommends that the draft NPS should advise the IPC that significant negative effects to cultural heritage resources may be difficult to mitigate. Overall the AoS found that there are likely to be minor significant negative effects on cultural resources except for the Bradwell site where the effect may be more significant. The significance and effectiveness of mitigation possibilities is uncertain and needs to be evaluated at project EIA level.*

Landscape

7.2.36 The potentially suitable sites, whilst being distinct in their local settings and planning context, share the following landscape issues:

- the sites are generally in less populated areas that may have value for visual amenity and as landscape resources;
- nuclear power stations usually require coastal/shoreline sites (for cooling water) and the scale of the facilities means that the scope for visual mitigation is quite limited;
- the long operational timescale involved leads to some uncertainty over future land uses on decommissioned sites.

7.2.37 There is the potential for long term irreversible effects on landscape through the location of reactors and plant at all the sites. These effects are increased if visually-intrusive cooling towers are required. However, with the exception of Oldbury, towers are not the preferred option proposed by the nominators for cooling. At all sites there is potential for short-term effects on landscape due to construction including visual impact of construction plant and equipment, disturbance of landforms, and removal of vegetation. In addition, increased traffic during construction and operation may have negative effects on landscape qualities, including noise and dust pollution affecting tranquillity.

7.2.38 Changes to site layout and boundaries can be made to minimise some direct landscape effects. Buffer zones and protection fences can be utilised to avoid or reduce effects on significant nominated site landscape features. Reinstatement or restoration of original landforms and vegetation where possible can help to minimise the impact of construction on landscape. In visual terms, many of the proposed power station sites will be seen in the context of existing power stations. However, there are still likely to be some long-term negative visual effects with limited potential for mitigation, until decommissioning.

7.2.39 The landscape effects of the draft Nuclear NPS may act in combination with the impacts of other planned energy projects: including wind farms and tidal energy. In combination effects are likely to include: improvements to transmission grid connectivity and possibly also nearby local housing and road infrastructure developments.

7.2.40 The AoS identified that the draft Nuclear NPS is likely to have negative effects locally at all sites. At one site Sizewell, negative effects of strategic significance were identified as the site is wholly within an Area of Outstanding Natural Beauty, an area nationally designated for its distinctive landscape character and natural beauty.

If developed together, the sites at Sellafield, Kirksanton and Braystones in Cumbria may have a strategically significant negative effect on landscape and associated visual/ amenity values due to their cumulative effect on the Lake District National Park.

7.2.41 There are likely to be some landscape and visual impacts that cannot be effectively mitigated at all sites due to the scale of development that is proposed. The AoS recommended that the draft NPS should consider drawing these particular sub-regional cumulative effects to the attention of the IPC when determining individual planning applications and examining the capacity of this particular area to accommodate such change.

7.2.42 *The AoS recommends that the draft NPS should advise the IPC that there are likely to be some visual impacts that cannot be mitigated due to the scale of new nuclear power stations; the significance of this is increased if cooling towers are proposed. The significance and effectiveness of mitigation possibilities is uncertain and needs to be evaluated at project EIA level. The AoS recommends that the draft NPS should advise the IPC of the likely strategically significant negative effects on landscape value and visual amenity from the three potentially suitable sites in Cumbria and their cumulative effects on the Lake District National Park. Overall the AoS found that there may be neutral or minor negative effects on landscape except for the sites in Cumbria where effects may be of national significance.*

Air Quality

7.2.42 The factors affecting air quality that are relevant for the draft Nuclear NPS depend on the type, scale, detailed design, locational characteristics and to a limited extent ancillary activities of the proposed new nuclear power stations. As well as these site specific issues, there are certain common implications for air quality arising from a NPS as follows:

- Emissions to air of non-radioactive air quality pollutants/greenhouse gases; and
- Possibility of national and transboundary effects, in the event of a significant unintended release of radioactive emissions.

7.2.43 Due principally to the relatively low level of air pollutant emissions from nuclear power stations overall air quality in the UK is likely to improve as a result of replacing oil, coal and gas fuelled electricity generation with nuclear power.

7.2.44 In areas local to the proposed nuclear power stations air quality, in respect of dust (temporarily during construction) and traffic pollutants, would be expected to worsen as a result of emissions from construction and workforce vehicles. However, it would be possible to mitigate such effects through measures such as highway improvements, use of rail and sea transport and the adoption of sustainable traffic and travel management plans.

7.2.45 There is a risk of deterioration in air quality due to radioactive releases to air or accidental releases of radioactive emissions. However, the risk of such an accident is judged to be very small because of the strict regulatory regime in place in the UK.

7.2.46 *The AoS recommends that the NPS could highlight to the IPC that effects on air quality are unlikely to be significant but that effects associated with the construction phase should be considered in the scope of the project level EIAs.*

Soils, Geology and Land Use

7.2.47 Geology and its associated soils influence the use of the land and the characteristics of the communities that live and work on the land. Soils and geology greatly influence vegetation and water with effects also linked to landscape, biodiversity, cultural heritage and material assets. Some geological formations and soils are also important as mineral resources, for earth science, archaeology, and ecology.

7.2.48 The factors affecting soils and geology that are relevant for the Nuclear NPS depend on the type, scale, detailed design and locational characteristics of the proposed new nuclear power stations. In common with other major infrastructure projects, nuclear power stations have the potential to have effects on soils and this depends upon the characteristics and sensitivities to change of the receiving environment and communities. Ground conditions and their suitability for development are mainly determined by geological and soil conditions. This is a particular feature that is relevant for the draft Nuclear NPS and common implications for soils, geology and land use are as follows:

- New nuclear power stations often proposed on or adjacent to existing power station sites.
- Sites are often located on coasts resulting in coastal squeeze, loss of intertidal land use and associated habitats.
- Sites are often located on marine shorelines and estuaries which may affect coastal geomorphological processes including erosion / deposition and sediment transport processes.
- New power station and associated infrastructure development will affect existing land uses, particularly agricultural land use.
- New development may result on loss of soil and mineral resources including sand and gravel deposits or other minerals.
- The development, operation and decommissioning of nuclear power sites may result in the increased risk of pollution and potential contamination of soils and controlled waters.
- Problems associated with land restoration, including reinstatement of previous soil conditions, loss of organic matter, erosion, changes to nutrient status, pH, and homogenisation.
- Development may result in soil loss or burial, physical damage including compaction and structural damage, changes to soil water regime, effects on soil biota and soil stripping and storage.

7.2.49 A number of potentially negative sustainability issues have been identified relating to effects on soils, geology and land use. These tend to be site specific in character. It is important to note that effects to soils also may directly affect the soil water

regime which in turn may affect various terrestrial habitats. It is recognised that the development of the NPS sites may result in the increased risk of pollution and potential contamination of soils and controlled waters on a local scale.

7.2.50 *The AoS recommends that the NPS should inform the IPC that effects on soils may affect the soil water regime which may affect various terrestrial habitats and this will need to be considered in the project level EIAs and HRAs. Overall, the effects of the draft Nuclear NPS are considered to be neutral on soils and geology.*

Water Quality and Resources

7.2.51 The factors affecting water that are relevant for the draft Nuclear NPS depend on the type, scale, detailed design and locational characteristics of the proposed new nuclear power stations. There are certain common implications for water quality and resources from the draft Nuclear NPS which have been identified as follows:

- Influences from cooling water abstraction and discharge;
- Effects on capacity to meet future water demand;
- Effects on local groundwater bodies;
- Effects on coastal process, including sediment movement, due to coastal works such as construction of flood defences;
- Indirect effects on the marine environment and fisheries may result from changes to water quality or coastal processes and these are addressed in the sections on biodiversity and ecosystems.

7.2.52 The site AoSs identified that generally there are likely to be minor negative effects on water quality and resources. Such adverse effects may compromise the achievement of water quality objectives, for example, the requirements of the Water Framework Directive[192] (WFD) to maintain or achieve good status. Minor adverse effects are likely on water quality in water bodies where cooling water is to be abstracted and discharged. However, the effects of these abstractions and discharges are generally capable of mitigation through appropriate siting, design, and operation, and will also be subject to Environment Agency consenting processes, although the outcome of these processes cannot be prejudged. Effects may be more difficult to mitigate in restricted estuarial waters than in coastal waters.

7.2.53 A further minor negative effect will be the effect of increased water demand and a potential effect on the capacity to meet water demand at a regional scale. This may be a more significant issue during the construction phase of each site's life. Individual water companies will have plans in place for meeting future demand and may be able to incorporate further demand from large industrial clients if informed at an early stage. Abstractions will be subject to licensing restrictions.

192 River Basin Management Plans are the plans for protecting and improving the water environment in accordance with the requirements of WFD. They have been developed by the Environment Agency in consultation with organisations and individuals. On 22 September 2009 the River Basin Management Plans were submitted to the Secretary of State for Environment, Food and Rural Affairs and Welsh Ministers for approval. http://www.environment-agency.gov.uk/research/planning/33106.aspx

7.2.54 There may be minor negative effects on local groundwater bodies, where effects may be further increased if cooling water is to be taken from non-seawater sources. Studies should be carried out to determine the effect on groundwater and surface water systems. It will be important during the project level EIAs to investigate any effects that might compromise WFD objectives.

7.2.55 Cumulative effects are likely to occur where there are clusters of sites. At these locations there will be additional stresses on water supply and may be effects where sites discharge cooling waters to the same water body. Cumulative effects may be most significant in the North West and the Severn Estuary. Mitigation options should be investigated to ensure cumulative effects are dealt with.

7.2.56 *The AoS recommends that the NPS should highlight to the IPC the characteristics of cooling water for new nuclear power stations and the implications for the marine and estuarial environments, including the interactions between discharges from regional clusters of nominated sites. The NPS should also inform the IPC that there could be increased water demand, particularly during the construction phase, which would be of greatest significance in those regions that are already under water stress. Generally, the AoS identified that minor negative effects are likely to be mitigated and overall the effects on water quality and resources are likely to be neutral.*

Flood Risk

7.2.57 The beneficial effect of power generation from nuclear power stations with regard to climate change mitigation is noted earlier under the climate change topic. As a low carbon source, nuclear power stations are expected to make a positive contribution to achieving carbon reduction targets which, indirectly, should have a beneficial effect on flood risk through moderating changes in rainfall patterns and sea level rise. Climate change adaptation is primarily considered in this section with regard to flood risk management.

7.2.58 In other respects, the relationship between the draft Nuclear NPS and flood risk is essentially local or possibly sub-regional where a number of potentially suitable sites are in proximity to each other. It also has a number of different effects. The first of these is the local impact that the individual development may have on the risk of flooding to land adjacent to those sites. Secondly the sites themselves may be vulnerable to the risk of flooding from a number of causes, coastal, storm surge, fluvial, groundwater and pluvial. Finally flood risk management measures put in place to mitigate the impacts of flooding on or from individual sites may impact on coastal process, hydrodynamics and sediment transport, which in turn may impact on designated habitats. All of these flood risk effects can occur during the construction, operation or decommissioning phases. As a result flood risk assessments need to take a long term view.

7.2.59 The flood risk effects to areas surrounding development sites could be either negative or positive. Negative impacts could be that flood risk is increased to the surrounding area as a result of any land raising required to protect the power stations or the footprint and layout of the sites which could impact upon floodplain storage and flood flow pathways. Positive impacts could also arise, as flood risk mitigation measures constructed as a result of the power stations could also provide flood risk protection

for new and existing developments in the district. Similar negative and positive impacts could affect designated landscapes, for example, sensitive habitats could become more vulnerable to flooding, or as a result of improved defences – less vulnerable.

7.2.60 Climate change will increase flood risk from all causes. Coastal flood risk is likely to increase as a result of predicted increases in sea level and changes in storm surge. Changes to the seasonal distribution of rainfall and in the intensity of extreme rainfall events are also likely to increase flood risk. Climate change is also likely to result in changes to coastal erosion.

7.2.61 The mitigation measures that may be required to manage flood risk as a result of the draft Nuclear NPS could have potentially negative effects on coastal processes and hydrodynamics. These measures have the potential to have secondary impacts on biodiversity and water quality, therefore potentially hindering the objectives and requirements of the EU Water Framework Directive.

7.2.62 Overall the AoS identified that the draft Nuclear NPS is likely to be negative with regard to flood risk, primarily as a result of the need for additional flood defences and their effects on coastal processes and hydrodynamics over the long project lifetime for new nuclear power stations.

7.2.63 The AoS recommends that the NPS should highlight to the IPC the need for detailed, site-specific investigations, including flood risk assessment, to determine the most appropriate and sustainable methods for protecting sites from flooding through the life cycle of the new nuclear power stations and to assess how these measures may affect flood risk in adjacent areas. Studies should also be undertaken to assess the impacts that any flood control measures may have on coastal processes and, indirectly, on ecology and biodiversity. Overall, the AoS identified that the effect of the draft NPS on flood risk and of flood risk on the sites in the draft NPS is likely to be negative, and the scale of the effects are likely to increase over time as a result of climate change.

Radioactive and Hazardous Waste

7.2.64 Before development consents for new nuclear power stations are granted, the Government will need to be satisfied that effective arrangements exist or will exist to manage and dispose of the waste they will produce[193]. The draft Nuclear NPS sets out the Government's view on the arrangements for the management and disposal of radioactive waste that will be produced from new nuclear power stations. The AoS has considered the sustainability implications of managing the different types of waste associated with the construction, operation and decommissioning of new nuclear power stations in the UK under the following headings:

- Spent Fuel;
- Intermediate Level Waste (ILW);
- Low Level Waste (LLW);
- Gaseous and liquid radioactive discharges;
- Non-radioactive hazardous waste.

193 Meeting the Energy Challenge: A White Paper on Nuclear Power, CM 7296, January 2008 [page 99].

7.2.65 The AoS has identified that the effects of waste management may arise both at a nuclear power station site and offsite at other locations where packaging, transport and/or disposal of waste is undertaken. Some minor negative effects have been identified at nuclear power station sites. These are principally associated with the management and storage of spent fuel and ILW. Minor negative effects may potentially arise during construction and decommissioning of interim waste storage facilities although some of these effects, for example on soils, cultural heritage and landscape are site specific and will need to be assessed at the project level.

7.2.66 The most important consideration for offsite waste management facilities is the additional quantity of spent fuel to be disposed of from new nuclear power stations that will require final disposal in a Geological Disposal Facility (GDF). The significance of the effects on the GDF will depend upon the number of new nuclear power stations built. The NDA has estimated the amount of spent fuel that would be generated by new nuclear power stations of either the AP-1000 reactor or EPR reactor being considered in the Generic Design Assessment (GDA). This assessment has indicated that a 10GW programme of new nuclear power stations operating for 60 years would increase by between 50-55% the amount of spent fuel and High Level Waste (HLW) to be disposed of in a GDF.

7.2.67 *In relation to the management of Spent Fuel and ILW at power station sites, the AoS (see Chapter 6) recommends that the draft Nuclear NPS should advise the IPC that the management of these radioactive wastes has the potential for effects on and off-site, including effects associated with transportation.*

7.2.68 *In addition, the AoS recommends that the draft Nuclear NPS suggest to the NDA that the effects of the additional volume of Spent Fuel and ILW from new nuclear power stations should be taken into account in their design and evaluation of a GDF, including transportation. It is not for the draft Nuclear NPS to direct the NDA in this way, however, the draft NPS makes it clear that the NDA is free to take account of anything set out in the draft NPS if it chooses to do so.*

7.3 Interactions and Cumulative Effects

7.3.1 Many of the factors for sustainable development and the draft Nuclear NPS are inter-related, particularly between biodiversity, water, climate change, energy, human health, and communities – their social and economic viability including supporting infrastructure and basic services. For example, new coastal and flood defence works may change the movement of sediments in the water, and this in turn may affect the ecology of a nearby wetland habitat. Cumulative and synergistic effects may arise from the interactions and additions of small insignificant effects. For example, synergistic effects may occur when a number of major developments occur in a sub-region so that the communities benefitting from them become more sustainable by reaching critical thresholds for services and infrastructure.

7.3.2 Any likely significant cumulative effects (negative and beneficial) and inter-relationships were identified and reported in the most relevant topic sections. Generally, the significance of these effects will depend upon the number of new nuclear power stations that are built, where, and when. The AoS identified that this was likely where there are clusters of potentially suitable sites for new nuclear power stations and found that this was likely to be significant for two regions. The AoS recommends that for the North West and South West regions the draft NPS should advise the IPC to consider interactions and cumulative effects if more than one station is built as follows:

- North West Region: Braystones, Heysham, Kirksanton and Sellafield. The AoSs identified potential beneficial effects of regional significance on employment and community viability, with additional positive effects on health and well-being from secure employment. However, there are also potential negative cumulative effects on landscape and visual impacts in relation to the character of the surrounding area including the Lake District National Park, and other development objectives for biodiversity, tourism and recreation/amenity.
- South West Region: Hinkley and Oldbury. The AoSs identified potential interactions and cumulative effects on important biodiversity sites in the Severn Estuary and River Wye. Potential positive effects on local employment, upskilling, community viability and health/well-being could be more significant if more than one new nuclear power station is built.

7.3.3 *The AoS recommends that the IPC should consider the capacity of supporting infrastructure, such as non-radioactive waste, water, flood risk, and transport, together with the implications of phasing and timing of other infrastructure. It further recommended that the draft NPS should guide the IPC to consider cumulative effects on the natural environment, particularly when considered in combination with other planning objectives, such as for biodiversity and tourism/recreation.*

7.3.4 *The AoS recommends that the draft NPS should draw attention for the IPC to opportunities for enhanced skills and expertise in the nuclear and associated industries where there are clusters of proposed suitable sites and in combination with regional development objectives.*

7.4 The Potentially Suitable Sites – Generic Findings

7.4.1 The detailed appraisal for each listed site is presented in the individual site AoS reports in Annexes A-J of this Main AoS Report. These site AoSs identified potential impacts and likely effects of a generic design of a new nuclear power station. They identified likely significant strategic and local effects and suggested possibilities for mitigation of significant negative effects, including recommendations made to inform the development of the draft NPS. The significance of local effects and identification of the most appropriate mitigation will depend upon detailed studies carried out as part of the project level EIAs and other studies for individual applications for development consent. The mitigation measures will be refined iteratively as part of the development of the proposals for the site.

7.4.2 The site AoSs recommends to the draft NPS that the findings of the site AoSs would be helpful to the IPC when scoping EIAs and other studies, and when considering applications for development consent. Part 5 of the draft Nuclear NPS sets out the findings of the Strategic Siting Assessment (SSA) process for each potentially suitable site and includes the findings of the AoS where they are relevant against the SSA criteria, and other key findings of the site AoSs.

7.4.3 Some findings of the site AoSs are similar across all the sites and reflect the development characteristics of new nuclear power stations; these are summarised in the following paragraphs. Certain findings of the site AoSs were of particular note to individual sites and these are summarised in the subsequent following paragraphs. The potential for interactions and any cumulative effects, particularly where there could be clusters of new nuclear power stations, was also explored and likely significant effects reported.

AoS Findings similar across the Sites

7.4.4 The significance of many effects at the local and regional levels, together with the possibilities and effectiveness of mitigation, can only be identified through the detailed studies for the project level EIAs and other studies associated with the applications for development consent to the IPC.

7.4.5 There is the potential for positive interactions and cumulative effects associated with the creation of temporary jobs during construction and permanent long term employment, expansion of an energy hub with education and upskilling, and enhanced prosperity for local communities, including the secondary benefits for health and well-being associated with secure employment. This will only be significant for improving community viability if the employment is secured for local people.

7.4.6 *The AoS recommends that the draft NPS should guide the IPC to the findings of the site AoS and site HRA reports to help scope the studies needed at the project level to inform their decision making. The AoS suggested that the draft NPS should consider requesting a sustainability assessment/statement for each application to ensure full consideration of socio-economic issues as well as environmental issues addressed in EIA. This was not taken forward specifically by the draft Nuclear NPS as the Overarching Energy NPS requires applications to include assessment of socio-economic effects.*

7.4.7 Many of the likely significant effects identified by the site AoSs are characteristic of major infrastructure projects, for example, noise, dust and disturbance during the construction phases. These generic impacts are dealt with in the Overarching Energy NPS and this was subject to AoS (see earlier in chapters 1 and 2).

7.4.8 *The AoS recommends that the draft NPS should advise the IPC that a requirement for an Environmental Management Plan as part of the EIA scoping will help ensure that any commitments to mitigating any significant impacts will be implemented.*

7.5 The Potentially Suitable Sites – Key Findings for each Site

Bradwell

7.5.1 The site at Bradwell is located in the east of England, on the northern coast of the Dengie Peninsula in Essex, at the mouth of the Blackwater River and Estuary. It is situated in a rural area close to the village of Bradwell-on-Sea. The Bradwell area has supported nuclear power facilities since the 1960s.

7.5.2 There are potential negative effects on three national and internationally protected nature conservation sites, including the Essex Estuaries SAC and Blackwater Estuary and Dengie SPA/Ramsar; effects on water quality and fish/shellfish populations in nearby coastal waters due to the abstraction and release of sea water for cooling.

7.5.3 Part of the site is at high risk of coastal flooding and there are both hard and soft flood defences already in place, but these may require upgrading over the lifetime of a new power station. This could have potential effects on erosion and visual appearance of the coastline. These effects are significant, but mitigation opportunities are likely to be available following further study.

7.5.4 A new nuclear power station would be set in the context of the existing power station at Bradwell, but the surrounding area is predominantly undeveloped and there is limited potential for mitigation of the negative impact on the local landscape. There are no significant negative effects anticipated on nationally designated landscapes.

7.5.5 Potential setting effects upon nearby scheduled monuments and listed buildings, and the West Mersea Conservation Area, could also be of regional or national importance, depending on distance and sight lines. The impact on the setting of Othona Roman fort and St. Peter's Chapel would be of exceptional significance. However, mitigation could be applied by siting the proposed facility close to the existing power station on the western side of the nominated site. Detailed assessment will be required at the project level Environmental Impact Assessment stage.

7.5.6 Bradwell is not close to any other nominated site and therefore does not form part of a cluster. This means that regional cumulative impacts are not considered relevant for this site.

Braystones

7.5.7 The site at Braystones is located in the North West Region of England, in a coastal location north of the village of Braystones, less than 4kms north-west of the existing Sellafield facilities. There is no existing nuclear power station at Braystones itself.

7.5.8 The site is located west of the River Ehen, south of Silver Tarn, Hollas and Harnsey Mosses Site of Special Scientific Interest (SSSI), and east of the Cumbrian Coastal Railway.

7.5.9 There are potential negative effects on four protected nature conservation sites including Drigg Coast SAC, and Hollas and Harnsey Mosses SSSI; visual impacts on the landscape from the power station and new power lines that could be seen from locations including the Lake District National Park; effects on water quality and migratory fish in nearby coastal waters due to the abstraction and release of sea water for cooling; and potential effects on erosion and visual appearance of the coastline due to the need for new flood defences and a marine landing station. There is also the potential for significant positive effects associated with long term employment and enhanced communities locally. These effects are significant at a local and sub-regional level, but mitigation opportunities are likely to be available following further study.

7.5.10 Braystones forms one of a cluster of three nominated sites in the Cumbria area which have the potential for significant adverse cumulative effects on biodiversity and landscape. There is also the potential for significant positive cumulative effects associated with long term employment and enhanced prosperity for communities at the sub-regional level if three power stations are built in Cumbria with enhanced benefits from the draft Nuclear National Policy Statement in combination with other proposals for regeneration in the North West.

Hartlepool

7.5.11 The site at Hartlepool is located in the north-east of England, in an established industrial area. The site surrounds the existing Hartlepool nuclear power station and is located at the mouth of the River Tees, on the north side of Greatham Creek. The Teesmouth area is predominantly industrial with an established oil and chemicals industry.

7.5.12 Teesmouth and Cleveland Coast is designated as a Special Protection Area for birds and a Ramsar wetland site. There are potential negative effects on four national and internationally protected conservation sites including Teesmouth and Cleveland Coast, and the Seaton Dunes and Common SSSI.

7.5.13 There are also potential negative effects on water quality and migratory fish in the region due to the abstraction and release of sea water for cooling; and potential effects on coastal erosion and visual appearance principally as a result of new coastal flood defences that would be required to protect against sea level rise during the lifetime of the nominated site. These effects are significant, but mitigation opportunities are likely to be available.

7.5.14 The development of a new nuclear power station will have a negative visual impact on the landscape and could potentially be seen from parts of the North York Moors National Park and Cleveland Heritage Coast. This impact could not be fully mitigated, however, the nominated site is adjacent to an existing nuclear power station, in an area that is already heavily industrialised, and so the additional impact on the landscape would less significant at a regional level.

7.5.15 There are likely to be positive local effects from employment generated by the development although the regional and national effects are considered to be marginal.

7.5.16 Hartlepool is not close to any other nominated site and therefore does not form part of a cluster. This means that regional cumulative impacts from sites included in the Nuclear NPS are not considered relevant for this site.

Heysham

7.5.17 The site at Heysham is located in the north-west of England, on the Lancashire coast south of Morecambe Bay 8km west of Lancaster. The site is adjacent to the existing Heysham Power Station, which has been operational since 1983, and Heysham Docks.

7.5.18 The site lies in the mouth of the Lune Estuary which is a designated Site of Special Scientific Interest (SSSI), and overlaps with the Morecambe Bay European Marine Site. There are potential negative effects on these national and internationally protected conservation sites.

7.5.19 There are also potential negative effects on water quality in the region due to the abstraction and release of sea water for cooling. River and coastal flood defence schemes already exist in the area of the nominated site, but these may need to be upgraded to protect against sea level rise and coastal erosion during the lifetime of the facility. These effects are significant, but mitigation opportunities are likely to be available following further study.

7.5.20 The development of a new nuclear power station will have a negative visual impact on the landscape and could potentially be seen from parts of the Lake District National Park. This impact could not be fully mitigated, however, the nominated site is adjacent to an existing nuclear power station, in an area that is already heavily industrialised, and so the additional impact on the landscape would be less significant at a regional level.

7.5.21 Positive effects of regional economic significance may occur when the project is considered cumulatively with other energy projects in the North West. The Heysham site is adjacent to an existing rail link and sea port, which presents opportunities for sustainable transport, particularly during construction.

7.5.22 Heysham is approximately 30km south east of a cluster of three nominated sites in the Cumbria area. The positive and negative impacts discussed above would lead to cumulative impacts at a regional level if all the nominated sites were developed.

Hinkley Point

7.5.23 The site at Hinkley Point is located in the south-west of England, on the Severn Estuary and Somerset coast, 10km to the south west of Highbridge and 13km to the north west of Bridgwater. Hinkley Point site has supported nuclear power facilities since 1965. The surrounding land is predominantly agricultural, and is sparsely populated with a few rural villages.

7.5.24 There is the potential for negative effects on water quality and migratory fish populations caused by the abstraction and release of cooling water, and a risk from coastal flooding. Existing flood defences are in place, but may need upgrading during the lifetime of the facility. Mitigation opportunities are likely to be available for the above following further study.

7.5.25 There is an existing nuclear power station at Hinkley Point, but a new power station would have additional negative visual impact on views from the Quantock Hills Area of Natural Beauty (AONB) at a sub-regional level, which could not be fully mitigated.

7.5.26 There is the potential for significant negative cumulative effects if two new nuclear power stations (Hinkley Point and Oldbury) and any of the Severn tidal power schemes are developed; and the effects of the latter project are likely to be more significant than two new nuclear power stations. These include the potential loss of nationally and internationally important estuarine habitats, where it may not be possible to mitigate fully. The Government is carrying out a two-year feasibility study to determine whether the Government could support a tidal power project in the Severn Estuary. The Government is assessing a range of different schemes and the scope and scale of environmental effects is likely to vary widely between them. The Government are conducting separate environmental studies into these impacts and whether they could be mitigated. These are not yet complete so the assessment in this report is based upon the potential effects outlined in the preliminary habitats screening report for Severn Tidal Power[194]. This report is not final and will be reviewed in the light of the feasibility study's findings. It covers all five options but does not distinguish between the individual options where environmental impacts will vary. There will be a further consultation on the Feasibility's study findings, likely in 2010.

7.5.27 There is also potential for positive cumulative effects associated with long term employment and enhanced prosperity for communities at the sub-regional level if both power stations are built in the Severn Estuary.

Kirksanton

7.5.28 The site at Kirksanton is located on the Cumbrian coast in the north-west of England, facing the Irish Sea and the Isle of Man. Kirksanton lies on the mouth of the Duddon Estuary which is an internationally important habitat and, as such, has been awarded SSSI (Site of Special Scientific Interest), SAC (Special Area of Conservation) and Ramsar status.

7.5.29 There is no existing nuclear power station at Kirksanton. The site is located approximately 30km south of the Sellafield nuclear facility, and approximately 20km from the Heysham nuclear power station. The site at Kirksanton partially overlaps with the Haverigg Wind Farm.

194 This was published in January 2009. For more details see http://severntidalpowerconsultation.decc.gov.uk/supporting_documents

7.5.30 There are likely negative effects on two national and internationally protected conservation sites, namely the Duddon Estuary and Morecambe Bay European Marine Sites; and effects on water quality in the region due to the abstraction and release of sea water for cooling. A coastal flood defence scheme already exists in the area of the nominated site, but undefended areas in the vicinity show signs of coastal erosion. The existing defences may need to be upgraded to protect against sea level rise and coastal erosion during the lifetime of the facility. These effects are significant, but mitigation opportunities are likely to be available following further study.

7.5.31 There is limited existing development at Kirksanton, with the exception of a wind farm, prison and disused airfield. The development of a new nuclear power station will have a negative visual impact on the landscape and could be seen from parts of the Lake District National Park, which could not be fully mitigated. New power lines and transport links would also be needed in the vicinity. This would therefore have a significant negative impact on the landscape at a local and sub-regional level.

7.5.32 Kirksanton forms one of a cluster of three nominated sites in the Cumbria area which have the potential for significant adverse cumulative effects on biodiversity and landscape. There is also the potential for significant positive cumulative effects associated with long term employment and enhanced prosperity for communities at the sub-regional level if three power stations are built in Cumbria with enhanced benefits from the draft Nuclear National Policy Statement in combination with other proposals for regeneration in the North West.

Oldbury

7.5.33 The site at Oldbury is located on the south side of the Severn Estuary in the South West of England. The site is located to the north of the existing Oldbury Nuclear Power Station, approximately 1.5km from the village of Oldbury-on-Severn, and 24km north east of Bristol. The dominating land use in the area surrounding Oldbury is agricultural.

7.5.34 There are potential negative effects on two national and internationally protected conservation sites, namely the Severn Estuary European Marine Site and the River Wye SAC. The area is a high risk flood zone. Existing flood defences are in place, but these are likely to need upgrading to protect against sea level rise and erosion during the lifetime of the facility. These effects are significant, but mitigation opportunities are likely to be available following further study.

7.5.35 Due to the large tidal range the existing power station needs a tidal reservoir to allow for continual abstraction and release of cooling water. The capacity of the Severn Estuary at this location is insufficient for a new larger nuclear power station, and cooling towers are therefore required. Although adjacent to the existing power station the cooling towers could be up to 200m high and would be visible from parts of the Wye Valley and the Cotswolds Areas of Natural Beauty (AONB). This would have a negative visual impact on the landscape at a sub-regional level, which could not be fully mitigated.

7.5.36 There is the potential for significant negative cumulative effects if two new nuclear power stations (Hinkley Point and Oldbury) and any of the Severn tidal power schemes are developed; and the effects of the latter project are likely to be more significant than two new nuclear power stations. These include the potential loss of nationally and internationally important estuarine habitats, where it may not be possible to mitigate fully. The Government is carrying out a two-year feasibility study to determine whether the Government could support a tidal power project in the Severn Estuary. The Government is assessing a range of different schemes and the scope and scale of environmental effects is likely to vary widely between them. The Government are conducting separate environmental studies into these impacts and whether they could be mitigated. These are not yet complete so the assessment in this report is based upon the potential effects outlined in the preliminary habitats screening report for Severn Tidal Power[195]. This report is not final and will be reviewed in the light of the feasibility study's findings. It covers all five options but does not distinguish between the individual options where environmental impacts will vary. There will be a further consultation on the Feasibility's study findings, likely in 2010.

7.5.37 There is also potential for positive cumulative effects associated with long term employment and enhanced prosperity for communities at the sub-regional level if both power stations are built in the Severn Estuary.

Sellafield

7.5.38 The site at Sellafield is located in the North West Region of England, in a coastal location that has supported nuclear power facilities since 1956, and is now an established area for the nuclear industry. Apart from the existing nuclear facility, no other current industrial land use is present in the immediate area and the surrounding area is largely agricultural.

7.5.39 This site lies on the Cumbrian coast and the Appraisal of Sustainability has identified potential negative effects on three protected nature conservation sites in the region, including Drigg Coast SAC and the River Ehen SAC. There are potential significant negative effects on water quality and migratory fish in nearby coastal waters due to the abstraction and release of sea water for cooling.

7.5.40 The risk of flooding due to rising sea levels is considered relatively low at Sellafield and existing hard flood defences are in place, which may require upgrading. Mitigation opportunities are likely to be available following further study.

7.5.41 The development would be visible from parts of the Lake District National Park and the impact could not be fully mitigated. However, this would be set in the context of the extensive existing nuclear facilities at Sellafield, and so the additional impact on the landscape would be less significant at a regional level.

195 This was published in January 2009. For more details see http://severntidalpowerconsultation.decc.gov.uk/supporting_documents

7.5.42 Sellafield forms one of a cluster of three nominated sites in the Cumbria area which have the potential for significant adverse cumulative effects on biodiversity and landscape. There is also the potential for significant positive cumulative effects associated with long term employment and enhanced prosperity for communities at the sub-regional level if three power stations are built in Cumbria with enhanced benefits from the draft Nuclear National Policy Statement in combination with other proposals for regeneration in the North West.

Sizewell

7.5.43 The site at Sizewell is located predominantly to the north of the existing Sizewell B nuclear power station near Leiston, Suffolk, in the East of England. The site lies on the Suffolk Heritage Coast and is wholly within the Suffolk Coast and Heaths AONB, both of which are national designations for protecting areas of special scenic, landscape and environmental value from undesirable development. Although the proposed development would be set in the context of the existing power station, it may have a direct and long term negative visual impact on a nationally designated landscape and this could not be fully mitigated.

7.5.44 There are likely adverse significant effects on three national and internationally protected nature conservation sites: Minsmere to Walberswick Heaths SPA and Ramsar sites, and Sizewell Marshes SSSI. Construction and the presence of development are likely to lead to direct loss and fragmentation of priority terrestrial and coastal habitats and wildlife corridors for protected species. There is potential for mitigation or compensation of biodiversity effects, including the creation of replacement habitat and to maintain the connectivity of wildlife corridors for certain species around the site.

7.5.45 There are likely significant effects on water quality and fish/shellfish populations in nearby coastal waters due to the abstraction and release of sea water for cooling. The nature and significance of these effects will be explored in project level studies; mitigation possibilities include the incorporation of fish protection measures.

7.5.46 There are existing sand and shingle flood defences in place, which may require upgrading to protect the site for the full life time of a new nuclear power station, with secondary, indirect and likely significant effects on coastal erosion and the visual appearance of the coastline. Mitigation opportunities through appropriate design and construction of the flood defences are likely to be available following detailed project level studies.

Wylfa

7.5.47 The site at Wylfa is located at Wylfa Head, which extends into the Irish Sea from the north coast of the Isle of Anglesey, some 15km north east of Holyhead between Cemaes and Cemlyn Bays. It includes the headland south of Mynydd-y-Wylfa local nature reserve and extends eastwards to the western outskirts of the villages of Cemaes and Cemaes Bay. The Wylfa site has supported nuclear power facilities since 1971.

7.5.48 There are potential negative effects on national and internationally protected nature conservation sites. These effects are significant, but mitigation opportunities are likely to be available following further study.

7.5.49 The site is predominantly located on higher ground with hard bedrock. The risks from coastal flooding, sea level rise and erosion are therefore considered to be low. However, further assessment is required to determine the need for additional defences over the lifetime of a new power station.

7.5.50 Coastal water conditions at the site are considered generally favourable for the dispersion of the heated water that would be released after cooling.

7.5.51 The development of a new nuclear power station will have a negative visual impact on the local and sub-regional landscape, particularly the Anglesey Area Of Natural Beauty (part of which lies within the nominated site boundary) and North Anglesey Heritage Coast. Currently the exact placing of a new nuclear power station is unknown as a large site has been nominated, but some negative impact, which may not be fully mitigatable, is anticipated.

7.5.52 There is also potential for positive effects associated with long term employment and enhanced prosperity for communities at the local level.

7.5.53 Wylfa is not close to any other nominated site and therefore does not form part of a cluster. This means that regional or sub-regional cumulative impacts are not considered relevant for this site.

7.6 Summary of AoS Findings

7.6.1 Overall nationally and generally at the strategic level, the AoS identified that the draft Nuclear NPS was likely to have significant beneficial effects for energy security of supply and to contribute positively to the Government's targets for a low carbon economy, reducing emissions of greenhouse gases and mitigating the predicted effects of climate change. Likely significant adverse effects were indicated for nationally and internationally important nature conservation sites. The details of the significance of these effects and any appropriate mitigation will be determined through detailed studies as part of the project level EIAs and HRAs to accompany the individual applications for development consent to the IPC.

7.6.2 At local and regional levels, likely significant negative and beneficial effects were identified and their significance depends upon further local investigations; these will be carried out in more detail with the project level EIA studies. Generally, likely significant negative effects were associated with landscape, cultural heritage, biodiversity, water, and the capacity of supporting infrastructure such as waste and transport facilities; likely significant beneficial effects were associated with employment and community viability. There were particular considerations for the North West region where up to four new nuclear power stations may be developed and in the South West where two new nuclear power stations may be developed.

8. Monitoring and Next Steps

8.1 Monitoring

8.1.1 Monitoring helps to examine the effects predicted through the AoS process against the actual effects of the NPS when it is implemented. The sustainability effects of the nuclear NPS could be monitored through the monitoring frameworks already carried out by the environmental, nuclear and health regulators, and the local authorities. The extent of nuclear generating activities will be monitored through the nuclear licensing procedures. Pollution control and environmental management monitoring is carried out by the environmental authorities; human health protection is through the health authorities. Regional Planning Bodies and Local Planning Authorities monitor the effectiveness of their spatial plans, including indicators such as employment and access to community facilities and services.

8.1.2 The Government will agree a list of indicators to monitor the performance of the draft Nuclear NPS over time. If unforeseen adverse effects are identified the Government will seek to establish the cause and develop remedial actions in consultation with the relevant regulators, planning and environmental bodies. It will be important to gather information on the wider effects of the draft Nuclear NPS with regard to the Government's objectives and targets for climate change and security of energy supplies.

8.1.3 The Monitoring Strategy will be developed during the consultation period and take into account responses received on the draft Nuclear NPS and the AoS and HRA. The Strategy will set out proposed indicators for monitoring together with agreed responsibilities and frequencies of monitoring during the implementation of the NPS. This will be outlined in the AoS Statement that will be published with the adopted Nuclear NPS.

8.2 Next Steps

8.2.1 The draft Nuclear NPS, the AoS and the HRA Reports will be available for review and public comment. The documents are available at www.energynpsconsultation.decc.gov.uk and details of how to comment are set out in the Consultation Document[196]. If you have any comments on issues raised in the AoS or HRA, please respond as part of the consultation on the draft Nuclear NPS.

8.2.2 The Government will consider comments received during the public consultation in their decision making on finalising the NPS. On designation of the NPS, an AoS Statement will be published and this will outline how the findings of the AoS and the responses to consultation have been taken into account. It will also provide further information on how monitoring will be carried out during the implementation of the NPS.

196 www.energynpsconsultation.decc.gov.uk

Technical Glossary

As Low As Reasonably Achievable (ALARA)

Radiological doses or risks from a source of exposure are As Low As Reasonable Achievable when they are consistent with the relevant dose target or target standard and have been reduced to a level that represents a balance between radiological and other factors, including social and economic factors. The level of protection may then be said to be optimised.

As Low As Reasonably Practicable (ALARP)

To satisfy the ALARP principle, measures necessary to reduce risk must be taken until or unless the cost of those measures, whether money, time or trouble is disproportionate to the reduction in risk.

Becquerel (Bq)

The standard international unit of radioactivity equal to one radioactive transformation per second.

Best Available Technique (BAT)

Best available techniques (BAT) is defined in the EU Directive on integrated pollution prevention and control 96/61/EC as:

- 'best available techniques' shall mean the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole: 'Techniques' shall include both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned,
- 'Available' techniques shall mean those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the operator,
- 'Best' shall mean most effective in achieving a high general level of protection of the environment as a whole.

Best Practicable Environmental Option (BPEO)

BPEO was described by the Royal Commission on Environmental Pollution Twelfth Report (Cm 210) 1988 as "the outcome of systematic and consultative decision making procedure which emphasises the protection and conservation of the environment across land, air and water. The BPEO procedure establishes, for a given set of objectives, the option that provides the most benefits or least damage to the environment as a whole, at acceptable cost, in the long term well as in the short term.

Best Practicable Means (BPM)	BPM is the term used by the Environment Agencies in authorisations issued under RSA93. It requires operators to take reasonably practicable measures in the design and operational management of their facilities to minimise discharges and disposal of radioactive waste so as to achieve a high standard of protection for the public and the environment. BPM is applied to such aspects as minimising waste creation, abating discharges and monitoring plant discharges and the environment.
Committee on Radioactive Waste Management (CoRWM)	Independent body first established by UK Government and devolved administrations in November 2003 to recommend the best option or combination of options for the long term management of Intermediate Level Waste (ILW) and High Level Waste (HLW).
Decommissioning	The process whereby a nuclear facility, at the end of is economic life, is taken permanently out of service and its site made available for other purposes.
Disposal	Means emplacement of spent fuel or radioactive waste in an appropriate facility without intention of retrieval.
Dose	The measure of radiation received. Various forms of dose are commonly referred to as equivalent dose, effective dose and absorbed dose. Dose is measure in Sieverts (effective and equivalent) and Grays (absorbed).
Dose Constraint	The restriction on annual dose to an individual from a single source such that when aggregated with doses from other sources, excluding natural background and medical procedures, the dose limit is not likely to be exceeded.
Dose Limit	1 mSv/y to members of the public from all man-made sources of radiation.
Encapsulation	A conditioning process in which radioactive waste is physically enclosed in a non-radioactive material that prevents radionuclides from moving.
Immobilisation	A conditioning process in which radioactive waste is chemically incorporated into a non-radioactive materials so that radionuclides cannot move.
Interim Store	Storage of radioactive waste prior to implementing a final management step, such as geological disposal.
Intermediate Level Waste (ILW)	Radioactive waste exceeding the upper activity boundaries for LLW but which do not need heat to be taken into account in the design of storage or disposal facilities.

Ionising Radiation Regulations (IRR)	UK Regulations that require the employers to keep exposure to ionising radiations as low as reasonably practicable. Exposures must not exceed specified dose limits.
Legacy waste	Radioactive waste that already exists or whose arising is committed in future by the operation of an existing nuclear power station.
Low Level Waste (LLW),	Radioactive waste having a radioactive content not exceeding 4 gigabecquerels per tonne (GBq/te) of alpha or 12 GBq/te of beta/gamma activity.
Nuclear Waste	General term for the radioactive waste produced by those industries involved with nuclear energy and nuclear weapons' production. It includes LLW, ILW and HLW from nuclear power stations.
Sievert (Sv)	Unit of radiation dose recommended by the International Commission on Radiation Protection. It takes into account the energy absorbed in the tissue concerned, and the biological effects of the different radiations.
Spent fuel	Used fuel assemblies removed from nuclear power plant reactors after several years use and treated either as radioactive waste or via reprocessing as a source of fissile material.
Substances of Low Activity (SoLA)	Exemption order which exempts radioactive material containing <0.4 Bq/g from certain provisions under RSA93 relating to waste accumulation and disposal.
Very Low Level Waste (VLLW)	Waste with a very low concentrations of radioactivity: • Low volumes of VLW is radioactive waste which can be safely disposed to unspecified destination with municipal, commercial or industrial waste, each 0.1 m3 of waste containing less than 400 kilobecquerels (kBq) of total activity or single items containing less than 40 KBq of total activity. • High volume VLLW is radioactive waste with maximum concentrations of 4 megabecquerels per tonne (MBq/te) of total activity which can be disposed of to specified landfill sites.
Waste management hierarchy,	A hierarchical approach to minimise the amount of waste requiring disposal. The hierarchy consists of non-creation where practicable, minimisation of arisings where the creation of waste is unavoidable, recycling and reuse, and only then disposal.
Waste Package	A container and all its contents.

List of Abbreviations

AA	Appropriate Assessment
ALARA	As Low As Reasonably Achievable
ALARP	As Low As Reasonably Practicable
AONB	Areas of Outstanding Natural Beauty
AoS	Appraisal of Sustainability
AoS Report	Report setting out environmental and sustainability effects of the Nuclear NPS. It will incorporate the requirements of the SEA Directive
BAP	Biodiversity Action Plan
BAT	Best Available Techniques
Bq	Becquerel – The standard international unit of radioactivity equal to one radioactive transformation per second
BPEO	Best Practicable Environmental Option
BPM	Best Practicable Means
CCGT	Combined Cycle Gas Turbine
CCW	Countryside Council for Wales
CEA	Cumulative Effects Assessment
CO_2	Carbon Dioxide
COMARE	Committee on Medical Aspects of Radiation in the Environment
CoRWM	Committee on Radioactive Waste Management
cSAC	Candidate Special Area of Conservation
CWS	County Wildlife Site
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
EA	Environment Agency
EIA	Environmental Impact Assessment
EU	European Union
GDA	Generic Design Assessment
GHG	Greenhouse Gas
HLW	High Level Radioactive Waste
HPA	Health Protection Agency
HRA	Habitats Regulations Assessment
HSE	Health and Safety Executive
IAEA	International Atomic Energy Agency
ILW	Intermediate Level Radioactive Waste
IRR	Ionising Radiation Regulations
IMD	Index of Multiple Deprivation
IPC	Infrastructure Planning Commission.
LLW	Low Level Radioactive Waste
LNR	Local Nature Reserves

LPA	Local Planning Authority
mSv	Millisievert
NII	Nuclear Installations Inspectorate
NPS	National Policy Statement
OCNS	Office for Civil Nuclear Security
OECD	Organisation for Economic Co-operation and Development
OSPAR	Oslo and Paris Conventions
PPS	Planning Policy Statement
SA	Sustainability Appraisal
SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SEPA	Scottish Environment Protection Agency
SNH	Scottish Natural Heritage
SO_2	Sulphur Dioxide
SPA	Special Protection Area
SSA	Strategic Siting Assessment
SoLA	Substances of Low Activity
Sv	Sievert – Unit of radiation dose recommended by the International Commission on Radiation Protection.
UN	United Nations
VLLW	Very Low Level Waste

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