DEPARTMENT OF ENERGY & CLIMATE CHANGE

Appraisal of Sustainability of the draft Nuclear National Policy Statement: Appendix 1 & 2 to the Main Report

EN-6: Draft National Policy Statement for Nuclear Power Generation

Planning for New Energy Infrastructure

November 2009

Preface

Appraisal of Sustainability of the draft Nuclear National Policy Statement

The Appraisal of Sustainability (AoS), incorporating Strategic Environmental Assessment, 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 will need to be accompanied by an Environmental Statement having been the subject of a detailed Environmental Impact Assessment.

The AoS/SEA 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 at http://www.energynpsconsultation.decc.gov.uk

This document is the Appendices to the Appraisal of Sustainability Main Report. These appendices have been prepared by the Department of Energy and Climate Change with expert input from a team of specialist planning and environmental consultancies led by MWH UK Ltd with Enfusion Ltd, Nicholas Pearsons Associates Ltd, Studsvik UK Ltd and Metoc plc.

Contents

Appendix 1:

Appendix 2:

Appendix A1: Climate Change - Greenhouse Gas Emissions

A1.1 Introduction

A1.1.1. Greenhouse gases, such as carbon dioxide, methane, nitrous oxide and ozone, occur naturally in the atmosphere being released by natural sources. The need and desire for continued growth to satisfy an increasing human population, has resulted in an increased level of greenhouse gas emissions, including the release of fluorinated gases, which do not occur naturally in the atmosphere. This increase in greenhouse gas emissions is widely recognised as one of the main contributors to global warming and therefore climate change.

A1.1.2. The SEA Directive requires that information to be provided in the Environmental Report includes "*the likely significant effects on the environment, including on issues such as .....climatic factors*..." and the Government's guidance on undertaking SEA[1] provides general guidance on preparing the environmental report and on sources of information.

A1.1.3. Taking action on climate change can generally be categorised into either of two elements:-
Mitigation - that is actions that are designed to reduce the emissions of those gases that cause global warming and anthropogenic climate change; or
Adaptation - that is adjustments in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderate harm or exploit beneficial opportunities[2].

A1.1.4. However addressing climate change is not a case of either/or, both mitigation and adaptation need to pursued in parallel. This was made clear in "*Tomorrow's Climate, Today's Challenge Climate Change - The UK Programme 2006*", where it states "Some degree of climate change resulting from past and present emissions of greenhouse gases is already inevitable. In order to cope with the impacts of climate change we need to adapt – this action is complementary to our efforts to reduce emissions to avoid dangerous levels of climate change"[3].

[1] ODPM 2005 *A practical guide to the Strategic Environmental Assessment Directive*
[2] IPCC, 2007: *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*
[3] Climate Change The UK Programme 2006, Tomorrow's Climate, Today's Challenge (2006), Department for the Environment, Food and Rural Affairs (2006)

A1.1.5. However, the factors affecting Climate Change that are relevant for this section of the appendix are those related to the SEA Objective to "minimise greenhouse gas emissions." As a result, this section of the appendix is focussed on the mitigation effects arising from the Nuclear NPS. While it is clear that climate change affects are more widespread than those related to the emissions of greenhouse gases, those affects are dealt with elsewhere within other topics, for example, hydrology, landscape, soils, health, flood risk, etc.

A1.1.6. The UK is subject to international agreements in relation to emissions of greenhouse gases, the best known of these being the Kyoto Protocol. This is subject to continuing development and it anticipated that a significant update to the Protocol will be agreed at the 15th Conference of the Parties in Copenhagen (COP 15) later this year. The UK is also subject to EU emissions reductions targets and has for a number of years had a domestic emissions reduction target which exceeds its Kyoto target.

A1.1.7. However, in 2008 the Climate Change Act passed into legislation which overtook any existing domestic legislative or voluntary emissions reduction target. This is arguably the most ambitious regulation currently in place anywhere in the world. It has resulted in a target for the net UK carbon account in 2050 to be at least 80% lower than the 1990 baseline being adopted.[4]

A1.1.8. Alongside this GHG reductions target, the Climate Change Act also requires that periodic reports on the risks, and the action proposed in response to those risks, presented by inevitable climate change are presented to Parliament. The first of those reports must be presented by the end of 2011. The government is currently in the process of letting a contract for undertaking that initial risk assessment.[5]

A1.1.9. In parallel with this national assessment the Climate Change Act empowers the Secretary of State to require reports from certain authorities, including statutory undertakings, to prepare an assessment of the current and predicted impact of climate change in relation to their functions and a statement of their proposals and policies for adapting to climate change. These measures will ensure that adapting to inevitable climate change is properly addressed.

A1.1.10. To achieve the reduction in GHG emissions that is required the Committee on Climate Change argues that electricity generation is almost completely decarbonised. This will require a significant change from the current mix of generation technologies. For additional background on this issue see "The Transition to a Low Carbon Economy"[6] and "Electricity in the UK"[7] from the Parliamentary Office of Science and Technology.

[4] Climate Change Act 2008, HM Government; www.opsi.gov.uk/acts/acts2008/ukpga_20080027_en_1
[5] See http://www.defra.gov.uk/science/funding/competitions.htm Competition Code CEOSA0901
[6] The Transition to a Low Carbon Economy, December 2008, POST 318, Parliamentary Office of Science and Technology

A1.1.11. Various studies, including those carried out by OECD(Organisation for Economic Co-operation and Development), World Energy Council and the Intergovernmental Panel on Climate Change (IPCC), indicate that carbon dioxide emissions from the operation of new nuclear power stations are significantly lower than those from the same electricity generated by conventional fossil-fuelled power stations. The IPCC concluded that "Nuclear power is therefore an effective greenhouse gas mitigation option". Major significant beneficial and long term effects, in terms of the reductions in greenhouse gas emissions, are predicted from displacing electricity generated by conventional means with electricity generated by nuclear power.

A1.2. Policy Context

A1.2.1. Appendix A in the Scoping Report (March 2008) sets out the review of relevant plans, programmes and environmental objectives for the appraisal of the Nuclear NPS. This was updated during April-May 2009 to take account of key policy and sustainability objectives that may have been established since the earlier scoping.

A1.2.2. The following table, Table A1.1, sets out the key objectives for sustainability that need to be taken in to account for appraising the effects of the Nuclear NPS with regard to Climate Change and reflecting the updated policy review , referred to above.

Table A1.1: Key Sustainability Objectives

Plan, Policy or Programme	Key Sustainability Objective
International	
UN Framework Convention on Climate Change	The SEA needs to include objectives that address climate change and the need to reduce greenhouse gas emissions. The baseline data collation should also obtain baseline evidence relating to these issues.
Kyoto Protocol to the UN Framework Convention on Climate Change (1992)	Compared to many other forms of electricity generation, nuclear power does not produce greenhouse gas emissions during the energy generating process and therefore contributes to the goal of the Kyoto Protocol. However, issues relating to greenhouse gas emissions as a result of the transport of raw materials and waste should be considered during

[7] Electricity in the UK, February 2007, POST 280,7Parliamentary Office of Science and Technology

Plan, Policy or Programme	Key Sustainability Objective
	the development of the NPS.
Aarhus Convention (Convention on access to information, public participation in decision making and access to justice in environmental matters) 1998	To allow sufficient time to permit consultation in accordance with the Aarhus requirements.
The European Spatial Development Perspective (ESDP) January 1999	To ensure that objectives compliment the principles of the ESDP and that interactions between topics are considered.
EU Directive to Promote Electricity from Renewable Energy (2001/77/EC)	Although nuclear power stations are not categorised as renewable facilities, they would reduce reliance on other non-renewable forms of electricity generation.
EU Sixth Environmental Action Plan (2002 – 2012)	The plan highlights that ambitious action is required to reduce the emissions of greenhouse gases, particularly after 20012 when the Kyoto targets expire.
European Sustainable Development Strategy (2006)	The construction of new nuclear power stations has the potential to contribute to the “climate change and clean energy” priority as carbon dioxide emissions from nuclear power stations are low compared to conventional large scale electricity generation.
The European Spatial Development Perspective (ESDP) (1999)	This requires that the interactions between topics and their impact on climate change should be considered in assessing strategic decisions.
National	
UK SD Strategy (2005)	Guiding principles include “Living Within Environmental Limits” and “Using Sound Science Responsibly”
Climate Change Act (2008)	The Act sets out the UK’s greenhouse gas target – an 80% reduction by 2050 against a 1990 baseline. The Act also includes an interim target for 2020 and establishes the Committee on Climate Change who advise on the carbon budget and the report on progress against the target every 5 years.

Plan, Policy or Programme	Key Sustainability Objective
Meeting the Energy Challenge: A White Paper on Nuclear Power (2008)	Constitutes the Government's formal response to the nuclear consultation. The Government believes it is in the public interest that new nuclear power stations should have a role to play in the country's future energy mix alongside other low-carbon sources. The White Paper explains the basis for the decision. It also provides information about the consultation responses provided and the Government's response to them.
Stern Review of the Economics of Climate Change	Examines the evidence on the economic impacts of climate change. Nuclear power represents a low-carbon form of electricity generation and would make a positive contribution towards reducing greenhouse gas emissions from the sector.
Government/Department for Transport 10 year Transport Plan (2000)	Highlights the need to reduce greenhouse gas emissions from transport and sets a target of a 20% reduction by 2010. Provides a framework to address consideration of site location and traffic impact.
Climate Change – The UK Programme 2006: Tomorrow's Climate Today's Challenge	The goals in this programme have been superseded by those set in the Climate Change Bill. However the programme sets out measures to reduce greenhouse gas emissions including from the energy supply sector.
Environment Strategy for Wales (2006)	The SEA objectives for climate change compliment the objectives and targets of this strategy.
Wales Changing Climate: Challenging Choices: The Impact of Climate Change in Wales 2020 - 2080	This report highlights the likely impacts of climate change in Wales and identifies some of the potential consequences. The objective to minimise the emissions of greenhouse gases will contribute to minimising impacts in the long term.

A1.3. Scope of the Appraisal

A1.3.1. **AoS Framework**: The relevant Sustainability Objectives for the appraisal are set out in Table A1.2 below. The guide questions shown are useful to illustrate the objectives.

Table A1.2: AoS Appraisal Framework for Climate Change

Sustainable Development Theme: Climate Change (Greenhouse Gas Emissions)	
AoS Objectives[8]	**Guide Questions**
13. to minimise greenhouse gas emissions	Will it take account of future effects and risks of climate change for example sea level rise? Will future changes in weather patterns be considered? Will it result in increased vehicular emissions (particularly carbon dioxide)? Will the development result in an overall reduction in greenhouse gas emissions over its life time resulting from changes in: • Scope, form and methods of asset construction, maintenance and demolition • Waste recycling and disposal • Land management practices • Other secondary activities in the wider local and national economy Note: Adaptation to climate change is discussed in other relevant topic appriasals, eg. biodiversity, water, flood risk.
As previously stated climate change covers both mitigation and adaptation elements. This topic deals solely with the mitigation aspects of changes in the level of emissions of greenhouse gases. The adaptation elements are covered elsewhere within the individual topic; i.e. impacts of climate change on sea level rise within hydrology and flood risk; impacts on ecological systems and networks with Biodiversity and Ecosystems Services. This approach is adopted to ensure that there is no duplication and/or double-counting of impacts.	

A1.3.2. **Temporal and Spatial Boundaries**: The AoS followed the approach taken for the appraisal of the SSA criteria and reported in the Environmental Study[9] and update of the environmental study[10].Short and long term effects relate to activity phases of nuclear power stations as follows:

- Construction: short term 5-6 years
- Operation: long term, base case of 60 years (with possible extension subject to regulatory approval)
- Decommissioning: around 30 years

[8] Numbers refer to objective numbers in the SEA Scoping Report and the Environmental Study
[9] BERR July 2008 Environmental Study http://www.berr.gov.uk/files/file47137.pdf
[10] January 2009 Applying the Strategic Siting Assessment Criteria: an update to the study of the potential environmental and sustainability effects http://www.berr.gov.uk/files/file49869.pdf

It is 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.

A1.3.3. The draft Nuclear NPS sets out the Government's policy on the national strategic issues and site specific issues and mitigations which need to be taken into account when granting consent for the construction of new nuclear power stations.

A1.3.4. **Consultation**: During the appraisal process, consultation and ongoing liaison were made with the following:

- Defra with overall responsibility for securing a healthy environment
- Environment Agency , responsible for protecting the water environment

A1.4. The Current Situation and Likely Evolution without the Nuclear NPS

A1.4.1. Climate change represents a significant risk to ecosystems, the economy and human populations and could lead to a number of changes to the baseline environmental conditions across the UK. Reports by the Intergovernmental Panel on Climate Change, most recently in the 4th Assessment Report[11] provide scientific evidence that the emission of greenhouse gas emissions including carbon dioxide (CO_2) is changing the world's climate. The UK Sustainable Development Strategy (2005) includes in its guiding principles "Using Sound Science Responsibly". As a result it has signed up to a number of international and domestic commitments to reduce the emissions of greenhouse gases from the UK.

A1.4.2. The Government is committed under the Kyoto Protocol to reduce emissions of greenhouse gases by 12.5% below 1990 levels by 2012. There are also more challenging domestic targets with a long term target for the net UK carbon account in 2050 to be at least 80% lower than the 1990 baseline being adopted in the Climate Change Act 2008.

A1.4.3. The UK Climate Change Programme 2006[12] established a set of policies and priorities for action in the UK and internationally, highlighting the roles that all sectors and also individuals play in tackling climate change in the long-term. The commitment of the Government to this issue is further reflected in the

[11] *Climate Change 2007 - The Physical Science Basis;* Contribution of Working Group I to the Fourth Assessment Report of the IPCC

[12] Climate Change The UK Programme 2006, Tomorrow's Climate, Today's Challenge (2006), Department for the Environment, Food and Rural Affairs (2006)

Climate Change Act (2008) which lays out a new approach managing and responding to climate change in the UK. It will set ambitious targets and strengthens institutional frameworks by establishing the independent Committee on Climate Change.

A1.4.4. Overall UK emissions of carbon dioxide have fallen by 6.4% between 1990 and 2005, with emissions from the power generation sector falling by 5.6% in the period 1999 - 2004. 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[13], both of which produce CO_2 emissions and contribute to global warming.

A1.4.5. Under a "Business as Usual" scenario, with the current generation mix, it is difficult to see how the Government's long term 80% carbon reduction target can be achieved. In line with the Government's Low Carbon Transition Plan (LCTP)[14], there is a need for the supply of electricity to be almost totally decarbonised by 2050[15].

A1.5. The Likely Effects of the draft Nuclear NPS

A1.5.1. Data from the Organisation for Economic Cooperation and Development (OECD) and the International Atomic Energy Agency (IAEA) suggest that lifecycle Carbon Dioxide emissions, i.e. CO_2 emitted during construction, operation and decommissioning (including fuel extraction) compare favourably with those from conventional fossil fuelled power stations. These data suggest Carbon Dioxide emissions in the range of 7 - 22 g/kWh for electricity generated from nuclear power. This compares with Carbon Dioxide emissions of approximately 385 g/kWh for gas fired and 755g/kWh for coal fired electricity power stations[16].

A1.5.2. However, other studies report figures that are both higher, and lower, than those quoted above for emissions of Carbon Dioxide from electricity generated from nuclear power stations. These range from 3.10 g/kWh (Vattenfall)[17] to a maximum of 130 g/kWh (University of Sydney)[18]. The University of Sydney study reported a range from 10 – 130 g/kWh with an average of 60 g/kWh. This

[13] *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
[14] *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
[15] 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.
[16] *Nuclear Energy & the Kyoto Protocol* (2002), OECD Nuclear Energy Agency; *Assessing the difference: Greenhouse Gas Emission of Electricity Generation Chains* (2000), IAEA Bulletin
[17] Life-cycle Assessment, *Vatenfall's Electricity in Sweden*, January 2005
[18] *Life-cycle Energy Balance and Greenhouse Gas Emissions of Nuclear Energy in Australia*, ISA, University of Sydney, November 2006

reasons for this large range was reported as being dependant on the assumptions made, particular those made in relation to the grade of Uranium ore used. Other levels of emissions have been reported in other studies, but they fall within the range (3.10 – 130 g/kWh CO_2) shown above.

A1.5.3. In its 4th Assessment Report, the Intergovernmental Panel on Climate Change endorsed data produced by the World Energy Council[19], reporting that "*Total lifecycle GHG (Greenhouse Gas) emissions are below 40 gCO_2/kWh (10gC-eq/kWh), similar to those for renewable energy sources*"[20]. The IPCC report goes on to say that "*Nuclear power is therefore an effective GHG mitigation option*".

A1.5.4. From these data, it can be concluded that CO_2 emission reductions could be expected from the operation of new nuclear power stations when compared to the same generation capacity being delivered by conventional fossil fuelled generating stations. The lifecycle emissions arising from the generation of electricity from this new nuclear capacity would be of a similar magnitude to those arising from new renewable energy sources. This would contribute positively towards the UK Government emissions reduction target.

Radioactive and Hazardous waste management

A1.5.5. The Main AoS Report (Chapter 6) and Annex K give the findings of an appraisal of sustainability of the arrangements for managing radioactive and hazardous wastes arising from the Nuclear NPS. This appraisal has used the AoS framework to consider the following waste streams:

- Spent Fuel[21]
- Intermediate Level Waste (ILW)
- Low Level Waste (LLW)
- Gaseous and Liquid Radioactive Discharges
- Non Radioactive Hazardous Wastes

A1.5.6. 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 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 of. The findings of the appraisal in relation to

19 *Comparison of Energy Systems using Life Cycle Assessment*, World Energy Council Special Report, July2004.
20 *Climate Change 2007 - Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [B. Metz,et al], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
21 In accordance with Government's view that in the absence of any proposals from industry, new nuclear power stations should proceed on the basis that spent fuel will not be reprocessed, spent fuel is considered to be waste for the purposes of the appraisal

the effects at new power station sites and due to transport of waste from these sites are summarised below.

A1.5.7. There will be some minor adverse effects due to greenhouse gas emissions arising from the construction and decommissioning of interim storage facilities for Spent Fuel, ILW and possibly also LLW at power station sites. During operation there may be minor adverse effects due to the transport of LLW, although in other respects waste management will facilitate the positive contribution that nuclear power generation makes as a low carbon energy source. The emissions from construction of waste facilities and from transport of waste may be mitigated by adoption of suitable resource and energy efficient methods and technologies.

A1.6. Summary Effects of the Potentially Suitable Sites

A1.6.1. As with any major infrastructure project, there can be positive and negative effects at each stage of development. The relative significance of these effects depends on the characteristics and scale of the receiving communities. The sustainability of each site was appraised and the findings are set out in the individual site AoS Reports (Annexes A –J). These appraisals identified strategically significant effects and locally significant effects. These effects are set out in Table A1.3 below.

Table A1.3: Summary of Potential Strategic Effects on Climate Change – Greenhouse Gas Emissions

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Bradwell	-	++	-?
Construction phase will result in a small increase in regional GHG emissions. Lack of sustainable transport options may result in higher emissions than otherwise would be the case. Operational phase will make a positive contribution to National and regional GHG targets when compared to equivalent conventional electricity generation. Decommissioning will result in a short term increase in emissions but this is outweighed by the benefits in the operational phase. Lack of sustainable transport options may result in higher emissions in this phase.			
Braystones	-	++	-?
Construction will result in local increase in emissions – this can be minimised by the use of more sustainable transport options. Operational phase will make a significant contribution to national and regional carbon reduction targets when compared to conventional electricity generation. Decommissioning will result in a short term increase in emissions but this is outweighed by the benefits in the operational phase.			
Hartlepool	-	++	-?
Construction will result in local increase in emissions – use of the existing good quality transport infrastructure should contribute to minimising this increase in all phases. Operational phase will make a significant contribution to national and regional carbon reduction targets when compared to conventional electricity generation. Decommissioning will result in a short term increase in emissions but this is outweighed by the benefits in the operational phase.			
Heysham	-	++	-?
Construction will result in local increase in emissions although sustainable transport opportunities could help to minimise these. Operational phase will make a significant contribution to national and regional carbon reduction targets when compared to conventional electricity generation. Decommissioning will result in a short term increase in emissions but this is outweighed by the benefits in the operational phase.			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Hinkley Point	-	++	-?
Construction phase will result in a small increase in regional GHG emissions. Lack of sustainable transport options may result in higher emissions than otherwise would be the case. Operational phase will make a positive contribution to National and regional GHG targets when compared to equivalent conventional electricity generation. Decommissioning will result in a short term increase in emissions but this is outweighed by the benefits in the operational phase. Lack of sustainable transport options may result in higher emissions in this phase.			
Kirksanton	-	+?	-?
Construction will result in local increase in emissions. Operational phase will make a significant contribution to national and regional carbon reduction targets when compared to conventional electricity generation. Decommissioning will result in a short term increase in emissions but this is outweighed by the benefits in the operational phase.			
Oldbury	-	++	-?
Construction will result in local increase in emissions – this can be minimised by the use of more sustainable transport options. Operational phase will make a significant contribution to national and regional carbon reduction targets when compared to conventional electricity generation. Decommissioning will result in a short term increase in emissions but this is outweighed by the benefits in the operational phase.			
Sellafield	-	++	-?
Construction will result in local increase in emissions – this can be minimised by the use of more sustainable transport options. Operational phase will make a significant contribution to national and regional carbon reduction targets when compared to conventional electricity generation. Decommissioning will result in a short term increase in emissions but this is outweighed by the benefits in the operational phase.			
Sizewell	-	++	-?
Construction phase will result in a small increase in regional GHG emissions. Lack of sustainable transport options may result in higher emissions than otherwise would be the case. Operational phase will make a positive contribution to National and regional GHG targets when compared to equivalent conventional electricity			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
generation. Decommissioning will result in a short term increase in emissions but this is outweighed by the benefits in the operational phase. Lack of sustainable transport options may result in higher emissions in this phase.			
Wylfa	-	++	-?
Construction will result in local increase in emissions and the lack of sustainable transport options may result in higher emissions than otherwise would be the case. The operational phase will make a significant contribution to national, Welsh Assembly and sub-regional carbon reduction targets when compared to conventional electricity generation. Decommissioning will result in a short term increase in emissions but this is outweighed by the benefits in the operational phase.			

Key: Significance of potential strategic effect at each development stage	
++	Development actively encouraged as it 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 "?"

A1.7. Interactions and Cumulative Effects

A1.7.1. The following table identifies the potential cumulative effects resulting from the NPS. The first column considers cumulative effects at a national scale and the second column considers effects at a regional scale. The third column

considers the potential effects in-combination with those effects caused by other plans.

A1.7.2. It is important to note that assignment of greenhouse gas emissions from bulk electricity generation to a location raises an important issue. Due to the interconnected nature of the UK's electricity transmission system the users of the energy generated may not reside in the same region as the generation station. So where are these emissions to be allocated – to the end user or the generator.

A1.7.3. In the following table the overall cumulative effect on emissions will be allocated to the National Level. However, given the importance of regional (and local) greenhouse gas emissions reduction targets, the regional impact will also be noted for information. However, it is important that this is not double-counted as a benefit. I.e. the emissions reduction in operation compared conventional electricity generation contribute to reducing national emissions, but as they occur in a region they can also be considered as a regional benefit.

Table A1.4: Cumulative Effects on Climate Change (Greenhouse Gas Emissions) of the NPS and in-combination with other plans:

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
The nuclear NPS will have a significant positive effect on the emissions of greenhouse gases at a national level. This will contribute to the Government's long term target of an 80% reduction in the UK carbon account measured against a 1990 baseline. The Committee on Climate Change states that that this can only be achieved in the electricity generation is almost	The Nuclear NPS will positively contribute towards the achievement of regional greenhouse gas emissions targets (subject to the caveat above) during their operational phase. During both the construction and decommissioning phases there will be an increase in CO_2 emissions which may be regionally significant depending on the location and number of	The nuclear NPS in combination with a number of other plans will contribute positively towards emissions reduction targets. The Government's Renewable Energy Strategy[25] is seeking to increase the percentage of energy generated from renewable sources to 15% by 2020 (from 1.8% in 2007). This includes extending and raising the level of the Renewables Obligation to encourage

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
completely decarbonised by 2030.[22] Currently, approximately 31% of CO_2 emissions in England and Wales arise as a result of power generation.[23] In the IPCC's 4th Assessment Report they conclude that "*Nuclear power is therefore an effective GHG mitigation option*"[24]. Accordingly electricity generated from nuclear power has the potential to make a significant contribution towards achieving the decarbonising of electricity generation. However the extent of this contribution is dependent on the scale of the total installed capacity.	developments bought forward. These emissions largely arise from the movement of goods/materials and workers. As a result, the sustainability of transport services associated with individual locations is a factor at this scale.	up to 30-35% of electricity to be generated from renewable sources by 2020. The Government also proposes to increase the energy efficiency of dwellings through the Code for Sustainable Homes[26]. This has a target that all new dwellings built from 2016 should be zero carbon rated. The code considers issues other than the building fabric and includes the electricity consumption for lighting and appliances. There are also a number of regional plans in place to encourage and facilitate the development of low carbon energy supply and greenhouse gas emissions reductions. These include the Energy Coast[27], the London Array[28] and the Severn Tidal Estuary project[29]. While these plans are

22 *Building a low-carbon economy – the UK's contribution to tackling climate change*,(2008) Committee on Climate Change
23 Greenhouse Gas Inventories for England, Scotland, Wales and Northern Ireland 1990 – 2004, National Environmental Technology Centre.
24 Climate Change 2007 - Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz,et al], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
25 The UK Renewable Energy Strategy – Consultation, June 2008; BERR
26 The Code for Sustainable Homes: Setting the standard in sustainability for new homes, 2008, DCLG
27 Britain Energy Coast TM: A Master Plan for West Cumbria (British Government and Cumbria Partners)
28 E.ON, London Array Wind Farm, http://eon-uk.com/generation/londonarray.aspx
29 Severn Tidal Estuary Regional Economic Impact Study- DTZ Consultants. http://severntidalpowerconsultation.decc.gov.uk/supporting_documents

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
		independent of the Nuclear NPS they all contribute to the Climate Change Act target for the net UK carbon account in 2050 to be at least 80% lower than the 1990 baseline.

A1.7.4. The principal significant effect for Climate Change –Greenhouse Gas Emissions is the potential for a positive contribution to be made towards the target to reduce the UK's level of greenhouse gas emissions. This arises as a result of the lifecycle CO_2 emissions, i.e. CO_2 emitted during construction, operation and decommissioning (including fuel extraction) comparing favourably with those from conventional fossil fuelled power stations. The World Energy Council[30], report that "*Total lifecycle GHG (Greenhouse Gas) emissions are below 40 gCO_2/kWh (10gC-eq/kWh), similar to those for renewable energy sources*". This is significantly lower than emissions from fossil fuel generating stations of approximately 385 g/kWh for gas and 755 g/kWh for coal. There is some uncertainty as to the precise levels of emissions for nuclear plant, being dependant on the assumptions made, particular those made in relation to the grade of Uranium ore used. As a result it is important that this aspect is studied and reported upon in more detail. Furthermore transportation is an important element and consideration should be given to the sustainability of transport modes used.

A1.8. Summary and Conclusions

A1.8.1. The overall predicted effects of the draft Nuclear NPS on Climate Change – Greenhouse Gas Emissions are predicted to be significantly positive.

A1.8.2. During the construction and decommissioning stages of new nuclear power stations, there may be short term negative effects, in terms of greenhouse gas emission, arising principally from the extraction and transport of materials., the manufacture and transport of goods, and the transport and activities of workers. The significance and scale of these effects depends upon the relative sustainability of the local and regional transport systems as well as the scale and methods of construction and decommissioning. Transport emissions could be mitigated by minimising the quantities of materials goods transported and distance travelled as well as by considering low carbon forms of transport using

30 *Comparison of Energy Systems using Life Cycle Assessment*, World Energy Council Special Report, July2004.

existing rail facilities and, in some cases, maritime freight facilities. Construction impacts could be mitigated by adopting lean methods of construction and maximising the use of low carbon material and methods.

A1.8.3. There will also be some negative effects during the decommissioning phase. These also arise as a result of differences in the sustainability of local transport services. As a result the impact greenhouse gas emissions from transport services arising during construction and decommissioning could be considered together.

A1.8.4. However, these effects are small in comparison to the benefits arising from the relatively low level of greenhouse gas emissions that result from electricity generated from nuclear power in comparison with conventional fossil fuel generation. A range of studies suggest that life cycle emissions from nuclear generation, i.e. CO_2 emitted during construction, operation and decommissioning (including fuel extraction) is significantly lower than those from conventional power stations. While the data varies widely, typically as a result assumptions made, particular those made in relation to the grade of Uranium ore used, the highest estimates are significantly lower than those for either gas or coal.

A1.8.5. In its 4th Assessment Report, the Intergovernmental Panel on Climate Change endorsed data produced by the World Energy Council[31], reporting that "*Total lifecycle GHG (Greenhouse Gas) emissions are below 40 gCO_2/kWh (10gC-eq/kWh), similar to those for renewable energy sources*"[32]. As a comparison, Carbon Dioxide emissions are reported to be approximately 385 g/kWh for gas fired and 755g/kWh for coal fired electricity power stations.[33] The IPCC report goes on to say that "*Nuclear power is therefore an effective GHG mitigation option*".

A1.8.6. From these data it can be concluded that the draft Nuclear NPS (e.g. new nuclear power stations which are subsequently constructed) would contribute positively towards the UK Government emissions reduction target.

31 *Comparison of Energy Systems using Life Cycle Assessment*, World Energy Council Special Report, July2004.
32 *Climate Change 2007 - Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [B. Metz,et al], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
33 *Nuclear Energy & the Kyoto Protocol* (2002), OECD Nuclear Energy Agency; *Assessing the difference: Greenhouse Gas Emission of Electricity Generation Chains* (2000), IAEA Bulletin

Appendix A2: Biodiversity and Ecosystems

A2.1 Introduction

A.2.1.1 Biological diversity is defined internationally[34] as

> " …*the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems*."

A.2.1.2 The UK Biodiversity Partnership and the UK Government set out the UK's commitments, describe our biological resources, and list priority habitats and species in the UK Biodiversity Action Plan (UKBAP)[35].

A.2.1.3 The SEA Directive requires that the information to be provided in the Environmental Report includes "the likely significant effects on the environment, including on issues such as biodiversity…fauna, flora... and the interrelationship between the above factors" (Annex I (f)).

A.2.1.4 The role of the natural environment to provide a wide range of goods and services is internationally recognised, for example, the Millennium Ecosystem Report[36] and within the UK, for example, by the Government[37] with a UK Action Plan for embedding this concept of ecosystems services that "…underpin human health, well-being and prosperity". The interrelationships between the natural environment and human health and well-being are recognised and "living within environmental limits" is one of the fundamental principles of the UK Sustainable Development Strategy[38]. For the purposes of this appraisal, biodiversity includes consideration of habitats, species, flora, fauna, and their interrelationships with each other and with other factors.

A.2.1.5 The biodiversity factors that are relevant and their implications for the Nuclear NPS depend upon the type, scale, detailed design, and locational characteristics of the proposed new nuclear power stations. As well as these site specific issues, there are certain common implications for biodiversity for the Nuclear NPS as follows:

- water discharge, abstraction and quality issues,
- habitat (and species) loss and fragmentation / coastal squeeze
- disturbance events (noise, light and visual)
- air quality

34Convention on Biological Diversity (1992) http://www.cbd.int/convention/
35 http://www.ukbap.org.uk/
36 http://www.millenniumassessment.org/en/index.aspx (last accessed 10 June 2009)
37 http://www.defra.gov.uk/wildlife-countryside/pdf/natural-environ/eco-action-exec.pdf (last accessed 10 June 2009)
38 Securing the Future – delivering UK sustainable development strategy. HM Government, 2005.

A.2.1.6 There are also potential indirect, direct, and cumulative effects with other factors and with other major infrastructure projects as well as cumulative effects and interactions between different sites. These may influence targets and thresholds for important habitats and species. The particular implications for the Nuclear NPS on sites of European nature conservation importance (Special Protection Areas SPAs, Special Areas of Conservation SACs, proposed SACs and SPAs, Ramsar sites, and European marine sites) have been assessed as part of a Habitats Regulations Assessment (HRA) and this is reported separately[39]. The appraisal reported here in this AoS considers the implications of the draft Nuclear NPS on national and regional/locally important biodiversity including for European sites as assessed in the HRA. The HRA Reports are published at the same time as the AoS Reports alongside the draft Nuclear NPS.

A2.2 Policy Context

A.2.2.1 Appendix A in the Scoping Report (March 2008) sets out the review of relevant plans, programmes and environmental objectives for the appraisal of the Nuclear NPS. This was updated during April-May 2009 to take account of key policy and sustainability objectives that may have been established since the earlier scoping.

A.2.2.2 The following table, A2.1, sets out the key objectives for sustainability that need to be taken into account for appraising the effects of the Nuclear NPS with regard to Biodiversity reflecting the updated policy review, referred to above.

39 *DECC 2009 Habitats regulations assessment of the draft Nuclear National Policy Statement*

Table A2.1: Key Sustainability Objectives

Plan, Policy or Programme	Key Sustainability Objective
International	
Convention on Biological Diversity (1992)	Commitment to sustainable development and recognition that biodiversity is more than plants, animals, micro organisms and their ecosystems – it is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live.
Directive on the Conservation of European Wildlife and of Wild Fauna and Flora (92/43/EEC) (Habitats Directive)	This directive has been transposed into national law by means of the Conservation (Natural Habitats, & c.) Regulations 1994 (as amended) to take measures to maintain or restore at favourable conservation status, natural habitats and species of European importance. Established a network of Special Areas of Conservation, which together with existing Special Protection Areas and Ramsar sites form a network of protected sites known as Natura 2000 sites. The directive requires assessment of plans and projects for implications for European sites through Habitat Regulations Assessment (HRA).
Birds Directive (79/409/EEC)	Provides a framework for the conservation and management of, and human interactions with, wild birds in Europe, enabling the EC/EU to meet its obligations under the Bern and Bonn Conventions. Established a general scheme of protection for all wild birds, including the identification and classification of Special Protection Areas for rare or vulnerable species listed in Annex I of the Directive, as well as for all regularly occurring migratory species.
Ramsar Convention (Convention on Wetlands of International Importance, especially as Waterfowl Habitat) 1971	International treaty for the conservation and sustainable utilization of wetlands, to stem the progressive encroachment on and loss of wetlands now and in the future, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. Established international network of Ramsar sites.
National	
UK Biodiversity Action Plan	This plan has been prepared to develop national

Plan, Policy or Programme	Key Sustainability Objective
(1994)	strategies for the conservation of biological diversity and the sustainable use of biological resources. The overall goal of the UKBAP is 'To conserve and enhance biological diversity within the UK and to contribute to the conservation of global biodiversity through all appropriate mechanisms'.
Planning Policy Statement 1 (PPS 1), Delivering Sustainable Development (2005)	This is concerned with delivering sustainable development, and considers the highest protection should be given to wildlife habitats, to include the conservation and enhancement of wildlife species and habitats and the promotion of biodiversity.
Planning Policy Statement [9] (PPS 9), Biodiversity and Geological Conservation (2005)	This promotes sustainable development by ensuring that biological and geological diversity are conserved and enhanced as an integral part of social, environmental and economic development.
The Countryside and Rights of Way Act 2000	The Act places a duty on Government Departments and the National Assembly for Wales to have regard for the conservation of biodiversity and maintain lists of species and habitats for which conservation steps should be taken or promoted, in accordance with the Convention on Biological Diversity.
Natural Environment and Rural Communities Act 2006	This Act provides that any public body or statutory undertaker in England and Wales must have regard to the purpose of conservation of biological diversity in the exercise of their functions.

A2.3 Scope of the Appraisal

A.2.3.1 **AoS Framework**: As a result of the scoping (March 2008) and ongoing consultation, the AoS framework for appraising the effects of the draft Nuclear NPS on biodiversity identified the relevant AoS objectives as set out in the following table:

Table A2.2: AoS Appraisal Framework for Biodiversity

Sustainable Development Theme: Biodiversity	
AoS Objectives[40]	**Guide Questions**
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 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 for example 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?
Biodiversity has a role to play in adaptation measures to mitigate the predicted effects of climate change –this is discussed elsewhere in the relevant topic, for example, Water Quality and Resources (see A10) and Flood Risk (see A11).	

A.2.3.2 **Temporal and Spatial Boundaries**: The AoS followed the approach taken for the appraisal of the SSA criteria and reported in the Environmental Study[41] and update of the environmental study[42]. Short and long term effects relate to activity phases of nuclear power stations as follows:

40 Numbers refer to objective numbers in the SEA Scoping Report and the Environmental Study
41 BERR July 2008 Environmental Study http://www.berr.gov.uk/files/file49869.pdf
42 BERR January 2009 Applying the Strategic Siting Assessment Criteria: an update to the study of the potential environmental and sustainability effects http://www.berr.gov.uk/files/file49869.pdf

- Construction: short term 5-6 years
- Operation: long term, base case of 60 years (with possible extension subject to regulatory approval)
- Decommissioning: about 30 years

It is 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.

A.2.3.3 The draft Nuclear NPS sets out the Government's policy on the national strategic issues and site specific issues and mitigations which need to be taken into account when granting consent for the construction of new nuclear power stations.

A.2.3.4 **Consultation**: During the appraisal process, consultation and ongoing liaison were undertaken with the statutory consultees and regional/local authorities. The most relevant consultations in relation to this AoS topic were made with the following:

- Natural England, responsible for protecting the natural environment in England;
- CCW, responsible for protecting the natural environment in Wales;
- Environment Agency, responsible for protecting the environment and promoting sustainable development in England and Wales; and
- Relevant Local Authorities

A2.4 The Current Situation and Likely Evolution without the Nuclear NPS

A2.4.1. The UK Government's commitment to the Convention on Biological Diversity (1992) is delivered through the UK Biodiversity Action Plan (BAP) which aims to contribute to a significant reduction of the current rate of biodiversity loss at the global, regional and national level by 2010. By 2008, 14% of UK BAP habitats and 10% of priority species were shown to be increasing. However 17% of habitats and 11% of priority species are declining, but the decline is slowing for 27% of all habitats and 10% of all species. Overall, in 2008, more priority species showed improved trends than in 1999, 2002 and 2005[43].

A2.4.2. The total area of land and sea designated in the UK as SSSI, SPA or SAC increased between 1996 and 2008 from 2.3 million to 3.5 million hectares which is an overall increase of 48% (Defra). The features of the designated sites are monitored to determine whether conservation objectives are being met. The

43 Defra (2009) Biodiversity Indicators in your Pocket 2009, Measuring Progress Towards Halting Biodiversity Loss

Government has set a target for 95% of features to be in either favourable or recovering towards favourable condition by 2010. As of 2008, the conditions of features in the UK under the SSSI, SAC and SPA designations were below the target generally between 60 and 80 per cent, although this figure drops to 37 per cent for those Special Areas of Conservation within Wales.

A2.4.3. The Scoping Report and the Environmental Study set out the baseline information; this was updated with key data during preparation of the site level reports in 2009.

A2.5 The Likely Effects of the draft Nuclear NPS

A2.5.1. The draft Nuclear NPS is likely to have some strategic adverse negative effects on national and European sites of biodiversity value across all sites included in the draft NPS as being 'potentially suitable' sites for new nuclear power stations. A range of impacts across common themes have been identified over the course of a nuclear power station's life cycle, the most significant of which are likely to occur during construction and operational phases. As a result of these, cumulative impacts have been identified at the sub-regional levels in the North West and South West of England, and detailed studies will need to be undertaken by developers to inform assessments of the cumulative ecological effects at project level, and taken into account by the IPC in decision-making.

Construction Phase

A2.5.2. During the construction phase a number of potential negative impacts across common themes have been identified, including water discharge, abstraction and quality, habitat (and species) loss and fragmentation, coastal squeeze, disturbance events and air quality.

A2.5.3. Key impacts identified across these themes in relation to site construction include changes in water quality (including increased nutrients, toxicity and sediment loading) from associated works, increased water abstraction affecting hydrology and local/regional water resources, direct habitat (and) species loss and potential fragmentation of wildlife corridors from the construction of the site and related infrastructure (including cooling water intake structures, sea/flood defences, hydrological disruption, marine off-loading and landing facilities, as well as potential improvements to transport links and grid connections), noise and visual disturbance from increased traffic, workforce, machinery, plant, and lighting, and increased gaseous emissions from site activity. The effects of these are, without mitigation, likely to have potential negative impacts on a number of European sites and associated biodiversity across all of the proposed new nuclear power station locations.

A2.5.4. Potential significant negative cumulative effects for biodiversity have been 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 'potentially suitable' nuclear power station development site. Across 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 the Severn Tidal Power project currently being considered by Government[44], are considered potentially significant for biodiversity in conjunction with nuclear development in these areas. It is recommended that the IPC be advised to carefully consider the cumulative effects of new nuclear sites in the North West and South West regions with other potential energy developments.

Operational Phase

A2.5.5. Key potential negative impacts are identified on biodiversity resources (including European and nationally designated sites) in relation to the operational phase include potential changes in water quality from discharges, water abstraction for cooling water and general purposes, potential habitat (and species) loss and fragmentation from cooling water intake and thermal discharges, potential disturbance events from site activity such as from plant, workforce and lighting and potential effects from 'coastal squeeze' and any interference with coastal processes such as from the presence of hard coastal defence measures and associated site management.

A2.5.6. As with the construction phase, during operation, potential significant negative cumulative effects on biodiversity have been 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 'potentially suitable' nuclear power station development site. Across all sites, potential cumulative effects have been identified with other plans and projects, especially in relation to other energy development proposals, most notably in the North West and South West regions.

Decommissioning Phase

A2.5.7. The impacts from decommissioning are also considered potentially negative, with the long term impacts of nuclear waste storage having the potential to be of significance for biodiversity over a long time period. Potential impacts identified include potential changes in water quality, direct habitat and species loss and habitat fragmentation of wildlife corridors, from the construction of facilities and related infrastructure to manage and handle waste, disturbance, and gaseous emissions.

44 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 is conducting separate environmental studies into these impacts and whether they could be mitigated. These environmental studies 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. This preliminary habitats screening 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.

A2.5.8. Cumulative impacts on European sites and associated biodiversity are likely to arise from decommissioning in the North West and South West regions of England from more than one 'potentially suitable' nuclear power station.

Impacts on Key Habitats and Species

A2.5.9. The implementation of the draft NPS has the potential for significant impacts on a range of habitats and species directly on proposed development sites or within close proximity of proposed nuclear developments. Significant direct or indirect habitat loss may result for a range of habitats, especially for coastal and estuarine habitats across a number of European sites. A number of species are considered vulnerable from the cumulative impacts of developing across all sites nationally including important assemblages of breeding, over-wintering and passage birds (especially breeding Little Tern and over-wintering Bewick's Swan), fish species (Atlantic Salmon, Sea/River Lamprey and Twaite/Allis Shad) and nationally important populations of Natterjack Toad along the Cumbrian coast. Detailed studies will need to be undertaken by developers to inform assessments of the cumulative ecological effects at project level.

Mitigation

A2.5.10. Mitigation measures have been suggested as detailed in Table 2.3 and within more detail within site HRA and AoS reports, which may help address the significant adverse effects identified if implemented effectively. However, without detailed assessment work, at the project level, uncertainties remain as to whether the suggested measures will be wholly effective in minimising or avoiding potential adverse effects on biodiversity particularly in relation to sites of European or national importance for nature conservation.

A2.5.11. The following table summarises the likely biodiversity effects of the draft Nuclear NPS:

Table A2.3: Summary of the likely biodiversity effects of the draft Nuclear NPS

Sustainable Development Theme: Biodiversity	
Generic Effects	**Possible Mitigation**
Negative: Water discharge, abstraction and quality • Water Quality • Water Quantity • Surface and Groundwater Flow	• Direct requirements for the efficiency of water use and the protection of water quality. This may include requiring that management measures relating to supply and discharge are in place prior to the implementation of the site proposals, and that decisions relating to best available technology (BAT) take specific account of the sensitivities of the individual receiving environments. • Require suitable design, including use of Sustainable Drainage Systems (SuDs). • Direct the selection of appropriate construction methods. • Require studies to ensure that local groundwater bodies are investigated and suitable design is adopted to avoid or mitigate potential impacts.
Habitat (and species) Loss and Fragmentation/Coastal Squeeze • Direct Habitat Loss • Loss of Surrounding Habitat (construction of associated infrastructure) • Barriers to Migration for fish, birds and other notable species • Coastal Squeeze Effects	• Require site layout/ design to avoid or mitigate habitat losses. • Require habitat creation to replace lost habitats and maintain connectivity of wildlife corridors around site. • Require ecological mitigation and management plan, to link to existing integrated land management plan. • Works being appropriately screened with height restrictions implemented to limit migratory path disturbance. • Minimising the extent of cooling water culverts and reducing thermal plumes. • If cooling towers required, keep their height as low as practically possible. • Incorporating fish protection measures within cooling water intake/system design. • Integrating with SMPs when determining the location and type of

Sustainable Development Theme: Biodiversity	
Generic Effects	**Possible Mitigation**
	coastal defences required; and utilizing soft engineering techniques such as managed retreat and foreshore recharge as possible flood defence techniques.
Disturbance (Noise, light and visual) • Recreational Activities • Construction and Decommissioning • Indirect effects (construction of associated infrastructure)	• Minimise need for encroachment of construction into sensitive areas through site design. • Require construction environmental management plans to minimise disturbance, for example through timing, visual/noise screening. • Require noise, light and visual impacts to be managed at a site level through phasing and timing that takes account of breeding and feeding cycles of sensitive species and should be supported by information on flight lines and migration routes as well as feeding and roosting areas. • Direct requirements for technologies and operating practices that take account of identified sensitivities in fish populations in the estuarine environment to include the incorporation of fish protection measures within cooling water intake/system design. • Develop and apply environmental management plans to limit disturbance impacts on site integrity.
Air Quality • Emissions arising from Construction, Operation and Decommissioning	• Require sustainable transport plans including, for example: the use of non-road transport where possible; the phasing of development; and robust monitoring by operators at sites to track changes throughout the lifecycle of proposed operations. • Promote the use of carbon-efficient forms of transport and construction during the power station lifecycle. • Support opportunities to offset

Sustainable Development Theme: Biodiversity	
Generic Effects	**Possible Mitigation**
	emissions as appropriate including phased development. • Development and implementation of air quality management plans. • Ensure that monitoring by operators accounts for the potential for cumulative impacts where the phasing between existing power stations and the new build overlaps.

Radioactive and Hazardous waste management

A2.5.12. The Main AoS Report (Chapter 6) and Annex K give the findings of an appraisal of sustainability of the arrangements for managing radioactive and hazardous wastes arising from the Nuclear NPS. This appraisal has used the AoS framework to consider the following waste streams:

- Spent Fuel[45]
- Intermediate Level Waste (ILW)
- Low Level Waste (LLW)
- Gaseous and Liquid Radioactive Discharges
- Non Radioactive Hazardous Wastes

A2.5.13. 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 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 of. The findings of the appraisal in relation to the effects at new power station sites and due to transport of waste from these sites are summarised below.

A2.5.14. There will be some minor adverse effects due to disturbance during construction of interim storage facilities for Spent Fuel, ILW and possibly also LLW at power station sites. Because the facilities for waste management at nuclear power station sites are expected to be sited within the areas considered in the site level AoS and HRA appraisals, any direct effects of constructing waste management facilities, such as habitat loss, are included in the site appraisals. The mitigation measures considered in previous sections in are also applicable to mitigate the effects of waste management.

A2.5.15. The long-term restrictions on public access to areas used for storage and disposal of radioactive waste are considered to be beneficial for biodiversity and ecosystems.

A2.6. Summary Effects of the Potentially Suitable Sites

A.2.6.1. As with any major infrastructure project, there can be positive and negative effects at each stage of development. The relative significance of these effects depends on the characteristics and scale of the receiving communities. The sustainability of each site was appraised and the findings are set out in the individual site AoS Reports (Annexes A –J). These appraisals identified strategically significant effects and locally significant effects. These effects are set out in Table A2.4 below.

45 In accordance with Government's view that in the absence of any proposals from industry, new nuclear power stations should proceed on the basis that spent fuel will not be reprocessed, spent fuel is considered to be waste for the purposes of the appraisal

Table A2.4: Summary of Potential Strategic Effects on Biodiversity

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Bradwell	--?	--?	-?
Some negative effects at a national/international scale. There is potential for adverse effects on sites and species considered to be of UK-wide and European nature conservation importance (the Essex Estuaries SAC, Blackwater Estuary SSSI/SPA/Ramsar site, Dengie SSSI/SPA/Ramsar sites, Mid-Essex Coast SPA/Ramsar and Abberton Reservoir SPA/Ramsar/SSSI), significant strategic effects on the biodiversity cannot be ruled out at this stage of the appraisal. There is, however, potential for the mitigation of biodiversity effects to be defined at project level.			
Braystones	--?	--?	--?
Some negative effects at a national/international scale. There is potential for adverse effects on the sites and species considered to be of UK-wide and European nature conservation importance (Drigg Coast, River Ehen, Wast Water, River Derwent and Bassenthwaite SACs, Silver Tarn, Hollas and Harnsey Mosses SSSI), significant strategic effects on biodiversity cannot be ruled out at this stage of the appraisal. There is, however, potential for the mitigation of biodiversity effects to be defined at project level.			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Hartlepool	--?	--?	--?
Some negative effects at a national/international scale. There is potential for adverse effects on sites and species considered to be of UK-wide and European nature conservation importance (Northumbria Coast SPA/Ramsar, Teesmouth and Cleveland Coast SPA/Ramsar site, the Seal Sands and the Seaton Dunes and Common SSSI/NNR and the Teesmouth NNR sites), significant strategic effects on the biodiversity cannot be ruled out at this stage of the appraisal. There is, however, potential for the mitigation of biodiversity effects to be defined at project level.			
Heysham	--?	--?	--?
Some negative effects at a national/international scale. There is potential for adverse effects on sites and species that are considered to be of UK-wide and European nature conservation importance (the Morecambe Bay SAC/SPA/Ramsar site, Leighton Moss SPA/Ramsar and the Lune Estuary SSSI), significant strategic effects on the biodiversity cannot be ruled out at this stage of the appraisal. There is, however, potential for the mitigation of biodiversity effects to be defined at project level.			
Hinkley Point	-?	-?	?
Some negative effects at a national/international scale. There is potential for adverse effects on sites and species considered to be of UK-wide and European nature conservation importance (the Severn Estuary cSAC, SPA, Ramsar, and Bridgwater Bay SSSI, NNR), significant strategic effects on biodiversity cannot be ruled out at this stage of the appraisal. There is, however, potential for the mitigation of biodiversity effects to be defined at project level.			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Kirksanton	--?	--?	--?
Some negative effects at a national/international scale. There is potential for adverse effects on sites and species considered to be of UK-wide and European nature conservation importance (the Duddon Estuary SPA/Ramsar/SSSI site and the Morecombe Bay SAC/SPA/Ramsar SSSI site), significant strategic effects on the biodiversity cannot be ruled out at this stage of the appraisal. There is, however, potential for the mitigation of biodiversity effects to be defined at project level.			
Oldbury	--?	--?	--?
Some negative effects at a national/international scale. There is potential for adverse effects on sites and species considered to be of UK-wide and European nature conservation importance (the Severn Estuary SAC, SPA/Ramsar site and the River Wye SAC site), significant strategic effects on biodiversity cannot be ruled out at this stage of the appraisal. There is, however, potential for the mitigation of biodiversity effects to be defined at project level.			
Sellafield	--?	--?	--?
Some negative effects at a national/international scale. There is potential for adverse effects on the sites and species considered to be of UK-wide and European nature conservation importance (Drigg Coast River Ehen, Wast Water, River Derwent and Bassenthwaite SACs and Low Church Moss SSSI), significant strategic effects on biodiversity cannot be ruled out at this stage of the appraisal. There is, however, potential for the mitigation of biodiversity effects to be defined at project level.			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Sizewell	--?	--?	--?
Some negative effects at a national/international scale. There is potential for adverse effects on sites and species considered to be of UK-wide and European nature conservation importance (the Minsmere to Walberswick Heaths and Marshes SAC/SPA/Ramsar site, Alde-Ore and Butley SAC/SPA/Ramsar, Orfordness-Shingle Street SAC, Sandlings SPA and the Sizewell Marshes SSSI sites), strategic effects on the biodiversity cannot be ruled out at this stage of the appraisal. There is, however, potential for the mitigation of biodiversity effects to be defined at project level.			
Wylfa	--?	--?	--?
Some negative effects at a national/international scale. There is potential for adverse effects on sites and species considered to be of UK-wide and European nature conservation importance (Cemlyn Bay, Menai Strait and Conwy Bay SACs, the Yns Feurig, Cemlyn Bay and the Skerries, Liverpool Bay, Lavan Sands and Puffin Island SPAs and five SSSIs within 2km of the site, including Tre'r Goff located within the site boundary), significant strategic effects on biodiversity cannot be ruled out at this stage of the appraisal. There is, however, potential for the mitigation of biodiversity effects to be defined at project level.			

Key: Significance of potential strategic effect at each development stage	
++	Development actively encouraged as it 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

Site		Significance of potential strategic effect at each development stage		
		Construction	Operation	Decommissioning
	development or the potential for successful mitigation, the significance category is qualified by the addition of ?			

A2.7 Interactions and Cumulative Effects

A2.7.1. The following table identifies the potential cumulative effects resulting from the consideration of new nuclear power stations at each of the potentially suitable sites. The first column considers cumulative effects at a national scale and the second column considers effects at a regional scale. The third column considers the potential effects in-combination with those effects caused by other plans.

Table A2.5: Cumulative Effects on Biodiversity of the Nuclear NPS and in-combination with other plans:

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
Biodiversity		
Given the coastal location of sites, there is potential for nationally significant negative impact on shingle habitat, most notably on 'perennial vegetation of stony banks'. There are only a few extensive examples of this habitat in Europe, and the UK hosts a significant part of the European resource. Proposed nuclear sites at Heysham, Kirksanton and Sizewell have potential to directly or indirectly affect this habitat resource. A number of the sites have	North West/Cumbria: Potential for significant negative cumulative effects for biodiversity in the region (Braystones, Sellafield, Kirksanton and Heysham). A number of European sites including the Drigg Coast SAC and Morecambe Bay SAC/SPA/ Ramsar are affected by more than one potentially suitable site. South West: Potential for significant negative cumulative effects for biodiversity in the region (Hinkley and	National: Other national energy NPSs in combination with Regional Spatial and Economic Strategies have potential for negative cumulative effects for biodiversity as a result of potential additional energy development, urban development and related infrastructure in vicinity of some European sites. North West: Coastal and inland designated areas are likely to be affected by other energy proposals including tidal, wave, biomass and wind farm proposals as part of the

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
potential to impact upon European sites listed of international and national importance for breeding, over-wintering and passage bird species, the cumulative impact of which (on certain species) could be nationally significant. Species of particular concern include breeding Little Tern populations (associated with seven of the sites) and over-wintering Bewick Swan populations (associated with three sites). Potential impacts on fish species have been highlighted as an area of potential impact for many of the sites. Of particular concern are potential impacts on Atlantic salmon, Sea/River Lamprey and Twaite/Allis Shad species, potential impacts on which would be concentrated in the South West (Oldbury and Hinkley) and North West (Braystones, Sellafield and Kirksanton) regions, the effects of which could be of national significance. Natterjack Toad populations have a restricted range in the UK, linked to areas of Coastal Sand Dunes. There are in the region of c.60 breeding sites in the UK, a large proportion of which are situated on the Cumbrian coast. 95% of the UK	Oldbury). A number of European sites including the Severn Estuary SAC, SPA/Ramsar and River Wye SAC are affected by more than one potentially suitable site.	wider Britain's Energy Coast™ Masterplan. The Regional Spatial and Regional Economic strategies propose potential additional housing and road infrastructure. A number of other specific projects are proposed for the region including Heysham Port, Morecambe Bay Barrage and Walney Offshore wind farm. Four potentially suitable nuclear sites have been identified in the region, the construction of which, along with the decommissioning of facilities at Heysham and Sellafield may have an impact. The cumulative effects on biodiversity could be significant. South West: The area could be a focus for other high profile energy or development projects, such as the tidal Severn Tidal Estuary Project. Decommissioning existing nuclear facilities at Hinkley and Oldbury could also have an impact. The cumulative effects on biodiversity could be significant. East of England: The East of England Plan outlines a role for renewable energy, and is a key region for offshore wind farm development. The Regional Spatial Strategy and Local Development Frameworks propose additional housing and regeneration of coastal towns. Other specific projects proposed for the region include Bradwell wind farm.

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
population is associated with 5 estuaries, including the Duddon Estuary, which contains between 18-25% of the UK population. The proposed site at Kirksanton is adjacent to the Duddon estuary; any impacts on the Natterjack Toad population could be of national significance. For the cumulative impacts identified, there is, however, potential for the mitigation of these effects at the project level. In each case, detailed baseline studies should be required to inform ecological assessment at the project level.		Two potentially suitable nuclear sites have been identified in the region, Bradwell and Sizewell, the construction of which, along with the decommissioning of existing facilities at these sites may have significant cumulative effect on biodiversity. North East: The area could be a focus for other high profile energy or development projects, such as tidal power generation at the Tees Barrage. The Regional Spatial and Regional Economic strategies highlight increased development and visitor numbers may affect the regions water quality and resource. The decommissioning of existing nuclear facilities at Hartlepool may also have an impact. The cumulative effects on biodiversity could be significant. Wales: Planned housing and associated community infrastructure, employment growth and increased transport movements associated with the Wales Spatial Plan and Local Development Frameworks, combined with the decommissioning of existing nuclear facilities at Wylfa may have an impact on biodiversity.

A2.8 Summary and Conclusions/Recommendations

A2.8.1. For biodiversity, it is predicted that the draft Nuclear NPS will have potentially strategic adverse negative effects on national and European sites of biodiversity value across all sites included in the draft NPS as being 'potentially suitable' sites for new nuclear power stations. Such effects are likely to be significant during the construction and operational phases of the development of sites. A number of common implications for biodiversity have been identified including impacts from water discharge, abstraction and quality, habitat (and species) loss and fragmentation, coastal squeeze, disturbance events (noise and visual) and air quality. Likely significant cumulative effects are also identified 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.

A2.8.1. Nationally, potential negative cumulative impacts have been identified for the shingle habitat 'perennial vegetation of stony banks', which occurs within a number of European sites within close proximity of proposed new nuclear sites at Heysham, Sizewell and Wylfa. At Kirksanton and potentially elsewhere along the Cumbrian coast. Detailed baseline studies into the above will need to be undertaken by developers to inform assessments of the cumulative ecological effects at project level, and taken into account by the IPC in decision-making.

A2.8.1. Potential significant negative cumulative effects for biodiversity have been 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 'potentially suitable' nuclear power station development site. Across 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 the Severn Tidal Estuary Project currently being considered by Government, are considered particularly significant for biodiversity in conjunction with nuclear development in these areas. It is recommended that the IPC be advised to carefully consider the cumulative effects of new nuclear sites in the North West and South West regions with other potential energy developments.

A2.8.1. Mitigation measures have been suggested within this section of the appendix, in the main AoS report and in more detail within site HRA reports, that may help address the significant adverse effects identified if implemented effectively. However, across all the sites included in the draft Nuclear NPS, at this strategic level, potential adverse effects have been identified on European sites, and without project level detailed assessment work, uncertainties remain as to whether mitigation will be wholly effective. For these sites, only at the project level can a conclusion of no adverse effect on the integrity of European sites and associated biodiversity be made with confidence.

Appendix A3: Communities: Population, Employment and Viability

A3.1. Introduction

The sustainability and viability of communities is associated with a number of inter-related factors. The UK Sustainable Development Strategy[46] sets out that "*we want to achieve our goals of living within environmental limits and a just society, and we will do it by means of a sustainable economy, good governance and sound science."* The Government[47] defines sustainable communities as "…*places where people want to live and work… They meet the diverse needs of existing and future residents, are sensitive to their environment and contribute to a high quality of life. They are safe and inclusive… and offer equality of opportunity and good services for all*". The components of a sustainable community include "*a flourishing and diverse local economy*" "*well connected*" for transport and communications and "*well served*" for services such as schools.

A3.1.1. The SEA Directive requires that information to be provided in the Environmental Report includes "*the likely significant effects on the environment, including on issues such as ...population...material assets...and the inter-relationship...*" (Annex I (f)) and the Government's guidance on undertaking SA incorporating SEA[48] provides further information.

A3.1.2. The factors affecting population, employment and community viability that are relevant for the draft Nuclear NPS depend on the scale and locational characteristics of the proposed developments. There is also potential for these factors to be affected by the timing of the developments as a result of the mix of skills required principally during the construction phase.

A3.1.3. The draft Nuclear NPS could have implications for these factors generally as follows:

- Employment opportunities during the construction phase;
- On-going employment during the operational phase;
- Employment opportunities during the decommissioning phase;
- Skills and technology;
- In-migration and out-migration in each phase;
- Influence of population migration and change on community dynamics and services;
- Temporary and long-term economic effects at a local, regional and national scale;
- Land and property prices; and
- Indirect and secondary influences on health and well-being as a result of employment opportunities.

46 UK Government, 2005 Securing the Future: delivering UK sustainable development strategy
47 http://www.communities.gov.uk/archived/general-content/communities/whatis/ (last accessed 9 May 2009)
48 ODPM, 2005 *Sustainability Appraisal of Regional Spatial Strategies and Local Development Documents*

A3.1.4. The majority of these factors for communities (population, employment and viability) are likely to be at the local and regional scales associated with the individual development of new nuclear power stations. However, energy generated by new nuclear power will contribute to the overall UK mix of energy that will influence the reliability of national supplies to sustain businesses and industries.

A3.2. Policy Context

A3.2.1. Appendix A in the Scoping Report[49] (March 2008) sets out the review of relevant plans, programmes and environmental objectives for the appraisal on the Nuclear NPD. This was updated during April-May 2009 to take account of any key policy and sustainability objectives that may have been established since the earlier scoping.

A3.2.2. The following table A3.1 sets out the key objectives for sustainability that need to be taken in to account for appraising the effects of the nuclear NPS with regard to Communities: Population, Employment and Viability and reflecting the updated policy review, referred to above.

Table A3.1: Key Sustainability Objectives

Plan, Policy or Programme	Key Sustainability Objective
International	
Aarhus Convention (Convention on access to information, public participation in decision making and access to justice in environmental matters) 1998	To allow sufficient time to permit consultation in accordance with the Aarhus requirements
The European Spatial Development Perspective (ESDP) January 1999	To ensure that objectives compliment the principles of the ESDP and that interactions between topics are considered
National	
UK SD Strategy (2005)	Guiding principles include "*ensuring a strong, healthy and just society*" and "*achieving a sustainable economy*"
Rural White Paper "Our Countryside: the future: A fair deal for Rural England" (2000), and review "Our	Adverse impacts upon the character and quality of the rural environment do not affect the viability of rural settlements

49 http://www.berr.gov.uk/consultations/page45265.html

Plan, Policy or Programme	Key Sustainability Objective
Countryside: the Future" (2004)	
The Egan Review: Skills for Sustainable Communities (2004)	Maintaining sustainable communities by ensuring that opportunities to access employment are considered
Good Practice Guide on Planning for Tourism (DCLG, 2007)	To ensure that planning and tourism are integrated in a sustainable way

A3.3. Scope of the Appraisal

A3.3.1. As a result of scoping and ongoing consultation, the AoS framework for appraising the effects of the draft Nuclear NPS on communities (population, employment and viability) identified the relevant AoS objectives as set out in following table:

Table A3.2: AoS Appraisal Framework for Communities: Population, Employment and Viability

Sustainable Development Theme: Communities: Population, Employment and Viability	
AoS Objectives[50]	**Guide Questions**
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 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?
The concept of a sustainable community covers a complex range of inter-related attributes and only those covering population, employment and economy are addressed in this section. The indirect effects of local employment on health and well-being are covered within the theme Health and Well-Being (see A5); the interactions with community infrastructure, such as transport and waste, are considered in the theme Communities: Supporting Infrastructure (see A4).	

50 Numbers refer to objective numbers in the SEA Scoping Report and the Environmental Study

A3.3.2. **Temporal and Spatial Boundaries**: The AoS followed the approach taken for the appraisal of the SSA criteria and reported in the Environmental Study[51] and update of the environmental study[52]. Short and long term effects relate to activity phases of nuclear power stations as follows:

- Construction: short term 5-6 years
- Operation: long term, base case of 60 years (with possible extension subject to regulatory approval)
- Decommissioning: around 30 years

It is 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.

A3.3.3. The draft Nuclear NPS sets out the Government's policy on the national strategic issues and site specific issues and mitigations which need to be taken into account when granting consent for the construction of new nuclear power stations.

A3.3.4. **Consultation**: During the appraisal process, consultation and ongoing liaison were undertaken with the statutory consultees and regional/local authorities.

A3.4. The Current Situation and Likely Evolution without the Nuclear NPS

A3.4.1. The Scoping Report and the Environmental Study set out the baseline information for population, demographics and employment. A range of population data is provided giving the distribution and changes on a national and a regional scale. The UK population is expected to increase at an average annual rate of growth of 0.7%. Demographic data is also provided and this shows that the UK has an aging population with the percentage of people aged 65 and over projected to rise to 23% in 2031 (from 16% in 2003).

A3.4.2. Unemployment data shows significant variation within regions which can be greater than that between regions. Since the first quarter of 2008 in the UK as a whole the trend in unemployment rates has been rising, reaching 7.1 % in May 2009[53].

51 BERR July 2008 Environmental Study http://www.berr.gov.uk/files/file47137.pdf
52 BERR January 2009 Applying the Strategic Siting Assessment Criteria: an update to the study of the potential environmental and sustainability effects http://www.berr.gov.uk/files/file49869.pdf
53 Office of National Statistics; May 2009

The Likely Effects of the draft Nuclear NPS

Construction Phase

A3.4.3. The draft Nuclear NPS is likely to have some positive employment effects particularly at sub-regional levels, and in some cases these benefits may be of regional significance. This will include positive effects through the provision of training, education and upskilling for employees and contractors. However, if planning approval was to be granted to a number of sites within a region, and these were to be developed in a similar timeframe, this could result in some short term negative effects. These effects include a potential shortage of construction workers to meet the needs of other industries and major projects within the region, and pressure on local services, particularly at a sub-regional level. This could be successfully mitigated through careful phasing of developments.

A3.4.4. Large scale in-migration can also result in disruption to local communities while integrating the incoming construction workforce. There will be some benefits to the local economy through the use of local support services, such as accommodation, local shops and leisure facilities.

A3.4.5. If a significant number of sites were to be developed at the same time, this may result in pressure in specialist construction skills of a national significance. This could be mitigated by effective programme management.

Operational Phase

A3.4.6. During the operational phase the quality and quantity of employment opportunities will be different to the construction phase being smaller in number, but of higher skill levels. This will have local benefits, but these are not likely to be nationally or regionally significant.

A3.4.7. Evidence on the effect of a nuclear facility such as a power station on property values is unclear. However, because any effect on property values is likely to be limited to the local area, this effect is not considered to be strategically significant.

Decommissioning Phase

A3.4.8. The effect in this phase will be reduced again in scale from the operational phase. This may result in some local employment and economy benefits, but these are unlikely to be nationally or regionally significant.

Radioactive and Hazardous Waste Management

A3.4.9. The Main AoS Report (Chapter 6) and Annex K give the findings of an appraisal of sustainability of the arrangements for managing radioactive and hazardous wastes arising from the Nuclear NPS. This appraisal has used the AoS framework to consider the following waste streams:

- Spent Fuel[54]
- Intermediate Level Waste (ILW)
- Low Level Waste (LLW)
- Gaseous and Liquid Radioactive Discharges
- Non Radioactive Hazardous Wastes

A3.4.10. 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 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 of. The findings of the appraisal in relation to the effects at new power station sites and due to transport of waste from these sites are summarised below.

A3.4.11. There is potential for minor positive effects on the economy through additional employment opportunities associated with the construction and operation of the interim storage facilities for spent fuel and ILW. However, the effect of interim storage on employment will be small in relation to the effect of other aspects of construction and operation. The employment opportunities associated with management of gaseous and liquid radioactive discharges at nuclear power stations and the small quantities of LLW and non-radioactive hazardous waste arising at the sites are not considered to be significant.

A3.5. Summary Effects of the Potentially Suitable Sites

A3.5.1. As with any major infrastructure project, there can be positive and negative effects at each stage of development. The relative significance of these effects depends on the characteristics and scale of the receiving communities. The sustainability of each site was appraised and the findings are set out in the individual site AoS Reports (Annexes A –J). These appraisals identified strategically significant effects (associated with factors of regional, national or international importance) and locally significant effects (associated with factors of local or area importance). These effects are set out in Table A3.3 below.

54 In accordance with Government's view that in the absence of any proposals from industry, new nuclear power stations should proceed on the basis that spent fuel will not be reprocessed, spent fuel is considered to be waste for the purposes of the appraisal

Table A3.3: Summary of Potential Strategically Significant Effects on Communities: Population, Employment and Viability

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Bradwell	+?	+?	0
Strategic effects are considered minor positive with regard to the creation of temporary jobs during construction and permanent full-time employment during operation, although some uncertainty identified as the project may lead to a shortage of local construction workers to meet the needs of other industries and major projects.			
Braystones	+?	+?	0
As above.			
Hartlepool	+?	+?	0
As above.			
Heysham	+?	+?	0
As above.			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Hinkley Point	+?	+?	0
Strategic effects are considered minor, although some uncertainty identified as project may lead to a shortage of local construction workers to meet the needs of other industries. Positive cumulative effects are also likely for the region when considered with proposals for a second nuclear power station and Severn Barrage in the South West - contributing to the regional economy and employment.			
Kirksanton	+?	+?	0
Strategic effects are considered minor positive with regard to the creation of temporary jobs during construction and permanent full-time employment during operation, although some uncertainty identified as the project may lead to a shortage of local construction workers to meet the needs of other industries and major projects.			
Oldbury	+?	+?	0
As above.			
Sellafield	+?	+?	0
As above.			
Sizewell	+?	+?	0
As above.			
Wylfa	+?	+?	0
As above.			

Key: Significance of potential strategic effect at each development stage	
++	Development actively encouraged as it 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

Key: Significance of potential strategic effect at each development stage	
--	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 ?

A3.6. Interactions and Cumulative Effects

A3.6.1. There are likely to be some regionally significant employment and economic benefits particularly during the construction phase, both from the effects of the Nuclear NPS itself and particularly in combination with other plans.

A3.6.2. There will also be on-going benefits during the operational phase but these are likely to be restricted to the local level. When these benefits are combined with those arising from other plans, for example, the Energy Coast Masterplan in the NW Region (Cumbria), the benefits in education, training and skills may become regionally significant.

A3.6.3. There is a small risk that during the construction phase regionally adverse effects may occur due to the increased demand in construction labour, which could lead to a shortage of local construction workers to meet the needs of other industries. This would be most likely to occur should development occur at a number of locations simultaneously; however, this may be mitigated through careful planning and phasing of proposed development projects.

A3.6.4. The following table identifies the potential cumulative effects resulting from the draft Nuclear NPS. The first column considers cumulative effects at a national scale and the second column considers effects at a regional scale. The third column considers the potential effects in-combination with those effects caused by other plans.

Table A3.4: Cumulative effects on population, employment and viability of the NPS and in-combination with other plans:

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
Employment		
Likely to have a small overall positive effect on national employment. If all 10 sites were constructed, the peak construction period employment figures of 40,000[55] would represent an increase of less than 0.15 per cent on 2009 UK employment figures of 29.27 million[56]. However with construction staggered over a longer period, between approximately 2015- 2030, the increase in national employment is likely to be dispersed over a 15 year period and is therefore less significant. The NPS is likely to increase demand for skilled construction labour with positive synergistic effects for the building industry through enhanced training an employment opportunities. In the longer-term, the NPS is likely to contribute significantly to the	**North-West/ Cumbria:** Significant positive cumulative effects for North West region. 4 power stations could contribute 16,000 short-term peak construction jobs, 2,000 permanent jobs and 8,000 associated jobs[57]. This would assist in bridging the gap between employment in the region and the rest of England. [58] For the Cumbria District, 3 power stations could contribute 12,000 short-term peak construction jobs, 1,500 permanent jobs and 6,000 associated jobs. The NPS will contribute significantly to the existing nuclear hub in the region and its development as the Energy Coast. [TM59] **South West:** Likely to be minor positive cumulative effects for regional employment figures, as 2	**National:** Other national Energy NPSs, in combination with Regional Spatial and Economic Strategies are likely to facilitate an increase in employment in the energy and renewable energy fields. When combined with the employment from Nuclear sites, there will be likely positive national effects for employment. **North-West/ Cumbria:** The location already has a strong nuclear skills base. The West Cumbria Energy Coast Masterplan also outlines a role for a wider renewables industry, with potential cumulative positive effects for employment in the region. **South West:** The Severn Tidal Estuary Project may have cumulative effects, when, combined with employment created at Hinkley Point and

55 Based on estimated peak construction workforce of 4,000 per site – Figures supplied by DECC, based on recent US experience and construction of Sizewell B.

56 ONS: Labour Market Statistics 2009

57 Based on estimated peak construction workforce of 4,000 per site; an operational workforce of 500 per site, and associated employment of an additional 2,000 jobs per site. Figures supplied by DECC, based on recent US Experience and construction of Sizewell B.

58 The Northwest employment rate is 73%, 2% behind the England average. The Northwest would need 80,000 more people in work to bridge the gap. NorthWest RES http://www.nwda.co.uk/PDF/RES06v2.pdf

59 Britain Energy Coast TM: A Master Plan for West Cumbria (British Government and Cumbria Partners)

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
development of jobs in the nuclear and associated industries. This will contribute to national employment through an increase in permanent employment of up to 27,500 jobs. This will enhance training and employment opportunities and assist in developing nuclear expertise on a national level.	nuclear sites in the South West (Hinkley Point and Oldbury). This could contribute 8,000 short-term peak construction jobs, 1,000 permanent jobs and 4,000 associated jobs to regional employment figures.	Oldbury, however the economic impact study undertaken for the Tidal Project outlines a broad range of employment estimates, depending on impacts on other industries, for example Ports. [60] The cumulative effects on employment are therefore uncertain. Other energy projects in the area, including potential Round 3 Offshore Windfarm projects in the Estuary and a gas power station in Newport, Wales may also contribute positively to regional employment in the energy sector. **East of England:** The East of England Plan[61] outlines a role for renewable energy, and is a key region for offshore wind farm development, including the £1.5 billion London Array Offshore Wind project, off the Essex and Kent Coasts. This is likely to contribute further to regional employment in the energy sector.

60 Severn Tidal Estuary Regional Economic Impact Study- DTZ Consultants. http://severntidalpowerconsultation.decc.gov.uk/supporting_documents

61 The East of England Plan, the Revision to the Regional Spatial Strategy for the East of England, published on 12 May 2008.

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
Employment		
No national adverse cumulative effects identified	**North-West/ Cumbria:** A regional adverse effect may occur due to the increased demand in construction labour, which could lead to a shortage of local construction workers to meet the needs of other industries or the need to import foreign labour. This may be a particular issue in Cumbria and the North-West although it is unlikely that construction of all 4 reactors would occur simultaneously.	**North-West/ Cumbria, South west and East of England:** Further energy/ renewables projects in the 3 regions may contribute to a national shortage of skilled construction labour, which could lead to indirect effects on other industries (for example housing industry) or the need to import labour from overseas. Mitigation is possible through the implementation of training programmes and encouraging employment in the industry.
Economic Development , Viability and Regeneration		
Likely positive direct and indirect economic benefits associated with the development of power stations including associated regeneration. These benefits are likely to be of minor significance at a national level. Economic benefits accruing to British Industry due to the requirement for goods and services to service the nuclear industry. The extent of this effect is uncertain as it is dependent on reactor-type and the percentage of goods and services sourced overseas.	**North-West, South west and East of England:** Positive regenerative effects likely at the regional level, particularly for the North West region, with some benefits possible for the South West and the East of England. **Cumbria:** The economic and regeneration effects are likely to be more significant for the Cumbria District (with 3 sites) due to increased employment and flow on effects for local businesses and the economy. An increased population, particularly	**Cumbria and the North West:** The Regional Economic Strategy for the North West, when combined with the positive benefits of a Nuclear 'hub' in the Cumbria District are likely to combine to bring positive regeneration benefits for the region as a whole. **South West:** Combined effects of nuclear Power Stations with other renewables projects likely to contribute positively to Regional Economic Development. The Severn Tidal Estuary Barrage is estimated to

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
	during the construction stage will also have secondary positive economic effects for other industries, businesses and services in Cumbria.	cost up to £14 billion and could contribute significantly to the South West Economy. **East of England Regions:** Combined effects of nuclear Power Stations with other renewables projects likely to contribute positively to Regional Economic Development. The £1.5 billion London Array Offshore Wind project, off the Essex and Kent Coasts will be the worlds largest and will contribute significantly to the economies of the South East and the East of England regions[62]. **Wales:** Likely to contribute to a positive economic impact when considered cumulatively with other projects in Wales.
Effects on tourism		
No national effects identified.	**North-West and South west:** Unlikely to have a cumulative effect on tourism in South West and East of England Regions due to distance between sites. **Cumbria:** Possible adverse cumulative effects on tourism in the Cumbria region, including	*Making the Dream a reality- the Tourism Strategy for Cumbria 2008-2018.* Potential for development of 3 Nuclear Power Stations to conflict with the Strategy priority of *developing the tourism industry in ways which do not detract from Cumbria's special*

62 http://eon-uk.com/default.aspx

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
	the Lakes District National Park, due to visual impacts and public perception of 3 additional nuclear sites in the region.	*landscapes.*

A3.7. Summary and Recommendations

A3.7.1. The predicted effects of the draft Nuclear NPS on Communities: Population, Employment and Viability are to be directly slightly positive although limited in scale. There are likely to be some minor employment benefits at the regional scale particularly during the construction phase. During the operational phase there are likely to be some regional or sub-regional benefits for training and skills, especially when in combination with other plans. There is also likely to be some minor local or sub-regional economic benefit through the use of local support services, such as accommodation, local shops and leisure facilities.

A3.7.2. However there are also some potential adverse effects. If a number of sites were to be developed simultaneously this could result in some short term negative effects. The most important of these is the potential for a shortage of construction workers to meet the needs of other industries and major projects. If these were in the same region this could become a significant effect within the region. Large scale construction projects may also place additional pressure on local services, particularly at a sub-regional level. Large scale in-migration can also result in disruption to local communities while integrating the incoming construction workforce. It was recommended by the AoS that the draft Nuclear NPS should set out that such potential cumulative effects should be considered and appropriate development phasing be addressed by the IPC.

A3.7.3. In the North West region (Cumbria sub-region) there is the potential for an adverse effect on tourism associated with the coast and the Lakes District National Park. It was recommended that the draft NPS should carefully consider the cumulative effects of additional nuclear sites in the region and advise the IPC to carefully consider the capacity of this area to accommodate such change.

Appendix A4: Communities: Supporting Infrastructure

A4.1. Introduction

A4.1.1. The SEA Directive requires that information to be provided in the Environmental Report includes "*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....."* and the Government's guidance on undertaking SEA[63] provides general guidance on preparing the environmental report and on sources of information. While this does not list infrastructure as a discrete issue, it is an essential underpinning element of many of the indentified issues.

A4.1.2. Similarly, the UK Sustainable Development Strategy "Securing the Future" does not include Infrastructure as a guiding principle, but the importance of having the right infrastructure in the right place, and at the right time, is clear throughout. This is captured in the following statement "Creating Sustainable Communities means putting sustainable development into practice. Sustainable Communities must combine social inclusion, homes, jobs, services, infrastructure and respect for the environment to create places where people will want to live and work now and in the future"[64].

A4.1.3. With respect to the *Communities: Supporting Infrastructure* factors the Nuclear NPS could have implications generally as follows:-

- Transport, national, regional and local networks;
- (non-nuclear) Waste management; and
- Energy security.

A4.1.4. There may also be implications for electricity transmission infrastructure. However, this will be subject to a separate National Policy Statement and is therefore not covered in this appendix. There are also likely to be some impacts on local community facilities; for example accommodation, shops, health care, schools, etc. These are likely to peak during the construction phase and are discussed in the *Communities: Population, Employment and Viability* topic.

63 ODPM 2005 *A practical guide to the Strategic Environmental Assessment Directive*
64 Securing the Future: The UK Sustainable Development Strategy, Defra 2005

A4.2. Policy Context

A4.2.1. Appendix A in the Scoping Report (March 2008) sets out the review of relevant plans, programmes and environmental objectives for the appraisal of the Nuclear NPS. This was updated during April-May 2009 to take account of key policy and sustainability objectives that may have been established since the earlier scoping.

A4.2.2. The following table sets out the key objectives for sustainability that need to be taken in to account for appraising the effects of the Nuclear NPS with regard to *Communities: Supporting Infrastructure* and reflect the updated policy review, referred to above.

Table A4.1: Key Sustainability Objectives

Plan, Policy or Programme	Key Sustainability Objective
International	
Aarhus Convention (Convention on access to information, public participation in decision making and access to justice in environmental matters) 1998	To allow sufficient time to permit consultation in accordance with the Aarhus requirements.
The European Spatial Development Perspective (ESDP) January 1999	To ensure that objectives compliment the principles of the ESDP and that interactions between topics are considered.
Directive on the Landfill of Waste (99/31/EC)	The development and operation of the facilities would generate waste. It is essential therefore to ensure that sufficient (non-nuclear) waste facilities are available.
European Sustainable Development strategy (2006)	The SEA should ensure that an appraisal of sustainability and the issues addressed in this plan are fully integrated into the development of the NPS where relevant.
European Transport Policy for 2010: A Time to Decide	The SEA framework should include objectives which address the need to protect the efficiency of the transport system. The baseline data collation process should also identify the main strategic transport links including roads, railway stations, airports and ports.

Plan, Policy or Programme	Key Sustainability Objective
EU – Emissions Trading Scheme (2003/87/EC) (and subsequent amendments)	The EU-ETS is designed to address emissions of greenhouse gases, but is an important element in influencing security of energy supply. This relevant to the SEA Objective avoid disruption to basic services and infrastructure.
National	
Government/ Department for Transport 10 year Transport Plan (2000)	The SEA should contain objectives that support an efficient and sustainable transport system. The main issue relates to trips to and from the new nuclear power stations. Whilst the volume of trips is not envisaged to be very high, consideration of sites with respect to journey lengths and traffic impact is important. The process of developing the NPS should consider the importance of not compromising or adversely affect existing strategic transport links.
Planning for a Sustainable Future: White Paper (2007)	SEA objectives should be developed which will enable a full and comprehensive assessment of the potential strategic environmental effects of the NPS.
Planning Act 2008	The scope of the SEA/AoS is sufficiently broad to ensure that population and material assets issues are included in socio-economic factors.
The Future of Transport White Paper – A Network for 2030 (2004)	The SEA should contain objectives that support an efficient and sustainable transport system. New nuclear power stations would generate trips associated with the delivery of raw materials and staff movements. Whilst the volume of trips is not envisaged to be very high, consideration of sites with respect to journey lengths and traffic impact is important. The process of developing the siting proposals for new nuclear power stations should take account of the importance of not compromising or adversely affecting existing strategic transport links.
The Energy White Paper: Meeting the Energy Challenge (2007)	The SEA should contain objectives that help to meet the objective of securing our energy future.

Plan, Policy or Programme	Key Sustainability Objective
PPG13 Transport (2001)	The SEA should contain objectives that support sustainable transport and the baseline data collation process should identify the main strategic transport routes across the UK. The preparation of the SSA criteria should consider the principles of sustainable transport, particularly at the local level when identifying possible areas for the development of new nuclear power stations, as suitable connections for the safe delivery of raw materials is essential. The criteria should also seek to avoid adverse impacts on the strategic transport infrastructure.
Planning Policy Wales (2002)	The NPS should have regard to the objectives of the principles in the plan and the siting process should include a comprehensive suite of objectives that will enable the potential sites to be robustly assessed from an environmental perspective. Respect for environmental limits and carrying capacity should be key principles central to the siting process. The SEA and the development of the NPS need to be transparent.
TAN 18 Transport (2007)	The SEA should include objectives that do not adversely affect the efficiency of the transport system and seek to reduce greenhouse gas emissions from transportation sources. The location of key strategic transport routes should also be identified through the baseline data collation process. The preparation of the NPS should consider the principles of sustainable transport. There will be a need for safe, efficient transport connections to enable the delivery of raw materials and the siting of new nuclear power stations should not adversely affect the strategic transport infrastructure.
Wales Transport Strategy Consultation Draft (July 2006)	The SEA should include objectives that do not adversely affect the efficiency of the transport system and seek to reduce greenhouse gas emissions from transportation sources. The location of key strategic transport routes should also be identified through the baseline

Plan, Policy or Programme	Key Sustainability Objective
	data collation process. The preparation of the NPS should consider the principles of sustainable transport. There will be a need for safe, efficient transport connections to enable the delivery of raw materials and the siting of new nuclear power stations should not adversely affect the strategic transport infrastructure.

A4.3. Scope of the Appraisal

A4.3.1. As a result of scoping and ongoing consultation, the AoS framework for appraising the effects of the draft Nuclear NPS on communities (supporting infrastructure) identified the relevant AoS objectives as set out in following table:

Table A4.2: AoS Appraisal Framework for Supporting Infrastructure

Sustainable Development Theme: Communities Supporting Infrastructure	
AoS Objectives[65]	**Guide Questions**
8. To avoid adverse impacts on the function and efficiency of the strategic transport infrastructure 9. To avoid disruption to basic services and infrastructure	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 (for example electricity, gas)? Will it place significant pressure on local/regional waste management facilities (non-nuclear waste)?
The concept of a sustainable community covers a large range of attributes. Only those covering infrastructure are covered in this section. Other elements are covered elsewhere. These factors will also have an impact on the population, employment and viability of communities and these are considered in the *Communities: Population, Employment and Viability* objective.	

A4.3.2. **Temporal and Spatial Boundaries**: The AoS followed the approach taken for the appraisal of the SSA criteria and reported in the Environmental Study[66] and

65 Numbers refer to objective numbers in the SEA Scoping Report and the Environmental Study
66 BERR July 2008 Environmental Study http://www.berr.gov.uk/files/file47137.pdf

update of the Environmental Study[67]. Short and long term effects relate to activity phases of nuclear power stations as follows:

- Construction: short term 5-6 years
- Operation: long term, base case of 60 years (with possible extension subject to regulatory approval)
- Decommissioning: around 30 years
- Lifetime of site: approximately 160 years

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.

A4.3.3. The draft Nuclear NPS sets out the Government's policy on the national strategic issues and site specific issues and mitigations which need to be taken into account when granting consent for the construction of new nuclear power stations.

A4.3.4. **Consultation:** During the appraisal process, consultation and ongoing liaison were undertaken with the statutory consultees and regional/local authorities. The most relevant consultations in relation to this AoS topic were made with the following:

- Department for Communities and Local Government that sets policy on local government, housing, urban regeneration and planning with an overall aim to develop safe, prosperous and healthy communities

A4.4. The Current Situation and Likely Evolution without the Nuclear NPS

A4.4.1. The Scoping Report and the Environmental Study set out the baseline information; this was updated with key data in April-May 2009.

A4.4.2. In certain locations road traffic is already at high stress levels and is predicted to grow for a variety of reasons, but typically as a result of general development. National and local transport policy is designed to encourage more sustainable travel choices and the growth of green travel plans associated with development is one of the tools that are in use.

A4.4.3. Waste arisings in the UK continue to grow[68] , but the percentage of domestic waste that is recycled has increased significantly faster[69]. The picture for

67 BERR January 2009 Applying the Strategic Siting Assessment Criteria: an update to the study of the potential environmental and sustainability effects http://www.berr.gov.uk/files/file49869.pdf

68 Total waste arisings in the UK, 2006, Environmental Accounts: Waste; Office for National Statistics

commercial and industrial waste is more complicated because of the large number of sectors involved. However, national policy, and programmes managed by both waste collection and disposal authorities continue to focus on the waste hierarchy in order to reduce waste and improve the efficient use of resources.

A4.4.4. Ensuring energy security and tackling climate change by decarbonising the economy are key goals for the UK government. Further details are set out in *The Low Carbon Transition Plan: National strategy for climate and energy*. This states that the UK Government has a five point plan to tackle climate change:

- Protecting the public from immediate risk;
- Preparing for the future;
- Limiting the severity of future climate change through a new international climate agreement;
- Building a low carbon UK; and
- Supporting individuals, communities and businesses to play their part.

A4.5. The Likely Effects of the draft Nuclear NPS

Transport

A4.5.1. The introduction of the Nuclear NPS will not have a significant impact on transport networks at a national scale. However, individual developments may have negative impacts on journey time reliability for users of the national road network in certain locations (see Table A4.4 below); – for details see the individual site level Appraisal of Sustainability reports. This could be compounded if a number of developments were to take place within the same general area (sub-region) particularly during the construction phase where a much larger workforce will be commuting to the site and regular movements of goods and materials, sometimes of very large size, will be required. At a number of the sites, the potential exists to use existing rail and/or maritime freight facilities. This facility could help to relieve the demand on the national highway network especially during peak periods. The use of detailed construction transport management plans should be employed to help to mitigate these impacts.

A4.5.2. At the regional and sub-regional level impacts on journey time reliability could be located close to each other this could become very significant locally if they were to be permitted and were to be developed simultaneously. Transport impacts during the decommissioning phase are anticipated to be less than those during the construction phase. However, “background” traffic levels can be expected to have changed during time between construction and decommissioning so each phase needs to be assessed individually. During the

69 Household waste - Recycling rate in England, Office for National Statistics

operational phase there could be significant effects in certain locations – particularly where the existing network is already under stress. The adoption of site level Green Travel Plans should help to mitigate these impacts. The transport impacts during each phase of development will need to examined during the individual site level Environmental Impact Assessments.

Waste Management

A4.5.3. It is likely that any development coming forward under the Nuclear NPS would be subject to the requirements of the Site Waste Management Plans Regulations 2008[70]. This requires that a detailed plan has to be made and updated on a regular basis and that the types and quantities of waste that are created, reused, recycled, recovered and disposed of must be recorded. The waste arisings from individual developments are unlikely to be strategically significant but may become so should sites located close to each other were to be permitted and were to be developed simultaneously. Some impacts may be positive, such as the generation of secondary aggregates during demolition at sites where existing facilities are to be removed.

A4.5.4. In the operational phase local impacts may be expected upon local and regional (non-nuclear) waste management facilities. However the scale of operation is not considered to be significant in the long/medium term. Any impacts may be mitigated by the implementation of an operational waste management plan.

Energy Security and climate change

A4.5.5. Energy security and tackling climate change by decarbonising the economy are key goals for the UK government.

A4.5.6. Nuclear power is a low carbon generation source. In its 4th Assessment Report, the Intergovernmental Panel on Climate Change endorsed data produced by the World Energy Council[71], reporting that "*Total lifecycle GHG (Greenhouse Gas) emissions* (for nuclear electricity generation) *are below 40 gCO_2/kWh (10gC-eq/kWh), similar to those for renewable energy sources*"[72]. The IPCC report goes on to say that "*Nuclear power is therefore an effective GHG mitigation option*". New nuclear power stations can contribute to the Government's goal of a low carbon, diverse energy mix.

A4.5.7. Without new nuclear power stations, the UK would be more reliant on renewables and Carbon Capture and Storage for reducing carbon emissions and there would be an increased risk of the UK not meeting its carbon reduction targets. The UK would be more reliant on a smaller number of technologies

70 The Site Waste Management Plans Regulations, 2008

71 *Comparison of Energy Systems using Life Cycle Assessment*, World Energy Council Special Report, July2004.

72 *Climate Change 2007 - Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [B. Metz,et al], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

which may also 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. Modelling for The Committee on Climate Change[73], found that if Carbon Capture and Storage were unavailable at reasonable cost out to 2050, then a significant expansion of nuclear power (to nearly 40 GW by 2050) 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 Carbon Capture and Storage 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.

Radioactive and Hazardous Waste Management

A4.5.8. The Main AoS Report (Chapter 6) and Annex K give the findings of an appraisal of sustainability of the arrangements for managing radioactive and hazardous wastes arising from the Nuclear NPS. This appraisal has used the AoS framework to consider the following waste streams:

- Spent Fuel[74]
- Intermediate Level Waste (ILW)
- Low Level Waste (LLW)
- Gaseous and Liquid Radioactive Discharges
- Non Radioactive Hazardous Wastes

A4.5.9. 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 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 of. The findings of the appraisal in relation to the effects at new power station sites and due to transport of waste from these sites are summarised below.

A4.5.10. The relatively small quantities of radioactive and hazardous waste produced by new nuclear power stations mean that no strategically significant effects on supporting infrastructure, for example the strategic road network, are expected to arise.

73 Building a Low Carbon Economy – the UK's contribution to tackling climate change, Committee on Climate Change, 2008

74 In accordance with Government's view that in the absence of any proposals from industry, new nuclear power stations should proceed on the basis that spent fuel will not be reprocessed, spent fuel is considered to be waste for the purposes of the appraisal.

A4.5.11. The low level radioactive waste and non-radioactive hazardous wastes produced by new nuclear power stations are expected to be disposed of in existing facilities, or their successors, for management of these types of waste. Higher activity radioactive wastes are expected to be disposed of in the same geological disposal facilities as legacy wastes and the implementation of geological disposal is being taken forward through the Managing Radioactive Waste Safely (MRWS) process, The largest impact on waste management facilities is assessed to be from the additional volume of spent fuel generated by new nuclear power stations. It has been estimated[75] that the quantity of spent fuel from a programme of nine AP-1000 reactors or 6 EPR reactors, would increase the underground footprint of a Geological Disposal Facility (GDF) by about 50-55% compared with the size of facility required to deal with higher activity legacy wastes. The volume of ILW that would be generated by a fleet of nine AP-1000 or six EPR reactors is estimated to increase the length of vault needed for storage of ILW in a GDF by less than 10% of the vault length required for higher activity legacy waste.

A4.6. Summary Effects of the Potentially Suitable Sites

A4.6.1. As with any major infrastructure project, there can be positive and negative effects at each stage of development. The relative significance of these effects depends on the characteristics and scale of the receiving communities. In the case of *Communities: Supporting Infrastructure*, each site has the potential to have an incremental effect on local and regional infrastructure both individually and in combination with other developments. The sustainability of each site was appraised and the findings are set out in the individual site AoS Reports (Annexes A –J). These appraisals identified strategically significant effects and locally significant effects. These effects are set out in Table A4.3 below.

75 See Chapter 6 and Annex K for details

Table A4.3: Summary of Potential Significant Strategic Effects on Supporting Infrastructure

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Bradwell	-	-	-
Potentially significant effect on the national road network during all phases as there are already under stress and this is predicted to remain unchanged. Local road network is of relatively low standard so local impacts could be significant. A detailed construction transport management plan will be required and green travel plans for the construction and operational workforce should be developed. Operational (Non-nuclear) waste may impact on existing waste management services; this may be mitigated by the implementation of an operational waste management plan.			
Braystones	-?	-?	-?
Potentially significant impacts on local and strategic networks in all phases particularly to the north. Use of rail transport during the construction phase could help to minimise these. A construction transport management plan and green travel plans for construction and operational workforces should be implemented.			
Hartlepool	-?	-?	-?
There may be some impacts on the local roads network particularly at peak times. A detailed construction transport management plan will be required and green travel plans for the construction and operational workforce could mitigate these impacts. Operational (Non-nuclear) waste may impact on existing waste management services, but this is not considered to be significant.			
Heysham	-	-	-
During the construction phase there may be some impacts on the regional road network. Use of existing nearby port facilities may contribute to minimising transport impacts. A green travel plan should be developed for the operational phase to minimise transport impacts on local networks. Operational (Non-nuclear) waste may impact on existing waste management services; this may be mitigated by the implementation of an operational waste management plan.			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Hinkley Point	-?	-?	-?
May result in additional stress on motorway network, and other local key roads, in all phases. This is likely to an increase over time as a result of other (unrelated) developments locally. Maritime and rail freight should be considered as an alternative for construction phase. A detailed construction transport management plan could help to mitigate this impact. Operational (Non-nuclear) waste may impact on existing waste management services; this may be mitigated by the implementation of an operational waste management plan.			
Kirksanton	-?	-?	-?
Potentially significant impacts on local/regional roads, including those in the National Park. Rail freight should be considered as an alternative for construction materials. A construction transport management plan and green travel plans for construction and operational workforces should be implemented. Operational (Non-nuclear) waste may impact on existing waste management services, but this is not considered to be significant.			
Oldbury	-?	-?	-?
May result in additional stress on the motorway network, and other local key roads, in all phases. This is likely to an increase over time, as these routes are already anticipated become over stressed. The use of rail freight for construction materials should be considered. Mitigation measures, including a construction transport management plan and green travel plans for construction and operational workforces should be implemented. Operational (Non-nuclear) waste may impact on existing waste management services; this may be mitigated by the implementation of an operational waste management plan.			
Sellafield	-?	-?	-?
Potentially significant impacts on local and strategic networks in all phases particularly to the north. Use of rail transport during the construction phase could help to minimise these. A construction transport management plan and green travel plans for construction and operational workforces should be implemented.			
Sizewell	-	-	-
During the construction phase there may be some impacts on the regional road			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
network. Consideration of the use of maritime and rail freight and development of a detailed construction transport management plan will help to mitigate these. A green travel plan should be developed for the operational phase to minimise impacts on local communities. Operational (Non-nuclear) waste may impact on existing waste management services; this may be mitigated by the implementation of an operational waste management plan.			
Wylfa	-?	-?	-?
Potentially significant impacts on local/regional roads, particularly at the Britannia Bridge during all phases. During the construction phase existing rail links and potentially maritime should be considered for construction materials. A detailed construction transport management plan could help to mitigate these impacts. Operational (Non-nuclear) waste may impact on existing waste management services; this may be mitigated by the implementation of an operational waste management plan.			

Key: Significance of potential strategic effect at each development stage	
++	Development actively encouraged as it 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 "?".

A4.7. Interactions and Cumulative Effects

A4.7.1. The following table identifies the potential cumulative effects resulting from consideration of new nuclear power stations at each of the potentially suitable sites.

A4.7.2. The principal national cumulative effect is that on Energy Security. New nuclear energy generation will add to the diversity of electricity supply in the UK. A diverse range of sources is one element that contributes to security of supply. Nuclear power currently accounts for around 18% of the UK's electricity generation, but most of the existing stations are due to close in the next 15 years, based on published lifetimes. While energy efficiency will have a significant part to play in addressing demand, new large scale electricity generation is anticipated to be required if electricity is more widely used for transport (e.g. electric cars and electrification of rail) or heating (e.g. instead of gas).

A4.7.3. At a regional scale the most significant effect is likely to be on the transport network, particularly during the construction phase and on those parts of the network that are already under stress. Where sites are located close to each other this could become very significant locally should these sites proceed. In each case a detailed Construction Transport Management Plan could help to mitigate these Waste arisings from the construction phase of individual developments are unlikely to be strategically significant, but each site is likely to require a construction Site Waste Management Plan. However, the impacts may become significant should sites located close to each other were to be permitted and were to be developed simultaneously.

A4.7.4. Some impacts may be positive, such as the generation of secondary aggregate during demolition at sites where existing facilities are to be removed.

A4.7.5. Table A4.4 identifies the potential cumulative effects resulting from the NPS. The first column considers cumulative effects at a national scale and the second column considers effects at a regional scale. The third column considers the potential effects in-combination with those effects caused by other plans.

Table A4.4: Cumulative Effects on Supporting Infrastructure of the NPS and in-combination with other plans:

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
Transport		
No significant national scale effects.	Some potentially significant negative effects particularly during the construction phase where a large workforce will be required and significant material movements will be necessary. The movement of large and heavy materials may also cause significant disruption and negatively impact upon journey time reliability. This is particularly the case in locations where the road network is already under stress. In certain locations existing rail and maritime freight facilities could be utilised for the movement of bulk material, particularly aggregates. In the operational phase development of some nominate sites may result in additional stress on local roads. A detailed construction transport management plan should be required and green travel plans for the construction and	Sites located close to growth areas may add to local travel disruption during both construction and operational phases. Other large scale energy proposals including the Energy Coast™, the London Array and the Severn Estuary Project may have cumulative transport effects if their development were to coincide with the construction phase of new nuclear stations. These effects may be most acute in relation to the movement of aggregates.

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
	operational workforce could mitigate negative impacts.	
Waste (Non-nuclear)		
No significant national scale effects.	Waste arisings from individual developments are unlikely to be strategically significant but may become so should sites located close to each other were to be developed simultaneously. Some waste impacts may be positive, such as the generation of secondary aggregate during demolition at sites where existing facilities are to be removed. Site Waste Management Plans are likely to be required at each location and Operational Waste Management Plans will minimise waste impacts during the operational phase.	Any large scale development, including highway development, has the potential to have a cumulative effect on the waste sector with development of new nuclear stations arising from the Nuclear NPS, particularly if they are in close proximity. This would include the use of secondary aggregates generated during demolition.
Energy Security		
One element of energy security is to have access to a diverse range of sources. Currently nuclear power accounts for around 18% of our electricity generation, but most existing stations are due to close in the next 15 years. New nuclear energy generation will	The interconnected nature of the UK electricity transmission system reduces the significance of regional impacts for this aspect. Any activity that increases the national security of energy supply will tend to increase security at a sub-national level.	The Energy White Paper, The Climate Change Act, the Low Carbon Transition Plan and the other Energy NPSs and the NPS on the Electricity Transmission Network are all directly relevant. The Government's target for the net UK carbon account in 2050 to be at

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
add to the diversity of electricity supply in the UK which will add to energy security.		least 80% lower than the 1990 baseline is being addressed by a number of means, including the Renewable Energy Strategy[76] which is seeking to increase the percentage of energy generated from renewable sources to 15% by 2020 (from 1.8% in 2007). This includes extending and raising the level of the Renewables Obligation to encourage up to 30-35% of electricity to be generated from renewable sources by 2020. This will encourage a more diverse range of means of electricity generation which will contribute to increasing energy security. The Code for Sustainable Homes[77] has a target that all new dwellings built from 2016 should be zero carbon rated, and includes the electricity consumption for lighting and appliances. Reducing demand is another means of increasing security.

76 *The UK Renewable Energy Strategy – Consultation*, June 2008; BERR
77 The Code for Sustainable Homes: Setting the standard in sustainability for new homes, 2008, DCLG

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
		There are also a number of regional plans in place to encourage and facilitate the development of low carbon energy supply and greenhouse gas emissions reductions. These include the Energy Coast™[78], the London Array[79] and the Severn Tidal Estuary project[80]. While these plans are independent of the Nuclear NPS by increasing the diversity of supply they all contribute to increasing the UK's energy security/

A4.8. Summary and Recommendations

A4.8.1. The predicted effects of the draft NPS on *Communities: Supporting Infrastructure* are to be slightly negative for transport and waste at a regional scale, and to be positive for energy security at all scales particularly in combination with other energy developments.

A4.8.2. Transport impacts will be negative and are likely to be most significant during the construction phases when a large workforce will be commuting to the sites. This will have significant negative effects at a local level and may have significant effects on parts of those parts of the national network that are already under stress. This will be exacerbated in this phase by the movement of materials, particularly aggregates. In some locations there will be opportunities to mitigate this impact through the use of rail and/or maritime freight.

A4.8.3. During the operational phase there may be local negative effects where networks are already under stress; this can be mitigated to some extent by the

78 Britain Energy Coast TM: A Master Plan for West Cumbria (British Government and Cumbria Partners)

79 E.ON London Array Wind Farm http://eon-uk.com/generation/londonarray.aspx

80 Severn Tidal Estuary Regional Economic Impact Study- DTZ Consultants. http://severntidalpowerconsultation.decc.gov.uk/supporting_documents

adoption of sustainable travel plans. During the decommissioning phase the impacts will be similar to, although lesser in extent, to those in the construction phase. However, background traffic levels will be different at that time so the impacts are less clear.

A4.8.4. Waste impacts will be slightly negative in all phases. Operational (Non-nuclear) waste may impact negatively on existing waste management services particularly where a number of stations are located within the same sub-region, but this may be mitigated by the implementation of an operational waste management plan. However, there is potential for some minor positive impact at a local level through the generation of secondary aggregates during demolition at sites where existing facilities are to be removed.

A4.8.5. The draft nuclear NPS will have a significant positive impact on energy security. The provision of variety of diverse sources of electricity generation generally adds to security of supply. Currently nuclear power currently accounts for around 18% of our electricity generation, but most of the existing stations are due to close in the next 15 years. While energy efficiency will have a significant part to play in addressing demand, new large scale electricity generation is anticipated to be required to ensure that demand can be met. As much new generation should be low carbon as possible to contribute to tackling climate change. The draft nuclear NPS plays a positive role in enabling new low carbon capacity to be bought forward.

Appendix A5: Human Health and Well-Being

A5.1. Introduction

A 5.1.1. "*Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*" World Health Organisation (1948, 2003). This definition recognises that our health can be affected by a complex interaction between various factors, such as our personal behavior and lifestyles, our living and working conditions, the condition of our communities, and our access to health and other services (for example, the European Commission on Social Determinants of Heath (2008). This understanding that health is wider than just absence of disease and that well-being is inter-related with many factors has guided ongoing development of public health policy.

A 5.1.2. The SEA Directive requires that the information to be provided in the Environmental Report includes "*the likely significant effects on the environment, including on issues such as…human health..."* (Annex I (f)). The Kiev (SEA) Protocol[81] (2003) implements political commitments made at the 3rd European Conference on Environment and Health; once ratified, amendments to the SEA Directive will be required to include health authorities as statutory consultees thus strengthening health factors in the SEA process. The Government has prepared draft guidance[82] on health in SEA. This follows on the Government's guidance[83] on undertaking SEA and provides further information on health effects, interactions, and sources of information. This AoS incorporates the requirements for health and SEA within an integrated appraisal and as modeled on the Government's guidance[84] for undertaking Sustainability Appraisal.

A 5.1.3. The health factors that are relevant and their implications for the draft Nuclear NPS depend upon the type, scale (both size/output of the individual power stations and the overall number of stations built), detailed design, and locational characteristics of the proposed new nuclear power station developments. There are certain common implications for health and well-being for the Nuclear NPS as follows:

- **Radiation:** implications associated with concerns for radiological protection for the health of workers and the public from permitted discharges during the operation and decommissioning of nuclear power stations; the interim storage of radioactive waste; and also potential hazards from accidental emissions.
- **Perceptions of health risks**

81 UNECE (2003) Protocol on Strategic Environmental Assessment (Kiev) http://www.unece.org/env/eia/sea_protocol.htm
82 DH 2007 draft Guidance on Health in SEA http://www.dh.gov.uk/en/Consultations/Liveconsultations/DH_073261
83 ODPM 2005 A practical guide to the SEA directive http://www.communities.gov.uk/publications/planningandbuilding/practicalguidesea
84 ODPM 2005 SA of RSSs and LDFs http://www.communities.gov.uk/publications/planningandbuilding/sustainabilityappraisal

- **Safety and security**: concern about accidental releases of radiation and terrorist attack
- **Employment**: various direct, indirect and inter-related health influences arising from long term employment opportunities and associated prosperity for local communities and supporting industries and businesses
- **Emissions to water**: many power stations do have significant emissions such as cooling water but these are unlikely to have any significant effects on health unless the quality of bathing waters is affected or there are cumulative effects on fisheries and seafood consumption
- **Emissions to air**: directly through operation of power plants and indirectly through transport activities
- **Noise**: directly through operation of power plants and indirectly through transport activities
- **Accessibility to green space and exercise:** nuclear power stations are often located in rural areas on the coast with potential conflicts for recreation and amenity
- **Accessibility to health and other community services**: especially during the construction phase with large numbers of workers placing demands on the capacity of local services.

A 5.1.4. There is also potential for site specific health and well-being implications at each stage of a nuclear power station: planning (stress due to uncertainty and planning blight), construction (as with any major infrastructure project – disturbance, noise and traffic), operation and decommissioning. The Scoping Report[85] set out the proposed scope of the appraisal and the Environmental Study[86] set out the findings of the appraisal of the Strategic Siting Assessment criteria with regard to health and well-being.

A5.2. Policy Context

A 5.2.1. Appendix A in the Scoping Report[87] (March 2008) sets out the review of relevant plans, programmes and environmental objectives for the appraisal of the Nuclear NPS. This was updated during April-May 2009 to take account of key policy and sustainability objectives that may have been established since the earlier scoping.

A 5.2.2. The following table sets out the key objectives for sustainability that need to be taken in to account for appraising the effects of the Nuclear NPS with regard to Human Health and Well-Being and reflects the updated policy review referred to above.

85 BERR March 2008 SEA Scoping Report
86 BERR July 2008 Applying the proposed SSA criteria: a study of the potential environmental and sustainability effects http://www.berr.gov.uk/files/file47137.pdf
87 http://www.berr.gov.uk/consultations/page45265.html

Table A5.1: Key Sustainability Objectives

Plan, Policy or Programme	Key Sustainability Objective
International	
World Health Organisation and the Ottawa Charter (1986)	Health promotion goes beyond health care and puts health on the agenda of policy makers in all sectors and at all levels.
EU (2007) Together for Health – a strategic approach for the EU 2008-2013	Community Action focuses on health determinants categorised as: personal behavior and lifestyles; influences within communities; living and working conditions and access to health services; general socio-economic, cultural and environmental conditions
UNEC (2003) The Kiev (SEA) Protocol	Strengthens health topic in SEA as health authorities will become statutory consultees when ratified
WHO (2008) Commission on Social Determinants of Health	Health equity through action on social determinants of health
EU 2004 Children's Environment and Heath Action Plan for Europe	Protect children from injury and ensure they have access to safe water, sanitation, recreational opportunities and clear air
National	
UK SD Strategy (2005)	Guiding principles include "ensuring a strong, healthy and just society"
Saving Lives: Our Healthier Nation White Paper (1999) A New Commitment to Neighbourhood Renewal National Strategy Action Plan (2001) Tackling Health Inequalities (2003 and 2007) Choosing Heath White Paper (2006) Our health, our care, our say White Paper (2006)	Improve health for everyone; reduce health inequalities; consider heath impacts early in planning process; narrow gap between deprived neighbourhoods; allow the public to make healthier and more informed choices in regard to their health; provide people with good quality social care and health facilities in the communities where they live
DOH (2008) Health Effects of Climate Change in the UK (update)	Need for greater emphasis to be placed on climate change and its potential health impacts
Countryside and Rights of Way Act (2000)	Allow people access to certain types of open land

A5.3. Scope of the Appraisal

A 5.3.1. As a result of the scoping consultation in (March 2008), a guide question on health inequalities was added. The relevant Sustainability Objectives for the appraisal are set out in the following table:

Table A5.2: AoS Appraisal Framework for Health and Well-Being

Sustainable Development Theme: Health and Well-Being	
AoS Objectives[88]	**Guide Questions**
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 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 it impact upon different vulnerable communities locally? Will it help to reduce health inequalities? Will the perceptions of adverse risk as a result of activities lead to adverse impacts on mental health for nearby communities? Will it adversely affect the ability of an individual to enjoy and pursue a healthy lifestyle? Will it result in the loss of recreational and amenity land or loss of access?
Health is cross-cutting across most objectives for sustainability. In particular, Objective Numbers 4, 5 and 10 on employment, sustainable communities, and property/land values were appraised within Sustainable Developement Theme Communities: Population, Employment and Viability. However, the indirect effects of local employment on health and well-being were considered within this topic here. Objective Numbers 8 and 9 on transport and other services were appraised within Sustainable Development Theme Communities: Supporting Infrastructure. Objective Number 12 on air quality, Number 13 on climate change and Number 14 on flood risk were appraised separately. Their inter-related effects on health and well-being were then considered here within the	

88 Numbers refer to objective numbers in the SEA Scoping Report and the Environmental Study

Sustainable Development Theme: Health and Well-Being	
AoS Objectives[88]	**Guide Questions**
overall Sustainable Development Theme of health and well-being. Waste is also a cross-cutting issue for most objectives for sustainability. Non-nuclear waste was appraised within the Sustainable Development Theme Communities: Supporting Infrastructure. Radioactive waste was appraised and reported separately in Chapter 6; however any particular site-specific issues for interim storage were also summarised in the individual AoS site reports.	

A 5.3.2. The role of access to recreational and amenity land as an important factor in the wider determinants of health and well-being was recognised and this AoS objective was integrated into the appraisals rather than being considered as a separate issue.

A 5.3.3. **Temporal and Spatial Boundaries**: The AoS followed the approach taken for the appraisal of the SSA criteria and reported in the Environmental Study[89] and update of the Environmental Study[90]. Short and long term effects relate to activity phases of nuclear power stations as follows:

- Construction: short term 5-6 years
- Operation: long term, base case of 60 years (with possible extension subject to regulatory approval)
- Decommissioning: around 30 years
- Lifetime of site: approximately 160 years

It is 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.

A1.1.1. The draft Nuclear NPS sets out the Government's policy on the national strategic issues and site specific issues and mitigations which need to be taken into account when granting consent for the construction of new nuclear power stations.

A 5.3.4. **Consultation**: During the appraisal process, consultation and ongoing liaison were undertaken with the statutory consultees and regional/local authorities. The most relevant consultations in relation to this AoS topic were made with the following:

89 BERR July 2008 Environmental Study http://www.berr.gov.uk/files/file47137.pdf
90 BERR January 2009 Applying the Strategic Siting Assessment Criteria: an update to the study of the potential environmental and sustainability effects http://www.berr.gov.uk/files/file49869.pdf

- Department of Health, with responsibilities for improving the quality of the NHS and social services
- Health Protection Agency, an independent organisation dedicated to protecting people's health in the UK
- Health and Safety Executive (including Office for Civil Nuclear Security and Nuclear Installations Inspectorate) and Environment Agency, with joint responsibilities for regulating the nuclear industry to protect health and the environment

A5.4. The Current Situation and Likely Evolution without the Nuclear NPS

Non Radiological (Non Nuclear) Factors

A 5.4.1. The Scoping Report and the Environmental Study set out the baseline information; this was updated with key data in April-May 2009. The Health Profiles for England provide a collation of national and regional data for a broad range of health determinants. The most recent covering 2008 and published by the Department of Health (DH) in January 2009 [91] reports improvements with regard to declining mortality rates for cancers, circulatory diseases and suicides; increasing life expectancy; and reducing infant mortality. Premature mortality rates from cancer for males over the last 30 years have fallen and are now amongst the lowest in the EU; for females, the rates are now closer to the EU average. Areas of concern include increasing levels of obesity (and the highest in the EU countries) and geographical inequalities across the country.

A 5.4.2. Annual health surveys[92] are carried out by the NHS and separate reports cover topics such as general health, smoking/drinking, weight, cardiovascular disease, accidents and physical activity; the 2001 report focused on respiratory disease. UK National Statistics[93] covers themes including Health and Social Care (lifestyles and behavior; conditions and diseases; health and safety; causes of death; disability; and health inequalities). The theme on Neighbourhoods and Communities (community wellbeing; crime and safety; education, skills and training; indices of deprivation; people and society; and physical environment) seeks to provide information to help improve local people and places. The Index of Multiple Deprivation (IMD) shows that the North West, North East and London are the most deprived regions, whilst the South East and East of England are the least deprived. Other key issues for Energy Infrastructure NPSs include the suitability of housing[94] and the extent of fuel poverty[95].

91 http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsStatistics/DH_093465 (last accessed 25 May 2009)
92 http://www.ic.nhs.uk/statistics-and-data-collections/health-and-lifestyles-related-surveys/health-survey-for-england (last accessed 25 May 2009)
93 http://www.statistics.gov.uk/hub/health-social-care/index.html (last accessed 25 May 2009)
94 For example, see DCLG website http://www.communities.gov.uk
95 http://www.berr.gov.uk/energy/fuel-poverty (last accessed 25 May 2009)

A 5.4.3. Respiratory illness places a significant burden on the health services and this is partly attributable to existing air pollution. According to Occupational Health and Safety Information (2006), death rates from respiratory disease are higher in the UK than Europe. Fuel poverty affected 3.5 million people in the UK in 2006. Trends with regard to health improvements, such as cancer mortality rates and increasing life expectancy, might be expected to continue although this may change. The increase in life expectancy contributes to demand for energy.

A 5.4.4. For recognised challenges, such as obesity and health inequalities, it is likely that improvements will occur as policies to address these problems are implemented. Trends on fuel poverty are more difficult to predict as these are very dependent on the price of fuel. More generally, changes to ecosystems and global bio- productivity as a result of climate change may affect human comfort and security, for example see the International Union for the Conservation of Nature IUCN and the Worldwatch Institute with its most recent Vital Signs report (April 2009) asserting that climate change continues to be an increasingly important driver for sustainability policy.

A 5.4.5. The importance of access to open space for recreational activities with its positive effects for health and well-being is recognised by the Government through current planning policy[96] and increasingly promoted by various initiatives, for example, Walking for Health[97] (Department of Health and Natural England). It could be assumed that as people become better educated on obesity and encouraged to exercise that the contribution to wider health might improve; however, such interactions are complex and uncertain.

A 5.4.6. Access to recreational opportunities is appraised and reported here in this section on health and well-being. Access to basic community and other services, together with availability of employment are other factors in wider determinants of health. Employment is detailed in Section A3 of Appendix 1 which covers: Communities: population, employment and viability, although the indirect effects of secure employment on health and well-being are reported here in this section of Appendix 1.

Radiological (Nuclear) Factors

A 5.4.7. **The UK Regulatory Regime**: Radioactivity occurs naturally and, for example, naturally occurring radon gas is the major source of radiation exposure to the general population in the UK and many other countries[98]. The potential for emissions of radiation from the nuclear power industry is regulated in the UK through a strict framework[99] to minimise potential health effects to workers and

96 PPS17 Open Space http://www.communities.gov.uk/publications/planningandbuilding/planningpolicyguidance17
97 http://www.whi.org.uk/ (last accessed 26 May 2009)
98 http://www.bre.co.uk/radon/maps.html (last accessed 26 May 2009)
99 Ionising Radiations Regulations 1999; Radioactive Substances Act 1993 and Environment Act 1995

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.

A 5.4.8. The Euratom Treaty[100] requires the UK to make an Article 37 submission to the EU of an assessment of the potential impacts on air, soil or water of other member states from proposed discharges or disposals of radioactive waste from new nuclear facilities so that it can be determined whether it would result in the radioactive contamination of the water, soil or airspace of another Member State. An RSA 93[101] authorisation for radioactive discharges and disposals would not be issued until a favourable opinion has been received from the EU. Therefore, the regulatory regime will ensure that the current and future situation with regard to radioactive disposals and waste in the UK and EU transboundary effects will be maintained and in accordance with agreed international standards.

A 5.4.9. The UK is also a signatory to the North Sea Conference and OSPAR[102] (Oslo-Paris Convention) which requires reductions in the discharges of radioactivity to the North Sea, including the UK's coastal waters. The aim of the OSPAR Radioactive Substances Strategy is to reduce discharges to levels where the additional concentrations in the marine environment above historic levels are close to zero by 2020. The UK Discharge Strategy (2001-2020) demonstrates the steps being taken towards the substantial reductions in discharges required by OSPAR. Thus, the regulatory regime will ensure that the current situation with regard to the UK marine environment and related transboundary effects is maintained and improved in the medium term.

A 5.4.10. The Health and Safety Executive regulates the nuclear industry through its Nuclear Directorate which is responsible for the UK safety regulation of nuclear power stations, decommissioning, and civil nuclear operational security. This regulation is carried out in partnership with others such as the Environment Agency and SEPA (who are responsible for monitoring and ensuring that nuclear power stations can meet high environmental standards) and the Health Protection Agency (HPA) (an advisory body and regularly review the radiation exposure of the UK population).

A 5.4.11. The HPA regularly reviews the radiation exposure of the UK population. The HPA has assessed the overall average annual dose to a member of the general public from all sources of radioactivity and calculates that this is 2.7 millisieverts (mSv, a measure of dose) per year, about 84% of which is from natural sources.[103[1]] The average dose to a member of the public due to

100 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).
101 Radioactive Substances Act 1993
102 http://www.ospar.org/
103[1] Ionising Radiation Exposure of the UK Population: 2005 Review HPA-RPD-001

radioactive discharges from the nuclear power industry is 0.03% of the annual dose from all sources.[104][2]

A 5.4.12. Radioactivity in Food and the Environment (RIFE, 2007) is the most recent annual report combining monitoring results of various agencies[105]. The survey measures radioactivity from different parts of the food chain, including for people who live close to nuclear sites and eat local food, and including how much radioactivity people would absorb from authorised radioactive discharges in air and water. The report concluded that the total dose in the UK is under the EU annual dose limit[106] for the public of 1 mSv for all exposures to radiation and the findings did not highlight any safety concerns for the food chain.

A 5.4.13. 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.

A 5.4.14. 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.

A 5.4.15. 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 within 25 km of a nuclear generating site in Britain is associated with an increased risk of childhood cancer'.

A 5.4.16. 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 Aldermaston, 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].

A 5.4.17. In its eleventh report COMARE examined the general pattern of childhood leukaemia in Great Britain and concluded that many types of childhood cancers

104[2] Ionising Radiation Exposure of the UK Population: 2005 Review HPA-RPD-001
105 Radioactivity in Food and the Environment (RIFE-12, 2007). Environment Agency, Scottish Environment Protection Agency, Environment and Heritage Service, Food Standards Agency (December 2008)
106 as implemented through the Ionising Radiations Regulations, HSE 1999

'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.'

A 5.4.18. 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.

A 5.4.19. 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.

A 5.4.20. COMARE is currently 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.

A5.5. The Likely Effects of the Draft Nuclear NPS

A 5.5.1. The key aim of the energy NPSs (including the Nuclear NPS) is to ensure continuity of energy supply. The health and well-being implications of not achieving this are likely to be significantly adverse, with possible impacts on critical infrastructure such as water supply and transport. Any cuts to domestic consumers (although protected from this eventuality as far as possible) are likely to affect vulnerable groups, for example, the elderly. Further indirect adverse effects on health and well-being are likely from impacts closure of businesses, reduced employment, strain on services and potential loss of viability of communities (see Appendices A3 and A4 on communities).

A 5.5.2. The Nuclear NPS also aims to contribute to the goal of tackling climate change and there are also adverse health and well being implications of not doing so. For example, unchecked climate change could lead to more heat waves and

increased flooding[107]. In 2003, an increase in average temperature of two degrees (during the summer heatwave) led to 35,000 extra deaths across Europe. In the summer floods of 2007 in England, there was serious damage to 300 schools across Yorkshire and Humber and critical infrastructure was also affected, with six motorways closed as well as many rail lines[108]. According to the emergency services, the summer of 2007 saw the largest number of search and rescue missions in the country since the Second World War – stretching resources to the limit. The flooding of the Mythe water treatment works meant that 140,000 homes were without normal water supplies for two weeks.

A 5.5.3. For the Nuclear NPS, potential generic effects for health and well-being are associated primarily with the carcinogenic effects of radiation, perceptions of risk, security and safety. Radiological health effects may occur during the construction, operation and decommissioning of new nuclear power stations through radiation from planned discharges, accidental releases and exposure of the workforce. The potential long term effects of interim storage (but this is site specific), transport, and disposal of radioactive waste are considered in Chapter 6 - Radioactive Waste, Spent Fuel and Hazardous Waste.

Radiological (Nuclear) Effects

A 5.5.4. The Health Protection Agency (HPA) considers that the existing regulatory mechanisms are sufficient for the radiological protection of human health from potential effects of new nuclear power stations. These include:

- radiation dose constraints and limits for both the public and workers
- optimisation of radiation protection
- the requirement to monitor radioactive discharges to the environment and to demonstrate that these remain within the relevant authorisations.

A 5.5.5. 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.

A 5.5.6. 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,

107 The UK Low Carbon Transition Plan, National strategy for climate and energy, DECC, 2009
108 *Review of 2007 summer floods*, Environment Agency, 2007

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 1 mSv.

A 5.5.7. 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 proposed Regulatory Justification decision.

A 5.5.8. The HPA also consider that existing mechanisms are sufficient to protect human health with regard to risk of accidents. These include:

- an adequately protective emergency plan
- the UK NII's Safety Assessment Principles that provide criteria to limit both maximum individual off site risk to the public from any accident and also the total number of deaths arising from a severe accident

Perceived Risks

A 5.5.9. Although there is a strict regulatory framework to protect people, there may be concern about perceived risks of living in the vicinity of new nuclear power stations. People's perceptions of risk relate to a complex interaction between social, cultural, and political factors and personal experience. As an example, one study[109] from September 2008 investigated attitudes to risk for people living near existing nuclear power stations and it concluded that "… *the majority of our participants view the existing station through a dominant frame of 'ordinariness' and are also supportive of nuclear power in general"* and noted that "*trust and distrust are important mediators of perceived risks , benefits and acceptability*". However, the Government does note that this is only one example of a study.

A 5.5.10. The Government recognises the importance of such factors and, for example, the guiding principles in the UK SD Strategy (2005) include "*actively promoting effective participatory systems of governance*…". The Government has aimed to be open and engaging in its approach to planning for new nuclear power stations from the Energy White Paper through the whole process of sites with ongoing liaison and participation of communities that might be affected by developing proposals. Thus mitigation to allay concerns about perceived risks of living in the vicinity of new nuclear power stations has been integrated into the development of the Nuclear NPS from the outset – and will continue throughout the ongoing appraisal processes including project level EIA and operational licensing.

Wider Determinants of Health and Well-Being (non nuclear)

109 http://www.kent.ac.uk/scarr/SCARRNuclearReportPidgeonetalFINAL3.pdf

A 5.5.11. There are indirect positive health effects associated with enhanced prosperity and long-term employment opportunities. Generally, this is relevant at the local or sub-regional scales and is considered to be insignificant at a national scale. Similarly, indirect effects on supporting services, associated infrastructure, and health inequalities are not significant at the national scale.

A 5.5.12. There is a possibility that the influx of workers required for the construction and operational phases of the proposed new power station may put a strain on local health and other services. In order to realistically gauge whether or not this will be a problem, a review should be carried out during the planning process to determine the need for any additional health service capacity and community assistance in the area. This review could comprise a Health Impact Assessment (HIA). However, whilst this may be considered good practice it is noted that HIA is not a statutory requirement for current energy applications. The applicability of an HIA may be considered on a case by case basis.

A 5.5.13. There are potential adverse health effects associated with uncertainty of decision-making on new nuclear power stations, including issues of planning blight as well as concerns about perceived risks from radiation and long term interim storage of radioactive waste. Generally, this is relevant at the local or sub-regional scales and is considered to be insignificant at a national scale.

Radioactive and Hazardous waste management

A 5.5.14. The Main AoS Report (Chapter 6) and Annex K give the findings of an appraisal of sustainability of the arrangements for managing radioactive and hazardous wastes arising from the Nuclear NPS. This appraisal has used the AoS framework to consider the following waste streams:

- Spent Fuel[110]
- Intermediate Level Waste (ILW)
- Low Level Waste (LLW)
- Gaseous and Liquid Radioactive Discharges
- Non Radioactive Hazardous Wastes

A 5.5.15. 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 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 of. The findings of the appraisal in relation to

110 In accordance with Government's view that in the absence of any proposals from industry new nuclear power stations should proceed on the basis that spent fuel will not be reprocessed, spent fuel is considered to be waste for the purposes of the appraisal

the effects at new power station sites and due to transport of waste from these sites are summarised below.

A 5.5.16. The effects of radioactive and hazardous waste management on human health and well-being are considered to be neutral. Construction and decommissioning of interim storage facilities for spent fuel, ILW and possibly also LLW may produce negative impacts due to the occupational risks of accident and injury to the workforce. However, because these potential effects are localised they are not considered to be strategically significant. Neither are the potential positive effects of employment on health and well-being considered of strategic significance because of the relatively small proportion of the power station's workforce that would be engaged on construction and operation of interim storage facilities. On site interim storage of spent fuel could result in managed radioactive discharges. However, the statutory controls that apply to processes and discharges and which must be complied with, mean that there should not be any negative effective on the physical well-being of either the workforce or the public in the vicinity of these sites.

A5.6. Summary Effects of the Potentially Suitable Sites

A 5.6.1. As with any major infrastructure project, there can be positive and negative effects at each stage of the development; the relative significance and effectiveness of mitigating adverse effects depends upon the characteristics of the receiving environment and communities. The sustainability of each site was appraised and the findings are set out in detail in the individual Site AoS Reports (Annexes A-J). These appraisals identified strategically significant effects (associated with factors of regional, national or international importance) and locally significant effects (associated with factors of local or area importance). Effects of strategic significance were summarised in each report and are set out below in the following table:

Table A5.3 Summary of Potential Strategically Significant Effects on Human Health and Well-Being

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Bradwell	+	+	+
There is the potential for negative effects on local and regional health from accidental radioactive discharges during operation although the risk of such an accident is judged to be very small because of the strict regulatory regime in the UK. The construction and operation of the proposed nuclear power station has the potential to increase disturbance and pressure on health service capacity as a result of an influx of both construction and operational worker. Potential for an increase in employment, community wealth, additional housing and other associated neighborhoods infrastructure - these positive effects are likely to be much more significant than any potential negative consequences assuming any effects on population health are not realised.			
Braystones	+	+	+
As above			
Hartlepool	+	+	+
As above.			
Heysham	+	+	+
As above.			
Hinkley Point	+	+	+
As above.			
Kirksanton	+	+	+
As above.			
Oldbury	+	+	+
As above.			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Sellafield	+	+	+
As above.			
Sizewell	+	+	+
As above.			
Wylfa	+	+	+
As above.			

Key: Significance of potential strategic effect at each development stage	
++	Development actively encouraged as it 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 "?"

Generally, positive effects on health and well-being through indirect effects on increased long term employment, community wealth, additional housing and other supporting services were identified for each potentially suitable site. Synergistic and secondary positive effects on well-being were indicated from securing community viability, often in rural areas. These positive effects are likely to be much more significant than any of the following potential negative consequences assuming any effects on population health are not realised. 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 construction and operation of the proposed nuclear power station has the potential to increase disturbance and pressure on health service capacity as a result of an influx of both construction and operational worker.

A5.7. Interactions and Cumulative Effects

A 5.7.1. As previously described, health and well-being is affected by a complex interaction of many factors. These factors may be associated with the other factors considered for each Site AoS and this is detailed in the individual site reports. They may also be affected by interactions with the effects from other plans, particularly apparent at the regional or sub-regional levels since local plans and policy must be in conformity with the regional plans and strategies. The following table identifies the potential cumulative effects arising from the NPS. The first column considers cumulative effects at a national scale and the second considers effects at a regional scale. The third column considers the potential effects in combination with those effects caused by other key plans.

Table A5.4: Cumulative Effects on Health and Well-Being of the NPS and in-combination with other plans

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in combination with other plans:
Employment		
There are indirect health effects associated with enhanced prosperity and long-term employment opportunities. However the overall increase in employment resulting from the NPS is considered unlikely to have a significant effect at a national scale.	**North-West and Cumbria:** Due to the potential concentration of up to 4 nuclear power stations in the North West and 3 in Cumbria, the benefits to health from enhanced prosperity and employment are likely to be significant for health at the district level and possibly for the region. **South West and East of England:** The health benefits from prosperity and employment associated with 2 nuclear power stations are unlikely to be considered significant at the regional scale.	**National:** NPS considered unlikely to have cumulative effects in-combination with other plans. **North-West and Cumbria:** Benefits from Nuclear NPS likely to enhance benefits from other proposals in Britain's Energy coast Master plan and North West Plan and lead to enhanced prosperity and employment in the region, with particular benefits for Cumbria. **South West and East of England:** Benefits from enhanced prosperity and long-term employment opportunities may contribute further to benefits from development and proposals in the regional spatial strategies and economic strategies for these 2 regions[111].
Physical Health		
No significant national cumulative effects identified.	**North West/Cumbria:** Cumulative radioactive discharges from four sites in combination with existing operations will need to be within regulatory limits. Depending upon the timing of operations, there could be significant impacts on health and wellbeing during the construction period,	**North West/Cumbria:** Further developments in Cumbria, including £2 billion package of regeneration projects outlined in Britain's Energy Coast Masterplan[112], could further contribute to air quality, noise and disruption impacts in the Cumbria District.

111 South West Regional Spatial Strategy; The East of England Plan, the Revision to the Regional Spatial Strategy for the East of England, published on 12 May 2008.
112 Britain Energy Coast: A Master Plan for West Cumbria

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in combination with other plans:
	including air and noise pollution and disruption. This needs to be considered in terms of project phasing. **South West:** potential effects on water quality through increased radioactivity in Severn Estuary.	**South West:** Severn Estuary Barrage project could lead to significant changes to hydrology, which may affect nutrient and pollutant dispersal with potential health effects.
Mental Health		
The construction of up to 10 nuclear power stations in Britain could have cumulative effects on mental health through increased anxiety relating to perceived nuclear safety and risk of terrorist attacks.	**North West/Cumbria:** Due to the higher concentration of sites in the region and in Cumbria, there could be an increase in anxiety relating to accidental discharge and risk of terrorist attack. There could be cumulative effects on radiation doses from radioactive material discharged from the 4 sites in combination with existing operations.	Perceived threat of terrorist attack may be affected in the longer term by government policies. No further cumulative effects considered likely at the regional scale in-combination with other plans.
Recreation		
No national cumulative effects identified.	**North West/Cumbria:** the location of up to 4 power stations in the region, and 3 within Cumbria District could result in potentially significant cumulative effects on recreational activities. Whilst there is the potential for loss of recreational land, there may be a wider effect on public perception of the area's recreational tourism industry.	No further cumulative effects considered likely at the regional scale in-combination with other plans.

A5.8. Summary and Recommendations

A5.8.0. The predicted effects of the draft NPS on radiological health are likely to be neutral since the regulatory mechanisms controlling nuclear power will aim to provide the same level of protection to people's health as exists at present.

However, the AoS recommended 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 which limits radiation to which members of the public are exposed from all sources of 1mSv per year, applies to the cumulative effects of planned exposures.

A 5.8.1. The construction of 10 nuclear power stations could have cumulative effects on mental health through increase anxiety relating to perceived radiation risks, nuclear safety and risk of terrorist attacks. These effects could be mitigated nationally and locally through continuing public liaison, participation and educational initiatives. It is recommended that the nuclear and safety regulators have particular regard to the potential synergistic and cumulative effects of a number of new nuclear power stations in a sub-regional area.

A 5.8.2. The predicted effects of the draft Nuclear NPS on the wider determinants of health are likely to be significantly beneficial to local communities through enhanced prosperity and long term employment opportunities. This will only be significant if employment is secured for local people and it was recommended that the draft NPS suggests that this should be a factor for consideration by the IPC, perhaps through the requirement on the developers for an impact assessment of the wider determinants of health.

Appendix A6: Cultural Heritage

A6.1. Introduction

A6.1.1 Cultural heritage embraces the historic and built environment, including archaeology, the settings of features, historic landscapes, and extends to human activities, ideas, spiritual and intellectual attitudes. Within the UK, there are very few areas that have not been affected by previous human activities.

A6.1.2 The SEA Directive requires that information to be provided in the Environmental Report includes "the likely significant effects on the environment, including on issues such as ... material assets, cultural heritage including architectural and archaeological heritage, landscape and the inter-relationship between the above factors." (Annex I (f)) and the Government's guidance on undertaking SA incorporating SEA[113] provides further information.

A6.1.3 The factors affecting cultural heritage 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 cultural heritage resources and this depends upon the characteristics and sensitivities to change of the receiving environment and communities.

A6.1.4 The draft Nuclear NPS could have implications for these factors generally, as follows:

- Permanent and temporary effects in terms of loss, damage or disturbance to cultural heritage features, of national, regional and local significance
- Effects on the historic context / setting of cultural heritage features within a wider environment
- Indirect effects on the amenity of cultural heritage features as enjoyed by the visitors and the local community

A6.1.5 These factors for cultural heritage are likely to be at local and regional scales associated with the individual development of new nuclear power stations. Implications at a national scale would only apply where cultural heritage features with national designations were affected.

A6.2. Policy Context

A6.2.1 Appendix A in the Scoping Report (March 2008) sets out the review of relevant plans, programmes and environmental objectives for the appraisal of the draft Nuclear NPS. This was updated during April-May 2009 to take account of key

113 ODPM 2005 A practical guide to the Strategic Environmental Assessment Directive

policy and sustainability objectives that may have been established since the earlier scoping.

A6.2.2 The following, A6.1, table sets out the key objectives for sustainability that need to be taken in to account for appraising the effects of the Nuclear NPS with regard to cultural heritage and reflecting the updated policy review, referred to above.

Table A6.1: Key Sustainability Objectives

Plan, Policy or Programme	Key Sustainability Objective
International	
Convention concerning the Protection of the World Cultural and Natural Heritage (UNESCO, 1972)	Encourage international cooperation in the conservation of our world's cultural and natural heritage Encourage States Parties to establish management plans and set up reporting systems on the state of conservation of their World Heritage sites Encourage participation of the local population in the preservation of their cultural and natural heritage
National	
White Paper, Heritage Protection for the 21st Century (2007)	Delivering sustainable communities by putting the historic environment at the heart of an effective planning system.
Draft Heritage Protection Bill (April 2008)	
Planning Policy Guidance 15: Planning and the Historic Environment (September, 1994)[114]	Effective protection for all aspects of the historic environment is fundamental, as it is a central part of cultural heritage and the sense of national identity. Conservation and sustainable economic growth are complementary objectives. The historic record contributes to education, adds to the quality of lives and is of importance for leisure and recreation.
Planning Policy Guidance 16: Archaeology and Planning (November, 1990)	

114 A new Planning Policy Statement (PPS) on the historic environment is due for publication in draft for consultation in summer 2009, alongside a working draft of the accompanying guidance. (Source: DCMS)

A6.3. Scope of the Appraisal

A6.3.1 As a result of scoping and ongoing consultation, the AoS framework for appraising the effects of the draft Nuclear NPS on cultural heritage identified the relevant AoS objectives as set out in the following table:

Table A6.2: AoS Appraisal Framework for Cultural Heritage

SD Theme: Cultural Heritage	
AoS Objectives[115]	**Guide Questions**
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 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?
Cultural heritage may be a factor indirectly affecting Human Health and Well-Being and this is addressed and reported in Section A5 of this appendix: Human Health and Well-Being.	

A6.3.2 Temporal and Spatial Boundaries: The AoS followed the approach taken for the appraisal of the SSA criteria and reported in the Environmental Study[116] and update of the Environmental Study[117]. Short and long term effects relate to activity phases of nuclear power stations as follows:

- Construction: short term 5-6 years
- Operation: long term, base case of 60 years (with possible extension subject to regulatory approval)
- Decommissioning: around 30 years

It is 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

115 Numbers refer to objective numbers in the SEA Scoping Report and the Environmental Study
116 BERR July 2008 Environmental Study http://www.berr.gov.uk/files/file47137.pdf
117 BERR January 2009 Applying the Strategic Siting Assessment Criteria: an update to the study of the potential environmental and sustainability effects http://www.berr.gov.uk/files/file49869.pdf

assumptions and there are a number of factors that could reduce or potentially increase, the total duration of onsite spent fuel storage.

A6.3.3 The draft Nuclear NPS sets out the Government's policy on the national strategic issues and site specific issues and mitigations which need to be taken into account when granting consent for the construction of new nuclear power stations.

A6.3.4 **Consultation**: During the appraisal process, consultation and ongoing liaison were undertaken with the statutory consultees and regional/local authorities.

A6.4. The Current Situation and Likely Evolution without the Nuclear NPS

A6.4.1 The Scoping Report[118] and the Environmental Study[119] set out the baseline information for cultural heritage; this was updated with key data in April-May 2009.

A6.4.2 A range of data is provided giving the cultural heritage features within the vicinity of each site, both on land and offshore, including internationally and nationally important features such as UNESCO World Heritage Sites and Scheduled Monuments, plus Register Battlefields, Protected Wrecks, Historic Parks and Gardens. Conservation Areas, Listed Buildings, Historic Landscapes and Areas of Archaeological Importance.

A6.5. The Likely Effects of the draft Nuclear NPS

A6.5.1 The draft Nuclear NPS is likely to have permanent, irreversible and/or long-term negative effects on cultural heritage throughout all phases of development, principally associated with the location and scale of the sites. Effects are likely to be felt at a local to regional scale, depending on distances, sight-lines, topography and ability to mitigate, but could be of regional to national importance.

Construction Phase

A6.5.2 The effects of the draft Nuclear NPS during construction on cultural heritage will be highly localised and associated with the footprint of the development and including any offshore works. Mitigation in these instances is avoidance during the planning and design stage, informed by detailed investigations during the

118 BERR (March 2008) Consultation on Strategic Environment Assessment Scoping Report for Proposed National Policy Statement for New Nuclear Power

119 BERR (July 2008) Applying the Proposed Strategic Siting Assessment Criteria: A study of the potential environmental and sustainability effects

project level EIA stage, such as consultation with the local authority archaeologist, trial trenching, geophysical surveys, detailed surveys of buildings and/or features, marine archaeology, and watching briefs during excavations and ground works. Disturbance effects will be incurred with regard to the amenity and setting of nearby cultural heritage features. Such effects may be related to noise, air quality, visual impacts and traffic. Disturbance effects can be controlled and minimised through good environmental site practices implemented via a Construction Environmental Management Plan.

Operational Phase

A6.5.3 The effects of the draft Nuclear NPS on cultural heritage during the operational phase will also be highly localised and associated with the location and scale of the development, affecting the setting of nearby cultural heritage features. Mitigation of the effects to features within the immediate proximity is likely to be very limited, although mitigation, in the form of effective landscaping, may be possible for features at greater distances.

Decommissioning Phase

A6.5.4 The decommissioning phase will allow the long-term effects on the settings of nearby cultural heritage features to be reduced or removed altogether. Disturbance effects on the amenity of such features effects can be controlled and minimised in a similar way to the effects of construction.

Table A6.3 Summary of Generic Effects and Possible Mitigation

Sustainable Development Theme: Cultural Heritage	
Generic Effects	**Possible Mitigation**
Negative: • Nuclear power stations have the potential to have effects on cultural heritage resources (for example Listed buildings, parks and gardens, Scheduled Ancient Monuments etc.), including those of regional and national and importance - these effects are common to other major infrastructure projects. This can include changes to the setting of heritage resources, although effects are dependent on distances, sight-lines, topography and ability to mitigate.	• Minimisation of footprint area • Careful siting within development boundary • Detailed investigations at EIA stage and watching briefs during construction. • Limited scope for landscape screening
• Large scale construction projects can have adverse effects on buried archaeological resources. The construction works including the establishment of foundations, ground disturbance, the movement of heavy machinery and the potential construction of new grid connection infrastructure could lead to the direct loss or damage to below ground archaeology. Dewatering could lead to hydrological modifications which could disturb paleoenvironmental deposits.	• Minimisation of footprint and working areas • Detailed investigations at EIA stage and watching briefs during construction. • Implementation of good site environmental site practices via a Construction Environmental Management Plan.
• Disturbance or loss to maritime archaeology.	• Detailed investigations at EIA stage and watching briefs during construction.

Sustainable Development Theme: Cultural Heritage	
Generic Effects	**Possible Mitigation**
• The presence of the development site and construction works could lead to adverse impacts on historic landscapes, for example direct loss of an important area of land, or temporary effects during construction stage.	• Landscape Impact assessment at EIA stage and consideration of changes to site layout/boundaries to minimise effects.
• The interim storage, transport and disposal of waste also has the potential for negative effects on items and landscapes of heritage significance.	• Effects to be assessed at EIA stage when information available re: transport routes.
• Increased noise/vibration and adverse air quality may lead to physical damage of cultural heritage features. Increased noise/vibration, adverse air quality and visual impacts may lead to a decreased amenity experienced by visitors to the cultural heritage feature.	• Refer sections on air quality and health

Radioactive and Hazardous waste management

A6.5.5 The Main AoS Report (Chapter 6) and Annex K give the findings of an appraisal of sustainability of the arrangements for managing radioactive and hazardous wastes arising from the Nuclear NPS. This appraisal has used the AoS framework to consider the following waste streams:

- Spent Fuel[120];
- Intermediate Level Waste (ILW);
- Low Level Waste (LLW);
- Gaseous and Liquid Radioactive Discharges; and
- Non Radioactive Hazardous Wastes.

A6.5.6 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.

120 In accordance with Government's view that in the absence of any proposals from industry new nuclear power stations should proceed on the basis that spent fuel will not be reprocessed, spent fuel is considered to be waste for the purposes of the appraisal

There may also be effects associated with the transport of waste between nuclear power stations and waste management sites. The 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 of. The findings of the appraisal in relation to the effects at new power station sites and due to transport of waste from these sites are summarised below.

A6.5.7 There is the potential for minor negative effects on cultural heritage and landscape during the construction and operation of on site interim storage facilities. The significance of these effects will be site specific and can be more meaningfully appraised once locations and designs are finalised. Emission stacks associated with gaseous discharges may locally have a negative effect on cultural heritage settings although effects will be dominated by the wider site development and their significance will depend on the setting of the site. The mitigation measures considered in previous sections are also applicable to mitigate the effects of waste management.

A6.6. Effects of the Potentially Suitable Sites

A6.6.1 As with any major infrastructure project, there can be negative effects at each stage of development, generally felt at a local scale, and particularly associated with the footprint of the development. The relative significance of these effects will depend on a variety of factors. Significance depends on the importance of the features, which may be of local to international importance, on the location and scale of the development, and on the distance between the proposed development and the cultural heritage feature (which itself can be influenced by topography, sight-lines and ability to mitigate).

A6.6.2 The sustainability of each site was appraised and the findings are set out in the individual site AoS Reports (Annexes A – J). These appraisals identified strategically significant effects (associated with factors of regional, national or international importance) and locally significant effects (associated with factors of local or area importance). These effects are set out in Table 6.4 below.

Table A6.4: Summary of Potential Significant Strategic Effects on Cultural Heritage

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Bradwell	--?	--?	+?
The main impacts of the development would be felt at a local to regional scale. Potential setting effects upon nearby scheduled monuments and listed buildings, and the West Mersea Conservation Area, could 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 especially if the development occurs on the eastern side of the site. However, mitigation could be applied by siting the proposed facility close to the existing power station on the western side of the site. Further detailed assessment at project level will be required.			
Braystones	-	-	-
Negative effects on cultural heritage features at a local scale There is potential for adverse effects on the settings of cultural heritage features of regional and national importance, as well as on buried archaeology of potentially high importance. However, there is a probability that these effects can be mitigated.			
Hartlepool	-?	-?	-?
Negative effects on cultural heritage features at a local scale, although there is some uncertainty about lines of site in this more urban setting. There is potential for adverse effects on the settings of scheduled monuments or other cultural heritage sites of regional or national importance depending on distance and sight lines. Further detailed assessment at project level will be required.			
Heysham	-	-	-
Negative effects on cultural heritage features at a local scale. There is the potential for adverse effects on local designations, but these are unlikely to be considered as being of national strategic significance. The site level AoS has not identified any amenity, cultural heritage, or landscape designations within the site boundary, though a prehistoric artefact was found in the area.			
Hinkley Point	-	-	-
Negative effects on cultural heritage features at a local scale. There is potential for adverse effects on the Wick Barrow Pixies' Mound Scheduled			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Ancient Monument (SAM), which is of national heritage significance. However, there is likelihood that this can be mitigated.			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Kirksanton	-	-	-
Negative effects on cultural heritage features at a local scale. There is potential for potential adverse effects on the settings of cultural heritage features of regional and national importance, as well as on buried archaeology that may be present on the site. However, there is a possibility that these effects can be mitigated.			
Oldbury	-	-	-
Negative effects on cultural heritage features at a local scale. There is potential for adverse effects on Scheduled Ancient Monuments, conservation areas, a registered park and garden and listed buildings, which may be of regional or national heritage significance, as well as on medieval agricultural earthworks and buried archaeology of potentially high importance.			
Sellafield	-	-	-
Negative effects on cultural heritage features at a local scale. There is potential for adverse effects on the settings of cultural heritage features of regional and national importance, as well as on buried archaeology of potentially high importance.			
Sizewell	-	-	-
Negative effects on cultural heritage features at a local scale. There is potential for adverse setting impacts upon Scheduled Monuments, Conservation Areas, Listed Buildings, historic landscape and historic townscapes. There is also potential for adverse physical impacts upon significant buried archaeology. However, these may be mitigated to some degree by appropriate facility location.			
Wylfa	-	-	-
Negative effects on cultural heritage features at a local scale. There is the potential for adverse effects on Scheduled Monuments, a registered garden and listed buildings, which may be of regional or national heritage significance. However, there is a possibility that this can be mitigated.			

Key: Significance of potential strategic effect at each development stage	
++	Development actively encouraged as it 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 "?".

A6.7. Interactions and Cumulative Effects

A6.7.1. As with any major infrastructure project, there can be negative effects at each stage of development, generally felt at a local scale, and particularly associated with the footprint of the development. The relative significance of these effects will depend on a variety of factors. Significance depends on the importance of the features, which may be of local to international importance, on the location and scale of the development, and on the distance between the proposed development and the cultural heritage feature (which itself can be influenced by topography, sight-lines and ability to mitigate).

A6.7.2. There are likely to be some locally/regionally significant effects on cultural heritage both from the effects of the Nuclear NPS itself, particularly where sites are in close proximity to each other, but also in combination with other plans.

A6.7.3. There may be small negative cumulative effects with other development and infrastructure projects within the locality/region, due to impacts on the land within the footprints of the developments resulting in a reduced overall buried resource. These effects would be permanent and irreversible, and mitigation involves the minimisation of the area of the footprint.

A6.7.4. Similarly, there may be small negative cumulative effects in terms of the settings of cultural heritage features. This will be more acute where major projects are in close proximity to each other, potentially affecting the same cultural heritage feature. Impacts of construction activities may be more prominent should construction phases of the development coincide, however this may be mitigated through careful planning.

A6.7.5. Interactions and synergistic effects can occur between cultural heritage and the different topics or sustainable development themes. Cultural heritage features provide a sense of national identity, and contribute to the health and well being

of the population via education, quality of lives, and leisure and recreation. Effects on the setting of cultural heritage features within a landscape context can result in effects on the amenity/enjoyment value of that feature.

A6.7.6. The following table identifies the potential cumulative effects resulting consideration of new nuclear power stations at each of the potentially suitable sites. The first column considers cumulative effects at a national scale and the second column considers effects at a regional scale. The third column considers the potential effects in-combination with those effects caused by other plans.

Table A6.5: Cumulative Effects on Cultural Heritage of the NPS and in-combination with other plans

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
No significant national cumulative effects identified.	No significant regional / district cumulative effects identified generally. **Cumbria:** Some locally significant cumulative adverse effects may arise in terms of the settings of cultural heritage features where sites are in close proximity to each other, potentially affecting the same cultural heritage features and their amenity value.	Some locally significant cumulative adverse effects may arise in terms of the settings of cultural heritage features where sites are in close proximity to other proposed major development / infrastructure projects, potentially affecting the same cultural heritage features and their amenity value. Effects may be more prominent should construction phases coincide.

A6.8. Summary and Conclusions/Recommendations

A6.8.1 The predicted effects of the draft Nuclear NPS on cultural heritage are likely to be negative throughout all phases of development, with permanent, irreversible and/or long-term effects principally associated with the location and scale of the sites. Effects are likely to be felt at a local to regional scale, depending on distances, sight-lines, topography and the ability to mitigate, but could be of regional to national importance.

A6.8.2 Effects of location are associated with the footprints of the site, where cultural heritage features, if present, are likely to be lost as part of ground works and excavations. Mitigation is the minimisation of the footprints and the avoidance of features, where possible, during the planning and design stage, informed by detailed investigations during the project level EIA stage and watching briefs during excavations and ground works.

A6.8.3 Effects of scale impact on the settings of nearby cultural heritage features within a landscape context. Highly dependent on distances, effects of scale can result in a reduced amenity value of that feature. Mitigation may be very difficult or impossible to achieve.

A6.8.4 Disturbance effects may also impact on the amenity and setting of nearby cultural heritage features, particularly during the construction phase, but can be controlled and minimised through good environmental site practices.

A6.8.5 Cumulative effects of local to regional significance may also arise where sites are in close proximity to each other and also in combination with other major development and infrastructure projects, potentially affecting the same cultural heritage features. This may be particularly acute in the North West region (Cumbria sub-region) where a number of sites are located, as well as being the focal area for the Britain's Energy Coast Master Plan. It is recommended that the NPS should carefully consider the cumulative effect of additional nuclear sites in this region and advise the IPC to carefully consider the capacity of the area to accommodate such change.

Appendix A7: Landscape

A7.1 Introduction

A7.1.1 Landscape is about the relationship between people and places. The landscape resource results from the way different components of the environment interact together and are perceived as:

- Natural, including the influences of geology, soils, climate, flora and fauna
- Cultural and social, including the historical and contemporary influences of land use
- Sensitivity to change

A7.1.2 These interactions contribute to the landscape characterisation process that helps with assessing the effects of development proposals. The influence of infrastructure developments on visual amenity is considered through the study of the visual resource and the individuals and communities who experience that resource.

A7.1.3 The SEA Directive requires that information to be provided in the Environmental Report includes "the likely significant effects on the environment, including on issues such as ...landscape...and the inter-relationship between the above factors." (Annex I (f)) and the Government's guidance on undertaking SA incorporating SEA[121] provides further information.

A7.1.4 The factors affecting landscape that are relevant for the Nuclear NPS depend on the type, scale, detailed design and locational characteristics of the proposed new nuclear power stations. As well as these site specific issues, there are certain common implications for landscape for the Nuclear NPS as follows:

- Nuclear power stations tend to be located in less populated areas that may have value for visual amenity and landscape resources.
- Nuclear power stations require coastal/shoreline locations to support the requirement for cooling.
- The scale of nuclear power station buildings means that visual mitigation potential is generally quite limited.
- Given the timescales involved, there is some uncertainty as to use and options for decommissioned sites.

A 7.2 Policy Context

A7.2.1 Appendix A in the Scoping Report (March 2008) sets out the review of relevant plans, programmes and environmental objectives for the appraisal of the Nuclear NPS.

121 ODPM 2005 *A practical guide to the Strategic Environmental Assessment Directive*

A7.2.2 The following table, A7.1, sets out the key objectives for sustainability that need to be taken in to account for appraising the effects of the Nuclear NPS with regard to Landscape and reflecting the updated policy review , referred to above.

Table A7.1: Key Sustainability Objectives

Plan, Policy or Programme	Key Sustainability Objective
International	
The European Landscape Convention[122] A Treaty Signed by the United Kingdom in 2006	Landscape is defined in the European Landscape Convention as follows: '*...an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors*' The European Landscape Convention (ELC) is the first international convention to focus specifically on landscape, and is dedicated exclusively to the protection, management and planning of all landscapes in Europe. The Convention's main objectives are concerned with the contribution landscapes make to guaranteeing well being for all and sustainable development.
National	
Planning Policy Statement 1[123] *(PPS 1),* Delivering Sustainable Development	This is concerned with delivering sustainable development, identifies that the quality, character and amenity value of the countryside and urban areas should be protected and enhanced.
Planning Policy Statement 7[124] *(PPS 7)* Sustainable Development in Rural Areas	This relates to sustainable development in rural areas and stresses that nationally designated landscapes (National Parks and AONBs) have been confirmed by the Government as having the highest status of protection in relation to landscape and scenic beauty (under the Countryside and Rights of Way Act). The Statement also promotes use of tools such as Landscape Character Assessment in the development of criteria based planning policies, and requires that development should be sensitive to landscape character.

122 Council of Europe (2000); '*European Landscape Convention*', Council of Europe.
123 ODPM (2005) '*Planning Policy Statement 1: Delivering Sustainable Development*', HMSO.

Plan, Policy or Programme	Key Sustainability Objective
The Countryside and Rights of Way Act[125]	This obliges local authorities to produce management plans for AONBs; The role of the AONB Management Plan is dictated by the purposes of designation, primarily to conserve and enhance natural beauty, as manifested in distinctive local landscape character; this role is reflected in management plan policy. In turn, one of the functions of the AONB Management Plan is to inform development plan policy with respect to the purposes of AONB designation.

A7.3 Scope of the Appraisal

A7.3.1 AoS Framework: As a result of scoping and ongoing consultation, the AoS framework for appraising the effects of the draft Nuclear NPS on landscape identified the relevant AoS objectives as set out in following table:

Table A7.2 AoS Appraisal Framework for Landscape

Sustainable Development Theme: Landscape	
AoS Objectives[126]	**Guide Questions**
24. to avoid adverse impacts on nationally important landscapes 25. to avoid adverse impacts on landscape character, quality and tranquility, diversity and distinctiveness	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 tranquility in an area? Will it adversely affect the landscape character or distinctiveness? Will it result in increased levels of light pollution?

A7.3.2 **Temporal and Spatial Boundaries:** The AoS followed the approach taken for the appraisal of the SSA criteria and reported in the Environmental Study6[127]and update of the Environmental Study[128]. Short and long term effects relate to activity phases of nuclear power stations as follows:

124 ODPM (1997); '*Planning Policy Statement 7: Sustainable Development in Rural Areas*' , HMSO.
125 HM Government, 2000; *The Countryside and Rights of Way Act.* .
126 Numbers refer to objective numbers in the SEA Scoping Report and the Environmental Study.
127 BERR July 2008 Environmental Study http://www.berr.gov.uk/files/file47137.pdf

- Construction: short term 5-6 years
- Operation: long term, base case of 60 years (with possible extension subject to regulatory approval)
- Decommissioning: around 30 years

It is 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.

A7.3.3 The draft Nuclear NPS sets out the Government's policy on the national strategic issues and site specific issues and mitigations which need to be taken into account when granting consent for the construction of new nuclear power stations.

A7.3.4 **Consultation:** During the appraisal process, consultation and ongoing liaison were undertaken with the statutory consultees and regional/local authorities. The most relevant consultations in relation to this AoS topic were made with the following:

- Defra with overall responsibility for securing a healthy environment
- Natural England with responsibilities including for protecting landscape
- The Countryside Council for Wales (CCW) with responsibilities for protecting landscape
- Local Planning Authorities
- English Heritage responsible for protecting the historic built environment

A 7.4 The Current Situation and Likely Evolution without the Nuclear NPS

A7.4.1 The Scoping Report and the Environmental Study set out the baseline information; this was updated with key data in April-May 2009.

A7.4.2 Generally across Europe there is a recognition that landscape diversity and quality is deteriorating. The following is an extract from the explanatory text accompanying the European Landscape Convention which confirms this position. '*The quality and diversity of many landscapes are deteriorating as a result of a wide variety of factors and that this is having an adverse effect on the quality of their everyday lives*.'

128 BERR January 2009 Applying the Strategic Siting Assessment Criteria: an update to the study of the potential environmental and sustainability effects http://www.berr.gov.uk/files/file49869.pdf

A7.4.3 At a national level Natural England have assessed landscape change in their publication 'State of the Natural Environment (2008). Their Countryside Quality Counts (CQC) project has measured landscape change by assessing change in landscape character for two periods, 1990-1998 and 1999-2003 (Haines-Young 2007). CQC uses England's Character Areas as the geographical framework for reporting and assesses both the magnitude and the direction of landscape change for each Character Area, using four categories: maintained, enhancing, neglected and diverging. They have summarized their findings as follows:

'The assessment for the second period, 1999-2003, showed that:

- Existing landscape character is being maintained *in 51% of England's landscapes (i.e. Character Areas), whilst in a further 10% existing character is being enhanced. However, 20% of our landscapes are showing signs of neglect, in the sense that past loss of character has not been reversed, while in a further 19% new landscape characteristics are emerging;*

- *The assessment suggests that the erosion of valued landscape character revealed in the 1990-1998 assessment has been arrested in some places and*
  slowed in others. There is also evidence that, in many key localities, the existing landscape character has been sustained or strengthened;

- *Areas where the landscape character was neglected or diverging are generally close to major centres of population and transport routes.'*

A7.5 The Likely Effects of the draft Nuclear NPS

A7.5.1 The draft Nuclear NPS is likely to have long-term negative effects on landscape throughout all phases of development, principally associated with the location and scale of the sites. Effects are likely to be felt at a local to regional scale, depending on distances, sight lines, topography and ability to mitigate. Given the scale of the likely development, fully effective mitigation of local level landscape and visual impacts during the construction and operational phases is unlikely.

A7.5.2 The following table summarises the likely landscape effects of the draft Nuclear NPS:

Table A7.3 Summary of the likely Landscape effects of the draft Nuclear NPS

Sustainable Development Theme: Landscape	
Generic Effects	**Possible Mitigation**
Negative: • Potential for long-term irreversible effects on landscape through location of reactors and plant, including visually-intrusive cooling towers	• Changes to site layout/ boundaries can be made to minimise some direct landscape effects. 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 adverse visual effects with limited potential for mitigation, until decommissioning.
• Potential for short-term effects on landscape due to construction including visual impact of construction/plant equipment (for example. cranes, temporary buildings); disturbance of landforms, removal of vegetation.	• Use of buffer zones, protection fences can be utilized to avoid or reduce effects on significant site landscape features. • Reinstatement or restoration of original landforms and vegetation where possible can help to minimise impact of construction on landscape.
• Increased traffic during construction and operation can have adverse effects on landscape qualities, including noise and dust pollution affecting tranquillity.	• Traffic Management Plans, Construction Environmental Management Plans and Green Travel plans can assist in minimising intrusion caused by vehicular traffic. Delivery of materials by sea is also likely to reduce potentially adverse impacts. Conditions of consent will help to control hours of operation/construction and dust.

Radioactive and Hazardous waste management

A7.5.3 The Main AoS Report (Chapter 6) and Annex K give the findings of an appraisal of sustainability of the arrangements for managing radioactive and hazardous wastes arising from the Nuclear NPS. This appraisal has used the AoS framework to consider the following waste streams:

- Spent Fuel[129]

129 In accordance with Government's view that in the absence of any proposals from industry new nuclear power stations should proceed on the basis that spent fuel will not be reprocessed, spent fuel is considered to be waste for the purposes of the appraisal

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

A7.5.4 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 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 of. The findings of the appraisal in relation to the effects at new power station sites and due to transport of waste from these sites are summarised below.

A7.5.5 There is the potential for minor negative effects on landscape during the construction and operation of on site interim storage facilities. The significance of these effects will be site specific and can be more meaningfully appraised once locations and designs are finalised. Emission stacks associated with gaseous discharges may locally have a negative effect on landscape although effects will be dominated by the wider site development and their significance will depend on the setting of the site. The mitigation measures considered in previous sections are also applicable to mitigate the effects of waste management.

A7.6 Summary Effects of the Potentially Suitable Sites

A7.6.1 As with any major infrastructure project, there can be positive and negative effects at each stage of development. The relative significance of these effects depends on the characteristics and scale of the receiving communities. The sustainability of each site was appraised and the findings are set out in the individual site AoS Reports (Annexes A –J). These appraisals identified strategically significant effects and locally significant effects. These effects are set out in Table A7.4 below.

Table A7.4: Summary of Potential Significant Strategic Effects on Landscape

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Bradwell	-	-	0?
Some negative effects at a Regional Scale. During construction and operation their is potential for adverse indirect landscape and visual effects from the new power station during construction and operation predominantly on local Special Landscape Areas and the coastal zone. No adverse effects are anticipated on nationally designated landscape. There are likely to be direct adverse effects on valued landscape features and some may be able to be effectively mitigated. Opportunities for visual mitigation are limited until decommissioning.			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Braystones	--	--	0?
Some significant negative effects at a National Scale. See Sellafield Commentary as effects comparable, with the exception that no existing power station facility exists on the site			
Hartlepool	-	-	0?
Some negative effects at a Regional Scale. During Construction and operation there are likely to be minor adverse landscape character and visual impacts on the on the site and the surrounding area, including distant viewpoints within the North York Moors National Park, Durham and the North Yorkshire and Cleveland Heritage Coast and nearby designated Conservation Areas within Hartlepool. The new power station will be seen within the context of the existing facility, however there is still likely to be deterioration in some views. Some landscape mitigation and enhancement may be possible at a local level by enhancing local green infrastructure. However, there will be limited potential for mitigating visual effects until after decommissioning.			
Heysham	-	-	0?
Some negative effects at a National/Regional Scale. During Construction there may be opportunities for reduction of existing clutter and detracting infrastructure through the use of existing brownfield land. There is some potential to avoid direct impacts of cooling culverts on the shoreline. Also, given the extent of construction laydown areas, there are likely to be temporary adverse effects on adjoining recreation land but at the same time some opportunities for improving the green infrastructure in the vicinity to the east, by the restoration of terrestrial habitat and enhancement of habitat connectivity. During operation, the new power station will be seen within the context of the existing power station facilities which are already prominent features in the local scene. However, there is still a likelihood of some long-term minor adverse landscape character and visual impacts during operation on the surrounding area, including distant viewpoints within the Lake District National Park to the north and Yorkshire Dales and Arnside Areas of Outstanding Natural Beauty and their proposed extension areas. Also, there is potential for adverse effects upon the setting of the Heysham Conservation Area. Visual mitigation is likely to be limited until decommissioning.			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Hinkley Point	-	-	0?
Some negative effects at a Regional/National Scale. There is some potential for mitigation by avoidance of direct effects on the significant landscape character and features of the site during and post construction. During Operation, the new power station will be seen within the context of an existing power station. However, there are still likely to be longer-term adverse landscape and visual impacts on the surrounding area including parts of the Quantocks Area of Outstanding Natural Beauty (arising from the large scale of the new reactor buildings and from potential associated transmission grid connections). There is some anticipated potential for landscape restoration on temporary construction lay down areas and when power stations are decommissioned.			
Kirksanton	--	--	0?
Some significant negative effects at a National Scale. See Sellafield Commentary as effects comparable, with the exception that no existing power station facility exists on the site.			
Oldbury	-	-	0?
Some negative effects at a Regional/National Scale. During construction and operation the main direct impacts would be at local level and over time these could be largely compensated for. However, although seen in the context of the existing power station, there are likely to be some long lasting adverse indirect landscape and visual impacts on the surrounding areas including parts of the AONBs of the Wye Valley and the Cotswolds, until decommissioning.			
Sellafield	--	--	0?
Some significant negative effects at a National Scale. There are likely to be strategically Adverse visual and landscape effects during construction and operation on the setting of the Lake District National Park. The new power station will be seen in the context of the existing power station on this site. However, there is still likely to be adverse visual effects that will not be able to be fully mitigated. Potential for in combination direct effects from the creation of new transmission grid connections on the Lake District National Park also which cannot be fully mitigated.			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Sizewell	--	--	0?
Some significant negative effects at a National Scale. During construction and operation there are likely to be direct and indirect adverse impacts on distinctive landscape character and features at local scale within an area of nationally designated landscape character and quality (Suffolk Coasts and Heaths AONB, Suffolk Heritage Coast). Despite being located alongside the existing power station there is likely to be long term deterioration in some views within a nationally designated landscape and on a Heritage Coast, until decommissioning.			
Wylfa	-	-	-
Some negative effects at a National/Regional Scale. Potential for some long-term adverse landscape character and visual impacts during operation on the surrounding area, including parts of Anglesey Area of Outstanding Natural Beauty and North Anglesey Heritage Coast. Direct effects on the AONB are likely to include those arising from new transmission grid connectivity. There may be some potential for the mitigation of landscape impacts through further consideration of site boundaries /layout and through landscape restoration and compensation after construction. The new power station will be seen within the context of the existing power station. However, opportunities for addressing adverse visual effects are likely to be limited until decommissioning.			

Key: Significance of potential strategic effect at each development stage	
++	Development actively encouraged as it 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

Key: Significance of potential strategic effect at each development stage	
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 "?".

A7.7 Interactions and Cumulative Effects

A7.7.1 The following table identifies the potential cumulative effects resulting from the NPS. The first column considers cumulative effects at a national scale and the second column considers effects at a regional scale. The third column considers the potential effects in-combination with those effects caused by other plans.

A7.7.2 The following table identifies the potential cumulative effects resulting from the NPS. The first column considers cumulative effects at a national scale and the second column considers effects at a regional scale. The third column considers the potential effects in-combination with those effects caused by other plans.

Table A7.5: Cumulative Effects on Landscape of the NPS and in-combination with other plans

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
Effects on the Nationally designated landscape National Resource arising from all of the schemes mentioned to the right.	Addition to the impacts of other planned Energy projects: including windfarms, the Severn Barrage	Improvements to transmission grid connectivity Nearby local housing and road infrastructure developments

A 7.8 Summary and Conclusions/Recommendations

A7.8.1 In landscape terms, the impacts of the Draft NPS are likely to have strategically adverse consequences on all sites. There are likely to be some landscape and visual impacts that cannot be effectively mitigated, in all situations, due to the broadly consistent amount and scale of development that has to be provided.

A7.8.2 The sites are all in coastal or shoreline locations, however, each is distinguished by the characteristics of their immediate local and wider landscape settings.

A7.8.3 Only one site (Sizewell) falls directly within a Nationally Designated Landscape, however, seven others have intervisibility from Nationally Designated Landscape Areas.

A7.8.4 Only two sites do not have an existing Nuclear Power station located alongside them (Braystones and Kirksanton). Therefore, on all of the other sites the proposed power stations would be seen in the context of the existing facilities.

A7.8.5 The main short term adverse landscape and visual effects directly on the sites will arise from construction laydown areas/access routes and off site associated disturbance to visual amenity and tranquility.

A7.8.6 Operational phase adverse effects are likely to arise from new buildings, road improvements, coastal defences, cooling culverts, marine landing platforms, new lighting requirements and associated new transmission grid infrastructure.

A7.8.7 Significant landscape in combination effects identified include the adaption of the sites to future climate change, the need for sensitivity to geomorphologic processes, the need to respond to local landscape character and avoid adverse effects on visual amenity and the implications of this for the approach and design of future sea defences. In addition, it is likely that each proposed power station will need some form of associated transmission grid improvements which could also have significant landscape and visual consequences for the site and its setting.

A7.8.8 Cumulative Impacts vary from site to site, however, the landscape and visual impacts of other energy related development occurs repeatedly and will be an important consideration in many cases.

A7.8.9 Some suggested mitigation opportunities have been identified within this section of the appendix and in more detail within the specific site Appraisals of Sustainability. However, mitigation measures and conclusions about the most appropriate design for each site will need to be developed following more detailed landscape/seascape and visual assessment carried out at a level that was beyond the scope of this study.

Appendix A8: Air Quality

A8.1. Introduction

A8.1.1. Under the Environment Act 1995 local authorities have statutory duties for local air quality management (LAQM) and are required to carry out regular reviews and assessments of air quality, for seven pollutants i.e. particles, nitrogen dioxide, sulphur dioxide, benzene, 1,3-butadiene, carbon monoxide and lead, against standards and objectives prescribed in regulations for the purpose of local air quality management. Where any of these objectives are not being achieved, authorities must designate air quality management areas (AQMAs) and prepare and implement remedial action plans to tackle the problem. The air quality across the UK varies at both a local and regional scale. However, air quality in the UK has generally continued to improve since 1997, when the first Air Quality Strategy was adopted, with current objectives for all air pollutants are being met in over 99 per cent of the UK[130].

A8.1.2. The SEA Directive requires that information to be provided in the Environmental Report includes "*the likely significant effects on the environment, including on issues such as ...air…climatic factors...and the inter-relationship between the above factors.*" (Annex I (f)) and the Government's guidance on undertaking SA incorporating SEA[131] provides further information.

A8.1.3. The factors affecting air quality that are relevant for the 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.

A8.2. Policy Context

A8.2.1. Appendix A in the Scoping Report (March 2008) sets out the review of relevant plans, programmes and environmental objectives for the appraisal of the Nuclear NPS. This was updated during April-May 2009 to take account of key policy and sustainability objectives that may have been established since the earlier scoping.

A8.2.2. The following table sets out the key objectives for sustainability that need to be taken in to account for appraising the effects of the Nuclear NPS with regard to Air Quality:

130 The United Kingdom National Air Quality Strategy, March 1997 (Cm 3587)
131 ODPM 2005 *A practical guide to the Strategic Environmental Assessment Directive*

Table A8.1: Key Sustainability Objectives

Plan, Policy or Programme	Key Sustainability Objective
International	
Convention on Long Range transboundary Air Pollution (LRTAP) and LRTAP Convention Protocols	This includes developing policies and strategies to combat the discharge of air pollutants through exchanges of information, consultation, research and monitoring. Most European countries (including the UK), the United States, Canada and Russia have signed up to the Convention.
European	
Ambient Air Quality Directives	The **Air Quality Framework Directive (96/62/EC)** on ambient air quality assessment and management defines the policy framework for 12 air pollutants known to have a harmful effect on human health and the environment **Directive 1999/30/EC** (the 1st Daughter Directive) sets limit values (values not to be exceeded) for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter (dust) and lead in ambient air.
National Emission Ceilings Directive	The **National Emission Ceilings Directive** (NECD) sets ceilings for each Member State for emissions of ammonia, sulphur dioxide, oxides of nitrogen (NO_x) and volatile organic compounds (VOCs). These four pollutants are primarily responsible for acidification, eutrophication and ground-level ozone. The ceilings must be met by 2010.
Large Combustion Plant Directive	The LCPD aims to reduce acidification, ground level ozone and particles throughout Europe by controlling emissions of sulphur dioxide (SO_2) and nitrogen oxides (NO_x) and dust (particulate matter (PM)) from large combustion plants (LCPs) in power stations, petroleum refineries, steelworks and other industrial processes running on solid, liquid or gaseous fuel.
Integrated Pollution Prevention and Control Directive (IPPC)	Pollution Prevention and Control (PPC) is a regulatory regime for controlling pollution from certain industrial activities. From 6 April 2008 it has been incorporated into the framework of the Environmental Permitting Regulations (EPR).
National	
The Environment Act 1995	The Environment Act 1995 requires the UK Government and the devolved administrations for Scotland and Wales to produce a national air quality strategy containing standards,

Plan, Policy or Programme	Key Sustainability Objective
	Sets out objectives and measures for improving ambient air quality and to keep these policies under review. Sets out a way forward for work and planning on air quality issues sets out the air quality standards and objectives to be achieved Introduces a new policy framework for tackling fine particles.
Local authorities have statutory duties for local air quality management (LAQM) under the Environment Act 1995.	Local authorities are required to carry out regular reviews and assessments of air quality in their area against standards and objectives prescribed in regulations for the purpose of local air quality management. Where any of these objectives are not being achieved, authorities must designate air quality management areas and prepare and implement remedial action plans to tackle the problem.

A8.3. Scope of the Appraisal

A8.3.1. AoS Framework: As a result of scoping and ongoing consultation, the AoS framework for appraising the effects of the draft Nuclear NPS on identified the relevant AoS objectives as set out in following table:

Table A8.2: AoS Appraisal Framework for Air Quality

Sustainable Development Theme: Air Quality	
AoS Objectives[132]	**Guide Questions**
12. to avoid adverse impacts on air quality	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?
The effects associated with climate change are addressed through the sustainability objective for climate change and greenhouse gas emissions and reported in A1: Climate Change. Effects on health are reported in A5: Health and Well-Being and effects on biodiversity are reported in A3: Biodiversity	

A8.3.2. **Temporal and Spatial Boundaries**: The AoS followed the approach taken for the appraisal of the SSA criteria and reported in the Environmental Study[133] and

132 Numbers refer to objective numbers in the SEA Scoping Report and the Environmental Study
133 BERR July 2008 Environmental Study http://www.berr.gov.uk/files/file47137.pdf

update of the environmental study[134].Short and long term effects relate to activity phases of nuclear power stations as follows:

- Construction: short term 5-6 years
- Operation: long term, base case of 60 years (with possible extension subject to regulatory approval)
- Decommissioning: around 30 years

It is 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.

A8.3.3. The draft Nuclear NPS sets out the Government's policy on the national strategic issues and site specific issues and mitigations which need to be taken into account when granting consent for the construction of new nuclear power stations.

A8.3.4. **Consultation**: During the appraisal process, consultation and ongoing liaison were undertaken with the statutory consultees and regional/local authorities. The most relevant consultations in relation to this AoS topic were made with the following:

- Health and Safety Executive (HSE)/Nuclear Installations Inspectorate (NII) with responsibility for nuclear safety and security
- Environment Agency, whose responsibilities include regulating hazardous industries such as the nuclear power sector.

A8.4. The Current Situation and Likely Evolution without the Nuclear NPS

A8.4.1. The Scoping Report and the Environmental Study set out the baseline information; this was updated with key data in April-May 2009.

A8.4.2. Air quality in the UK has generally continued to improve since 1997 when the first Air Quality Strategy was adopted. Over the past ten years the air quality in the UK has improved and current objectives for all air pollutants are being met in over 99 per cent of the UK.

A8.4.3. The European Union Directive (96/62/EC) on Ambient Air Quality Assessment and Management (the Framework Directive) sets a framework under which limit values or target values for the concentrations of specified air pollutants in

134 January 2009 Applying the Strategic Siting Assessment Criteria: an update to the study of the potential environmental and sustainability effects http://www.berr.gov.uk/files/file49869.pdf

ambient air are set. The latest report,[135] based on a combination of air monitoring and modelling, under this Directive gives the following information regarding ambient air quality for the 43 air quality assessment zones in the UK:

- No UK zones exceed the sulphur dioxide (SO2) limit values;
- 41(8 measured and 33 modelled) of the 43 UK zones exceed the annual average nitrogen dioxide(NO2) limit value;
- 1 UK zone (measured) exceeds the current annual average PM10 (particles less than ten micrometres) limit value;
- Currently 41 UK zones (27 measured and 14 modelled) are set to exceed the indicative annual average PM10 limit value which must be achieved by 2010; and
- No UK zones exceed the lead, benzene or carbon monoxide (CO) limit values.

A8.4.4. Given that one of the dominant sources of sulphur dioxide pollution in the UK is power generation from the burning of fossil fuels, it can be assumed that the concentration of this gas in UK air might be expected to increase, or at least decrease less rapidly, without the Nuclear NPS, given that more electricity will be generated by fossil fuels.

A8.4.5. Whilst the largest source of nitrogen dioxide in the UK is traffic, there are contributions from fossil fuel burning and so efforts to reduce the concentration of this gas in UK air will be slowed without the adoption of the Nuclear NPS.

A8.4.6. Fossil fuel power generation also contributes to the concentration of PM10 in UK air. For the same reasons as above, non-adoption of the Nuclear NPS would not help to reduce this pollutant, therefore.

A8.5. The Likely Effects of the draft Nuclear NPS

A8.5.1. Given that nuclear power stations do not emit significant quantities of carbon dioxide, sulphur dioxide, nitrogen oxides or particulates when compared to fossil fuel generating stations, displacing oil, coal and gas fuelled electricity generation with nuclear power should improve overall UK air quality.

A8.5.2. In areas local to 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, use of cleaner fuels in vehicles and the adoption of sustainable traffic and travel management plans.

A8.5.3. Radioactive releases to air, which could have a detrimental effect on local and regional air quality (in the event of a significant release), are strictly controlled in

135 UK air quality modelling for annual reporting 2007 on ambient air quality assessment under Council Directives 96/62/EC, 1999/30/EC and 2000/69/EC, Defra et al, 2009

accordance with limits laid down in authorisations issued by the Nuclear Installations Inspectorate (NII), a division of the Health and Safety Executive and the Environment Agency. These agencies regulate radioactive discharges from nuclear power stations and have responsibilities for ensuring that workers, the general public and the environment are protected against exposure to radioactivity. Regulation of air (and other) discharges off or on nuclear sites is regulated under the Radioactive Substances Act 1993. This regulatory system should ensure that permitted radioactive discharges do not cause unacceptable deterioration in air quality.

A8.5.4. There is a risk of an accidental release of radioactive emissions associated with the construction of new nuclear power stations (as a result of the Nuclear NPS). However, the risk of such an accident is judged to be very small because of the strict regulatory regime in the UK. The Health and Safety Executive's (HSE) site licensing process will also ensure 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.

Table A8.3 Summary of Generic Effects and Possible Mitigation

Sustainable Development Theme: Air Quality	
Generic Effects	**Possible Mitigation**
Negative: • Construction - increase in air emissions associated with transport, including nitrogen dioxide; oxides of nitrogen; PM10; carbon monoxide; benzene; and 1,3-butadiene. • Operational- increase in air emissions associated with transport and operation of plant, delivery of goods to site and transfer of non-radioactive waste from site.	• Transport Management Plans to reduce and manage traffic impacts; Green Travel Plans to minimise vehicular travel to site. These should include: the use of non-road transport where possible; the phasing of development; and robust monitoring by operators at sites to track changes throughout the lifecycle of proposed operations. • Promote the use of carbon-efficient forms of transport and construction during the power station lifecycle. • Operational Environmental Management Plans to minimise emissions. • Support opportunities to offset emissions as appropriate. • Operational release of non-radioactive gases is regulated through EA licensing process. • Ensure that monitoring by operators

Sustainable Development Theme: Air Quality	
Generic Effects	**Possible Mitigation**
	accounts for the potential for cumulative impacts where the phasing between existing power stations and the new build overlaps
• As with other large construction projects, the generation of dust and sand from construction	• Construction Environmental Management Plans including measures to minimise emissions.
• Operational release of gaseous radioactive emissions (planned and accidental)	• Planned release and risk of unplanned release is controlled through the regulatory process (HSE and NII) and risk assessment undertaken for consenting processes.
• Interim storage of waste on site – potential for accidental release of radiation.	• Risk controlled through the regulatory process (HSE and NII) and risk assessment undertaken for consenting processes.

Radioactive and Hazardous waste management

A8.5.5. The Main AoS Report (Chapter 6) and Annex K give the findings of an appraisal of sustainability of the arrangements for managing radioactive and hazardous wastes arising from the Nuclear NPS. This appraisal has used the AoS framework to consider the following waste streams:

- Spent Fuel[136]
- Intermediate Level Waste (ILW)
- Low Level Waste (LLW)
- Gaseous and Liquid Radioactive Discharges
- Non Radioactive Hazardous Wastes

[136] In accordance with Government's view that in the absence of any proposals from industry new nuclear power stations should proceed on the basis that spent fuel will not be reprocessed, spent fuel is considered to be waste for the purposes of the appraisal

A8.5.6. 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 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 of. The findings of the appraisal in relation to the effects at new power station sites and due to transport of waste from these sites are summarised below.

A8.5.7. There is the potential for minor negative effects on local air quality associated with construction and decommissioning of interim storage facilities for spent fuel, ILW and possibly also LLW, due to non-radioactive emissions from construction plant and vehicles. Transport associated with the movement of spent fuel, ILW and LLW to disposal facilities may also have minor negative effects on air quality although these may be mitigated by the use of rail transport. Radioactive emissions associated with operational interim storage facilities will have a negligible effect and will be managed by engineered containment and compliance with regulations.

A8.6. Summary Effects of the Potentially Suitable Sites

A8.6.1. It should be noted that there are currently significant differences in the air quality around the potentially suitable sites, with the more isolated sites in sparsely populated areas, such as Wylfa, recording lower pollutant levels than those located near significant conurbations, such as Hartlepool. Effects need to be judged with this in mind, therefore.

Table A8.4: Summary of Potential Significant Strategic Effects on Air Quality

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Bradwell	-	-?	-?
Adverse effects have been identified for a significant urban and rural population to be affected by any significant accidental release of radioactive emissions from the Bradwell site. However, it is noted that there is a very low risk of such an event occurring. Prevention measures include existing risk assessment and regulatory			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
processes. The nuclear regulatory bodies will need to be satisfied that the radiological and other risks to the public associated with accidental releases of radioactive substances are as low as reasonably practicable and within the relevant radiological risk limit.			
Braystones	-	-?	-?
Adverse effects has been identified that the potential for transboundary effects from any accidental release of radioactive emissions from the Braystones site has a potentially strategic effect on sustainability. However, it is noted that there is a very low risk of such an event occurring. Prevention measures include existing risk assessment and regulatory processes. The nuclear regulatory bodies will need to be satisfied that the radiological and other risks to the public associated with accidental releases of radioactive substances are as low as reasonably practicable and within the relevant radiological risk limit.			
Hartlepool	-	-?	-?
Proximity to large conurbation. Adverse effects have identified the potential for a significant strategic negative impact on air quality from accidental releases of radioactive material. However, before granting a site licence, the nuclear regulatory bodies will need to be satisfied that the risks associated with accidental releases of radioactive material to the atmosphere are as low as reasonably practicable and within the relevant radiological risk limits.			
Heysham	-	-?	-?
Proximity to conurbation Adverse effects have been identified that the potential exists for a large population to be affected by any significant accidental release of radioactive emissions from the Heysham site, which has a potentially strategic effect on sustainability. However, it is noted that there is a very low risk of such an event occurring. Prevention measures include existing risk assessment and regulatory processes. The nuclear regulatory bodies will need to be satisfied that the radiological and other risks to the public associated with accidental releases of radioactive substances are as low as reasonably practicable and within the relevant radiological risk limit.			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Hinkley Point	-	-?	-?
Adverse effects have been identified that the potential exists for a significant urban and rural population to be affected by any significant accidental release of radioactive emissions from the Hinkley Point site. However, it is noted that there is a very low risk of such an event occurring. Prevention measures include existing risk assessment and regulatory processes. The nuclear regulatory bodies will need to be satisfied that the radiological and other risks to the public associated with accidental releases of radioactive substances are as low as reasonably practicable and within the relevant radiological risk limit.			
Kirksanton	-	-?	-?
Proximity to built-up areas Millom. Adverse effects have been identified that the potential for a large urban population to be affected by any accidental release of radioactive emissions from the Kirksanton site. This, combined with potential transboundary effects, has a potentially strategic effect on sustainability. However, it is noted that there is a very low risk of such an event occurring. Prevention measures include existing risk assessment and regulatory processes. The nuclear regulatory bodies will need to be satisfied that the radiological and other risks to the public associated with accidental releases of radioactive substances are as low as reasonably practicable and within the relevant radiological risk limit. However, there is unlikely to be any detrimental impact from air quality during the operation phase and impacts during construction and decommissioning are deemed to be slight.			
Oldbury	-	-?	-?
Adverse effects have been identified that the potential exists for a large population to be affected by any significant accidental release of radioactive emissions from the Oldbury site, which has a potentially strategic effect on sustainability. However, it is noted that there is a very low risk of such an event occurring. Prevention measures include existing risk assessment and regulatory processes. The nuclear regulatory bodies will need to be satisfied that the radiological and other risks to the public associated with accidental releases of radioactive substances are as low as reasonably practicable and within the relevant radiological risk limit.			
Sellafield	-	-?	-?

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Adverse effects have been identified that the potential for transboundary effects from any accidental release of radioactive emissions from the Sellafield site has a potentially strategic effect on sustainability. However, it is noted that there is a very low risk of such an event occurring. Prevention measures include existing risk assessment and regulatory processes. The nuclear regulatory bodies will need to be satisfied that the radiological and other risks to the public associated with accidental releases of radioactive substances are as low as reasonably practicable and within the relevant radiological risk limit.			
Sizewell	-	-?	-?
Adverse effects have been identified that the potential for a large number of people to be affected by any accidental release of radioactive emissions from the Sizewell site, combined with potential transboundary effects, has a potentially strategic effect on sustainability. It should be noted that the prevailing wind would tend to transport airborne contaminants' seaward over the North Sea and potentially beyond to northern continental Europe. However, it is noted that there is a very low risk of such an event occurring. Prevention measures include existing risk assessment and regulatory processes. The nuclear regulatory bodies will need to be satisfied that the radiological and other risks to the public associated with accidental releases of radioactive substances are as low as reasonably practicable and within the relevant radiological risk limit.			
Wylfa	-	-?	-?
Adverse effects have been identified that the potential exists for a significant urban and rural population to be affected by any significant accidental release of radioactive emissions from the Wylfa site which, combined with potential transboundary effects, has a potentially strategic effect on sustainability. However, it is noted that there is a very low risk of such an event occurring. Prevention measures include existing risk assessment and regulatory processes. The nuclear regulatory bodies will need to be satisfied that the radiological and other risks to the public associated with accidental releases of radioactive substances are as low as reasonably practicable and within the relevant radiological risk limit.			

Key: Significance of potential strategic effect at each development stage

++	Development actively encouraged as it 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 "?".

A8.7. Interactions and Cumulative Effects

A8.7.1. A number of potentially negative impacts have been identified relating to air quality. However, these tend to be local and site specific in character.

A8.7.2. The following table identifies the potential cumulative effects resulting from the NPS. The first column considers cumulative effects at a national scale and the second column considers effects at a regional scale. The third column considers the potential effects in-combination with those effects caused by other plans.

Table A8.5: Cumulative Effects on Air Quality of the NPS and in-combination with other plans

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
Given that nuclear power stations do not emit significant quantities of carbon dioxide, sulphur dioxide, nitrogen oxides or particulates when compared to fossil fuel generating stations, displacing oil, coal and gas fuelled electricity generation with nuclear power should improve overall UK air quality.	North-west: potential for sub-regional and regional air quality effects associated with increased traffic during the construction and operational phases due to cluster of proposed nuclear power stations. South-west: potential for sub-regional and regional air quality effects associated with increased traffic during the construction and operational phases due to proximity of two proposed power stations. Radioactive releases to air, which could have a detrimental effect on regional air quality are strictly controlled by the environmental regulators and this system should ensure that these discharges do not cause unacceptable deterioration in air quality. There is a risk of an	

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
	accidental release of radioactive emissions leading to air pollution. However, the risk of such an accident is judged to be very small because of the strict regulatory regime in place in the UK.	

A8.8. Summary and Conclusions/Recommendations

A8.8.1. 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 displacing oil, coal and gas fuelled electricity generation with nuclear power.

A8.8.2. 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.

A8.8.3. 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.

Appendix A9: Soils, Geology and Land Use

A9.1. Introduction

A9.1.1. 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 (for example coastal cliffs), archaeology, and ecology (for example cave habitats for bats).

A9.1.2. The SEA Directive requires that information to be provided in the Environmental Report includes "*the likely significant effects on the environment, including on issues such as…soil... material assets…and the inter-relationship between the above factors.*" (Annex I (f)) and the Government's guidance on undertaking SA incorporating SEA[137] provides further information.

A9.1.3. 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 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 impact coastal geomorphological processes including erosion / deposition and sediment transport processes;
- New power station and associated infrastructure development will impact 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;

137 ODPM 2005 *A practical guide to the Strategic Environmental Assessment Directive*

- Problems associated with land restoration, including reinstatement of previous soil conditions, loss of organic matter, erosion, changes to nutrient status, pH, and homogenization;
- Development may result in soil loss or burial, physical damage including compaction and structural damage, changes to soil water regime, effects on soil biota, soil stripping and storage, loss of paleosols (refers to a former soil preserved by burial underneath either sediment or volcanic deposits[138]).

A9.1.4 Various waste streams will be generated by the construction, operation and decommissioning of power stations that may affect soils, geology and land use.

A9.1.5 The management of non-radioactive, non-hazardous waste is considered in Section A4 of Appendix 1: Communities: supporting infrastructure. The sustainability implications of the management of radioactive and hazardous waste are considered in Section 6 of the Main AoS report and in the appropriate sections of Appendix 1.

A9.2. Policy Context

A9. 2.1. Appendix A in the Scoping Report (March 2008) sets out the review of relevant plans, programmes and environmental objectives for the appraisal of the Nuclear NPS. This was updated during April-May 2009 to take account of key policy and sustainability objectives that may have been established since the earlier scoping.

A9. 2.2. It should be noted that soils occupy a somewhat unique position in earth heritage environmental assessment because they are not explicitly covered by any of the existing designated area legislations in Britain. These designations are often used as the basis for assessing threats to biological, geological and geomorphological interests. The position of soils at the interface between the geosphere, biosphere and hydrosphere means that they are an integral part of the environmental assessment process where changes to soils can have subsequent effects on other parts of ecosystems, such as vegetation composition and water courses.

A9. 2.3. The following table, A9.1, sets out the key objectives for sustainability that need to be taken in to account for appraising the effects of the Nuclear NPS with regard to soils, geology and land use and reflecting the updated policy review, referred to above.

138 Access Science: Definition of Paleosol http://www.accessscience.com/abstract.aspx?id=484200&referURL=http%3a%2f%2fwww.accessscience.com%2fcontent.aspx%3fid%3d484200

Table A9.1: Key Sustainability Objectives

Plan, Policy or Programme	Key Sustainability Objective
International	
European Commission (EC) Towards a Thematic Strategy for Soil Protection, April 2002 (COM (2002) 179).	• To prevent further soil degradation and preserve its functions. • To restore degraded soils to a level of functionality consistent at least with current and intended use, whilst also considering the cost implications of the restoration of soil.
European Union (EU) Proposals for Soil Framework Directive, 2007.	• To prevent further soil degradation and preserving its functions. • To restore degraded soils to a level of functionality consistent at least with current and intended use, whilst also considering the cost implications of the restoration of soil.
Landfill Directive, Council Directive 1999/31/EC (1999).	• EU Landfill legislation.
Waste Framework Directive (2008).	• EU Waste legislation.
Directive on Hazardous Waste (91/689/EEC).	• EU Hazardous Waste legislation.
National	
Draft Soils Strategy for England, 2001.	• To identify emerging priorities for soil protection on maintaining soil carbon and the recycling of organic wastes to land.
Soil Action Plan for England: 2004 – 2006, Defra.	• Preserving soil functions. • Management framework for soils. • To identify emerging priorities for soil protection. • Maintaining soil carbon • Recycling of organic wastes to land
Part 2A of the Environmental Protection Act 1990.	• Guidance on contaminated land.
Contaminated land (England) Regulations 2000.	• Guidance on contaminated land.
Integrated Pollution Prevention and Control Directive.	• Guidance on pollution prevention and control.

Plan, Policy or Programme	Key Sustainability Objective
The Landfill Regulations (England and Wales) 2002.	• England and Wales landfill legislation.
Hazardous Waste (England and Wales) Regulation (2005).	• England and Wales hazardous waste legislation.
PPG7 The Countryside.	• Includes guidance on planning issues which may have possible impact on land use and soils.
Regional Important Geological and Geomorphological Sites.	• Lists of protected sites of regionally important geological and geomorphological interest.
Relevant Shoreline Management Plans	• Shoreline management and coastal defenses.
Mineral Planning Guidance	• Mineral planning guidance for mineral extraction proposals.

A9.3. Scope of the Appraisal

A9. 3.1. AoS Framework: As a result of scoping and ongoing consultation, the AoS framework for appraising the effects of the draft Nuclear NPS on soils, geology and land use identified the relevant AoS objectives as set out in following table:

Table A9.2: AoS Appraisal Framework for Soils, Geology and Land Use

Sustainable Development Theme: Soils, Geology and Land use	
AoS Objectives[139]	**Guide Questions**
19. To avoid damage to geological resources. 20. To avoid the use of greenfield land and encourage the re-use of brown-field sites. 21. To avoid the contamination of soils and adverse impacts on soil functions.	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?

139 Numbers refer to objective numbers in the SEA Scoping Report and the Environmental Study

Sustainable Development Theme: Soils, Geology and Land use	
AoS Objectives[139]	**Guide Questions**
	Will it adversely affect land under land management agreements?
Effects on minerals and wastes infrastructure are addressed and reported in A4 Communities: supporting infrastructure. Issues associated with other use of the land and the potential for planning blight are dealt with and reported in A3 Communities: population, employment, and viability. Issues associated with radioactive and hazardous waste are cross-cutting and delt with in the Main AoS report.	

A9. 3.2. **Temporal and Spatial Boundaries**: The AoS followed the approach taken for the appraisal of the SSA criteria and reported in the Environmental Study140 and update of the Environmental Study[141].Short and long term effects relate to activity phases of nuclear power stations as follows:

- Construction: short term 5-6 years
- Operation: long term, base case of 60 years (with possible extension subject to regulatory approval)
- Decommissioning: around 30 years

It is 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.

A9. 3.3. The draft Nuclear NPS sets out the Government's policy on the national strategic issues and site specific issues and mitigations which need to be taken into account when granting consent for the construction of new nuclear power stations.

A9. 3.4. Consultation: During the appraisal process, consultation and ongoing liaison were undertaken with the statutory consultees and regional/local authorities. The most relevant consultations in relation to this AoS topic were made with the following:

- Defra with overall responsibility for securing a healthy environment

140 BERR July 2008 Environmental Study http://www.berr.gov.uk/files/file47137.pdf
141 BERR January 2009 Applying the Strategic Siting Assessment Criteria: an update to the study of the potential environmental and sustainability effects http://www.berr.gov.uk/files/file49869.pdf

A9.4. The Current Situation and Likely Evolution without the Nuclear NPS

A9.4.1. The Scoping Report and the Environmental Study set out the baseline information; this was updated with key data in April-May 2009. A range of baseline data was collated for each NPS site, the information collected included:

- Agricultural land classification
- Soil type
- RIGGS (Geological SSSIs)
- Potential Environmental Hazards
- Historical land use based on historical map information.

Table A9.3 AoS Appraisal Framework for Soils, Geology and Land Use

Sustainable Development Theme: Soils, Geology, Land Use	
Generic Effects	**Possible Mitigation**
Negative: • Localised loss of soil and geological / mineral resources, loss of soil structure, and indirect effects on biodiversity.	• EMP (Environmental Management Plans) incorporating Soil Management Plans to minimise loss of soils and geological / mineral resources.
• Soil loss or burial, damage to paleosols, problems associated with reinstatement of previous soil conditions.	• EMP (Environmental Management Plans) incorporating Soil Management Plans to minimise effects on soil structure during construction, operation and decommissioning.
• Physical damage of soil including topsoil stripping and storage, impacts on soil structure, compaction of soil, changes to soil water regime and drainage characteristics. • Removal or alteration of parent material.	• EMP (Environmental Management Plans) incorporating Soil Management Plans to minimise effects on soil structure during construction, operation and decommissioning.
• Impacts relating to changes in chemistry, effects on soil pH, effects on soil biota, oxidation of organic matter, changes to horizons, effects on biodiversity, effects on homogenization and loss of discrete horizons.	• EMP (Environmental Management Plans) incorporating Soil management plans to minimise effects on soil structure during construction, operation and decommissioning.
• Soil Erosion, loss of organic matter and increased runoff, from plant and from access roads and transmission	• EMP (Environmental Management Plans) incorporating Soil management plans to minimise effects on soil

Sustainable Development Theme: Soils, Geology, Land Use	
Generic Effects	**Possible Mitigation**
infrastructure.	structure during construction, operation and decommissioning.
• Contamination of soils associated with the release of radioactive substances and other hazardous materials. This may remain after the decommissioning stage.	• Remediation of contaminated land-remediation and restoration plans • Restoration and aftercare plans
• Loss of high quality agricultural soils.	• Site layout and location to avoid loss of good quality agricultural land.
• Development of NPS and associated infrastructure will result in loss of intertidal land use and their associated habitats.	• Impact on surrounding land uses to be considered in EIA, and site specific mitigation put in place. May include acquisition of affected land.
• May lead to blight, and will lead to loss of land for other uses.	• Impact on surrounding land uses to be considered in EIA, and site specific mitigation put in place. May include acquisition of affected land.

A9.5. The Likely Effects of the draft Nuclear NPS

A9.5.1. None of the proposed NPS sites are located on or adjacent to a site of regional geological or geomorphological importance. Sellafield had a mineral abstraction site present locally (Florence Iron Ore Mine, Egrement). None of the other NPS sites recorded nearby mineral abstraction sites.

A9.5.2. Many of the sites are located in areas not used for agriculture or on agricultural land which is not of high value (typically Grade 3-4).

A9.5.3. Development of the NPS sites at Sizewell and Wylfa may have significant impacts on the peat superficial deposits which may in turn affect the ground water regime which maintains important terrestrial marsh habitats at both sites.

A9.5.4. Nearby landfill sites were reported at Sellafield, Sizewell, Heysham, Oldbury and Hinkley Point.

A9.5.5. Potentially contaminated land adjacent to the potentially suitable sites has been reported at Sellafield, Hartlepool and Heysham.

A9.5.6. A moderate risk relating to the presence of compressible ground stability hazards has been recorded at Sellafield, Sizewell (low to high risk), Bradwell,

Braystones, Heysham (very low to moderate), Hartlepool (very low to moderate), Kirksanton and Oldbury.

A9.5.7. A moderate risk relating to the presence of running sand ground stability hazards has been reported at Bradwell, Heysham (very low-moderate), Hartlepool (very low to moderate) and Oldbury.

A9.5.8. A low to moderate risk relating to the presence of shrinking or swelling clay ground stability hazard was reported for Bradwell.

Radioactive and Hazardous waste management

A9.5.9. The Main AoS Report (Chapter 6) and Annex K give the findings of an appraisal of sustainability of the arrangements for managing radioactive and hazardous wastes arising from the Nuclear NPS. This appraisal has used the AoS framework to consider the following waste streams:

- Spent Fuel[142]
- Intermediate Level Waste (ILW)
- Low Level Waste (LLW)
- Gaseous and Liquid Radioactive Discharges
- Non Radioactive Hazardous Wastes

A9.5.10. 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 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 of. The findings of the appraisal in relation to the effects at new power station sites and due to transport of waste from these sites are summarised below.

A9.5.11. Interim storage facilities will be required at new nuclear power station sites for spent fuel, ILW and possibly also for LLW. The impact on soils, land use and geology will be dependent on the interim storage option chosen and on local conditions at the site but it is possible that minor negative effects on soil structure and geology may arise within the footprint of the store. Contamination of soil adjacent to the interim store should not arise provided that the facility is constructed and operated in accordance with best practice. No significant effects on soils, geology or land use are expected from the management of gaseous and liquid hazardous discharges or the management of non-radioactive hazardous waste.

142 In accordance with Government's view that in the absence of any proposals from industry new nuclear power stations should proceed on the basis that spent fuel will not be reprocessed, spent fuel is considered to be waste for the purposes of the appraisal.

A9.6. Summary Effects of the Potentially Suitable Sites

A9.6.1. As with any major infrastructure project, there can be positive and negative effects at each stage of development. The relative significance of these effects depends on the characteristics and scale of the receiving communities. The sustainability of each site was appraised and the findings are set out in the individual site AoS Reports (Annexes A –J). These appraisals identified strategically significant effects and locally significant effects. These effects are set out in Table A9.4 below.

Table A9.4: Summary of Potential Significant Strategic Effects on Soils, Geology and Land Use

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Bradwell	-?	-?	-?
Potential sustainability issues, mitigation and / or negotiation. The AoS has identified potential, adverse, indirect effects on soils that are important for biodiversity sites. However, there is potential for mitigation through careful planning of construction and operational facilities.			
Braystones	-	-?	-
Potential sustainability issues, mitigation and / or negotiation. The AoS has identified potential, indirect, adverse effects on soils that may support terrestrial habitats. However, there is the potential for mitigation through careful planning of construction and operational facilities.			
Hartlepool	-?	-?	-?
Potential sustainability issues, mitigation and / or negotiation. The AoS has identified potential, adverse, indirect effects on soils that are important for biodiversity sites. However, there is potential for mitigation through careful planning of construction and operational facilities. Any development will also need to address the contamination issue to prevent the pollution of controlled waters.			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Heysham	-?	-?	-?
Potential sustainability issues, mitigation and / or negotiation. The AoS has identified potential, adverse, indirect effects on soils that are important for biodiversity sites. However, there is potential for mitigation through careful planning of construction and operational facilities.			
Hinkley Point	-?	-?	-?
Potential sustainability issues, mitigation and / or negotiation. The AoS has identified potential, adverse, indirect effects on soils that are important for biodiversity			
Kirksanton	-?	-?	-?
Potential sustainability issues, mitigation and / or negotiation. The AoS has identified potential indirect, adverse effect on soils that may support terrestrial habitats. However, there is the potential for mitigation through careful planning of construction and operational facilities.			
Oldbury	-	-?	-?
Potential sustainability issues, mitigation and / or negotiation. The AoS has identified potential, adverse, indirect effects on soils that are important for biodiversity sites. However, there is potential for mitigation through careful planning of construction and operational facilities.			
Sellafield	-	-?	-
Potential sustainability issues, mitigation and / or negotiation. The AoS has identified potential indirect, adverse effect on soils that may support terrestrial habitats. However, there is the potential for mitigation through careful planning of construction and operational facilities.			
Sizewell	-	-?	-?
Potential sustainability issues, mitigation and / or negotiation. There is potential for adverse effects on soil structure which are likely to impact upon groundwater and future potential land use. Such effects can be mitigated by minimising the development's footprint and adopting soil and water management best practice during construction.			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Wylfa	-?	-?	-?
Potential sustainability issues, mitigation and / or negotiation. The AoS has identified potential, adverse, indirect effects on soils that are important for biodiversity sites. However, there is potential for mitigation through careful planning of construction and operational facilities.			

Key: Significance of potential strategic effect at each development stage	
++	Development actively encouraged as it 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 "?".

A9.7. Cumulative Effects and Interactions

A9.7.1. The following table, A9.5, identifies the potential cumulative effects resulting from the NPS. The first column considers cumulative effects at a national scale and the second column considers effects at a regional scale. The third column considers the potential effects in-combination with those effects caused by other plans.

Table A9.5: Cumulative Effects on Soils, Geology and Land Use of the NPS and in-combination with other plans

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
Soils, Geology and Land use		
		South-West: In relation to Oldbury and Hinkley Point NPS sites other major schemes proposed in the Severn Estuary will likely result in significant in-combination effects, including the Severn Tidal Power Schemes and the Bristol Deep Sea Container Terminal. The in-combination effects require more detailed assessment, at present it is not understood whether the proposed Severn Barrage tidal power schemes (5 schemes considered) would have a detrimental impact on coastal erosion at the site. It is possible that some schemes may result in reduced coastal erosion due to some of the schemes resulting in impounding of the estuary restricting transfer of energy built up over long distances to the coastline at the site, and preventing tidal currents and flooding by storm surge reaching the site. However, all proposed schemes need to be looked at more closely within the EIA process to determine if in-combination effects are likely.

A9.8. Summary and Conclusions

A9.8.1. A number of potentially negative sustainability issues have been identified relating to impacts on soils, geology and land use. These tend to be site specific in character. It is important to note that impacts to soils also may directly impact the soil water regime which in turn may impact various terrestrial habitats. It is recognized 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.

Appendix 10: Water Quality and Resources

A10.1 Introduction

A10.1.1. The water environment includes consideration of environmental protection (both related to public health and the natural environment) and the sustainable use of natural resources. All aspects of water are inter-related including:

- Quality and hydrology of surface water: watercourses (rivers, canals), lakes, wetlands
- Quality and hydrology of groundwater
- Quality of estuarine and coastal waters
- Marine, freshwater and terrestrial ecology
- Water supplies for drinking water, agriculture and industry
- Wastewater treatment and sewerage
- Use of waters for recreation and amenity
- Use of waters for navigation and transport
- Land drainage and flood risk management (fluvial and coastal) (refer to Section A11 of Appendix 1)

A10.1.2. The SEA Directive requires that information to be provided in the Environmental Report includes "*the likely significant effects on the environment, including on issues such as ...water…climatic factors, material assets...and the inter-relationship between the above factors.*" (Annex I (f)) and the Government's guidance on undertaking SA incorporating SEA[143] provides further information.

A10.1.3. The factors affecting water that are relevant for the Nuclear NPS depend on the type, scale, detailed design and locational characteristics of the proposed new nuclear power stations. As well as these site specific issues, there are certain common implications for water for the Nuclear NPS as follows:

- Influences from cooling water abstraction and discharge
- Impacts on capacity to meet future water demand
- Impacts on local groundwater bodies
- Coastal flood defences (refer to Section A11 of Appendix 1)

A10.2 Policy Context

A10.2.1. Appendix A in the Scoping Report (March 2008) sets out the review of relevant plans, programmes and environmental objectives for the appraisal of the Nuclear NPS. This was updated during April-May 2009 to take account of key policy and sustainability objectives that may have been established since the earlier scoping.

143 ODPM 2005 *A practical guide to the Strategic Environmental Assessment Directive*

A10.2.2. The following table ,A10.1, sets out the key objectives for sustainability that need to be taken in to account for appraising the effects of the Nuclear NPS with regard to Water Quality and Resources and reflecting the updated policy review, referred to above.

Table A10.1: Key Sustainability Objectives

Plan, Policy or Programme	Key Sustainability Objective
International	
EU Water Framework Directive (2000)	to enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands, which depend on the aquatic ecosystems to promote the sustainable use of water to reduce pollution of water to ensure progressive reduction of groundwater pollution
EU Bathing Water Directive (2006)	to attain, on the basis of common standards, good bathing water quality and a high level of protection
EU Drinking Water Directive (1995)	to protect the health of consumers and to make sure water is wholesome and clean
EU Groundwater Directive (2006; to be repealed 2013)	to ensure underground water quality complies with good chemical status criteria
EU IPPC (Integrated Pollution Prevention and Control) Directive (2008)	to minimise pollution from industrial sources; including emissions to air, land and water
EU Climate Change Strategy – Adapting to climate change: towards a European framework for action (White Paper 2009)	to establish a framework to reduce the EU's vulnerability to the impact of climate change, including dealing with significant changes to the quality and availability of water resources
National	
UK Water Strategy *Future Water* (2008)	to improve the quality of our water environment and the ecology which it supports to sustainably manage risks from flooding and coastal erosion, to ensure a sustainable use of water resources to implement fair, affordable and cost-reflective water charges to cut greenhouse gas emissions

Plan, Policy or Programme	Key Sustainability Objective
	to embed continuous adaptation to climate change
UK Draft Floods and Water Bill (2009)	to deliver improved security, service and sustainability for people and communities to make clear who is responsible for managing all sources of flood risk to protect essential water supplies by enabling water companies to control more non-essential uses of water during droughts to encourage more sustainable forms of drainage in new developments
Environment Agency: Making space for water programme (2004 onwards)	to establish an holistic approach to managing flood and coastal erosion risk to achieve sustainable development to increase resilience to flooding
Environment Agency: Water for people and the environment strategy (2009)	to manage water resources over the coming decades so that water can be abstracted and used in a sustainable way

A10.3 Scope of the Appraisal

A10.3.1. **AoS Framework:** As a result of scoping and ongoing consultation, the AoS framework for appraising the effects of the draft Nuclear NPS on water quality and resources identified the relevant AoS objectives as set out in following table:

Table A10.2 AoS Appraisal Framework for Water Quality and Resources

Sustainable Development Theme: Water Quality and Resources	
AoS Objectives[144]	**Guide Questions**
15. to avoid adverse impacts on surface water hydrology and channel geomorphology (including coastal geomorphology)	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?
16. to avoid adverse impacts on surface water quality (including coastal and marine water quality) and assist achievement of Water Framework Directive objectives	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?
17. to avoid adverse impacts on the supply of water resources	Will it adversely affect water supply as a result of abstraction? Will it increase demand for water?[145]
18. to avoid adverse impacts on groundwater quality, distribution and flow and assist achievement of Water Framework Directive objectives	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?

144 Numbers refer to objective numbers in the SEA Scoping Report and the Environmental Study
145 Guide question added as a result of scoping

Sustainable Development Theme: Water Quality and Resources	
AoS Objectives[144]	**Guide Questions**
The effects on water ecology and wetlands are addressed by sustainability objectives 1, 2, and 3 and reported in Section A2 of Appendix 1. Flood risk is dealt with separately using sustainability objective 11 and reported separately in Section A11 of Appendix 1.	

A10.3.2. **Temporal and Spatial Boundaries:** The AoS followed the approach taken for the appraisal of the SSA criteria and reported in the Environmental Study[146] and update of the Environmental Study[147]. Short and long term effects relate to activity phases of nuclear power stations as follows:

- Construction: short term 5-6 years
- Operation: long term, base case of 60 years (with possible extension subject to regulatory approval)
- Decommissioning: around 30 years

It is 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.

A10.3.3. The draft Nuclear NPS sets out the Government's policy on the national strategic issues and site specific issues and mitigations which need to be taken into account when granting consent for the construction of new nuclear power stations.

A10.3.4. **Consultation**: During the appraisal process, consultation and ongoing liaison were undertaken with the statutory consultees and regional/local authorities. The most relevant consultations in relation to this AoS topic were made with the following:

- Defra with overall responsibility for securing a healthy environment
- Environment Agency , responsible for protecting the water environment

146 BERR July 2008 Environmental Study http://www.berr.gov.uk/files/file47137.pdf
147 BERR January 2009 Applying the Strategic Siting Assessment Criteria: an update to the study of the potential environmental and sustainability effects http://www.berr.gov.uk/files/file49869.pdf

A10.4 The Current Situation and Likely Evolution without the Nuclear NPS

A10.4.1. The Scoping Report and the Environmental Study set out the baseline information for water quality and resources; this was updated with key data in April-May 2009.

A10.4.2. In general, surface water quality is expected to increase to or remain unchanged at good ecological status. Groundwater quality is in general predicted to remain unchanged. These trends fit in with the Environment Agency's target for all water bodies to achieve good ecological status by 2027.

A10.4.3. Individual household demand for water is set to decrease due to increased metering and introduction of water efficiency measures. Similarly, individual non-household (largely industrial) consumption shows a trend of either decreasing or remaining steady. Total industrial consumption is decreasing significantly due to the national trend of reduction in heavy industries with a large demand for water.

A10.4.4. Although individual household demand is set to decrease, increases in population will put cumulative pressures on demand for water and on waters and estuaries into which effluent is discharged. New housing and economic growth will lead to particular pressures in both the North West and South East of England.

A10.4.5. The increase in population coupled with the effects of climate change (including longer drier periods) will increase pressure on water resources and there is an emerging trend for areas to be classified with "Area of Water Scarcity" status.

A10.4.6. With no interventions, most water companies will have supply deficits which will increase through to 2035. However, all water companies have plans in place to address these deficits through measures to improve water efficiency, leakage detection, the development of new sources and the upgrade of existing sources.

A10.5 The Likely Effects of the draft Nuclear NPS

A10.5.1. Table A10.1 below summarises the likely effects of the draft nuclear NPS on water quality and resources.

Table A10.3: Likely effects of the draft NPS and possible mitigation options

Sustainable Development Theme: Water Quality and Resources	
Generic Effects	**Possible Mitigation**
Negative: • Direct effects on hydrodynamics and sediment transport through need for new coastal defences and marine facilities. May disturb estuarine geomorphological processes including erosion, deposition and sediment transport processes.	• Design and location of any coastal flood defence or marine facilities.
• Cooling water requires abstraction and discharge potential effects on coastal processes, hydrodynamics and sediment transport. • Indirect effects on biodiversity, including on nationally and internationally designated habitats • Thermal impacts of cooling water discharges, with indirect effect on aquatic biodiversity.	• Water abstraction and discharge subject to Environment Agency consent. • Direct requirements for the efficiency of water use and the protection of water quality. This may include requiring that management measures relating to supply and discharge are in place prior to the implementation of the site proposals, and that decisions relating to best available technology (BAT) take specific account of the sensitivities of the individual receiving environments. • Require suitable design, including use of Sustainable Drainage Systems (SUDs). • Direct the selection of appropriate construction methods
• Construction activities may disturb and mobilise any contaminated soil in the site, which could subsequently pollute watercourses and groundwater. • A site may have to be drained or de-watered for construction. Dewatering and site drainage may result in lowering of the water table with potential indirect effects on downstream flood storage, subsidence and the distribution and flow of groundwater.	• Require studies to ensure that local groundwater bodies are investigated and suitable design is adopted to avoid or mitigate potential impacts. • The abstraction of water will require a licence under the Water Resources Act 1991.

Sustainable Development Theme: Water Quality and Resources	
Generic Effects	**Possible Mitigation**
• Increased demand for water, particularly during construction phase can have adverse effects on water resources, particularly in drier parts of the UK, for example East of England, South East.	• Direct requirements for the efficiency of water use

Radioactive and Hazardous waste management

A10.5.2. The The Main AoS Report (Chapter 6) and Annex K give the findings of an appraisal of sustainability of the arrangements for managing radioactive and hazardous wastes arising from the Nuclear NPS. This appraisal has used the AoS framework to consider the following waste streams:

- Spent Fuel[148]
- Intermediate Level Waste (ILW)
- Low Level Waste (LLW)
- Gaseous and Liquid Radioactive Discharges
- Non Radioactive Hazardous Wastes

A10.5.3. 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 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 of. The findings of the appraisal in relation to the effects at new power station sites and due to transport of waste from these sites are summarised below.

A10.5.4. Minor adverse effects may arise due to contamination of surface and groundwater with non-radioactive run-off during construction of interim storage facilities for spent fuel, ILW and possibly also LLW. Potential damage to interim storage facilities may occur in the event of flooding of power stations sites, leading to deterioration in the condition of the storage canisters/packaging containing waste leading to possible risk of contamination of surface or ground waters. The mitigation of this risk includes the provision of suitable flood protection measures which are also referred to in Section A11 of Appendix 1.

148 In accordance with Government's view that in the absence of any proposals from industry new nuclear power stations should proceed on the basis that spent fuel will not be reprocessed, spent fuel is considered to be waste for the purposes of the appraisal

A10.5.5. An increase in the number of nuclear facilities' emission authorisations has the potential to result in a greater number of releases of radiation emissions into surface and groundwater sources across the country. The limits for these discharges are determined, authorised and regulated by the Environment Agency and are limited by the impact they may pose to the local environment, taking account of any interactions between discharges. Hence, no significant effects are expected on water quality or resources from controlled radioactive discharges because of the safeguards provided by the regulatory regime.

A10.6 Summary Effects of the Potentially Suitable Sites

A10.6.1. As with any major infrastructure project, there can be positive and negative effects at each stage of development. The relative significance of these effects depends on the location of the site, its proximity to water bodies and the existing water surplus/deficit status within the region. The sustainability of each site was appraised and the findings are set out in the individual site AoS Reports (Annexes A –J). These appraisals identified strategically significant effects (associated with factors of regional, national or international importance) and locally significant effects (associated with factors of local or area importance). These effects are set out in Table A10.4 below.

Table A10.4: Summary of Potential Significant Strategic Effects on Water Quality and Resources

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Bradwell	-	-	-?
Minor negative impacts of cooling water abstraction and discharge on water quality and capacity to meet water demand at regional scale. Potential minor negative impacts on local groundwater bodies. Adverse effects on water resources, including groundwater resources, could occur through increased demand, particularly during construction. Indirect effects on nationally and internationally designated habitats, including from the thermal impact of cooling water discharges have also been identified. This is of potential wider significance because of indirect effects on national and European designated habitat sites.			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Braystones	-	-	-
Minor negative impacts of cooling water abstraction and discharge on water quality and capacity to meet water demand at regional scale. Adverse effects have been identified effects on water. Direct effects on water resources could be brought about through increased demand, particularly during construction. Indirect effects, of potentially wider significance, on nationally and internationally designated habitats, including from the thermal impacts of cooling water discharges, have also been identified. Any new engineering works at the coastline will interfere with the stability of the coastline and the sediment transport regime and could cause accelerated erosion at the sites, cause erosion up or down drift of the site and possibly impact on the marine protected areas.			
Hartlepool	-	-	-?
Minor negative impacts of cooling water abstraction and discharge on water quality and capacity to meet water demand at regional scale. Adverse effects on water on coastal processes, hydrodynamics and sediment transport, principally as a result of new coastal defence works that may be required. Indirect effects on nationally and internationally designated habitats, including from the thermal impact of cooling water discharges have also been identified. This is reflected in the assessment of effects on biodiversity. There may also be adverse effects on water resources, including groundwater resources, which could occur through increased demand, particularly during construction.			
Heysham	-	-	-
Minor negative impacts of cooling water abstraction and discharge on water quality and capacity to meet water demand at regional scale. Potential minor negative impacts on local groundwater bodies. Potential, adverse, indirect effects on water have been identified. Direct effects on water resources could be brought about through increased demand, particularly during construction. Indirect effects on nationally and internationally designated habitats, including from the thermal impact of cooling water discharges, have also been identified. This is of potential wider significance because of indirect effects on national and European designated habitat sites, for example. In addition, there are			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
potential cumulative effects with existing discharges from Sellafield and Heysham sites and with other new sites.			
Hinkley Point	-	-	-
Minor negative impacts of cooling water abstraction and discharge on water quality and capacity to meet water demand at regional scale. Potential, adverse, effects on water including on coastal processes, hydrodynamics and sediment transport has been identified. Adverse effects on water resources, including groundwater resources, could occur through increased demand, particularly during construction. Indirect effects on nationally and internationally designated habitats, including from the thermal impact of cooling water discharges have also been identified. This is of potential wider significance because of indirect effects on national and European designated habitat sites.			
Kirksanton	-	-	-
Minor negative impacts of cooling water abstraction and discharge on water quality and capacity to meet water demand at regional scale. Potential minor negative impacts on local groundwater bodies. Adverse effects have identified potential adverse effects on water quality and coastal processes, including sediment transport. Direct effects on water resources, including groundwater resources, could be brought about through increased demand, particularly during construction. Indirect effects, of potentially wider significance, on nationally and internationally designated habitats, including from the thermal impacts of cooling water discharges on water quality, have also been identified.			
Oldbury	-	-	-
Minor negative impacts of cooling water abstraction and discharge on water quality and capacity to meet water demand at regional scale. Potential minor negative impacts on local groundwater bodies. Potentially adverse and indirect effects on water have been identified. Direct effects on water resources could be brought about through increased demand, particularly during construction. Indirect effects on nationally and internationally designated habitats, including the thermal impact of cooling water discharges have also been identified. This is of potential wider significance because of indirect effects on			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
national and European designated habitat sites.			
Sellafield	-	-	-
Minor negative impacts of cooling water abstraction and discharge on water quality and capacity to meet water demand at regional scale Potentially adverse and indirect effects on water have been identified. Direct effects on water resources could be brought about through increased demand, particularly during construction. Indirect effects, of potentially wider significance, on nationally and internationally designated habitats, including from the thermal impacts of cooling water discharges, have also been identified. Any new engineering works at the coastline will interfere with the stability of the coastline and the sediment transport regime and could cause accelerated erosion at the sites, cause erosion up or down drift of the site and possibly impact on the marine protected areas.			
Sizewell	-	-	-
Minor negative impacts of cooling water abstraction and discharge on water quality and capacity to meet water demand at regional scale. Potential minor negative impacts on local groundwater bodies. Adverse direct and indirect effects on water have been identified. Direct effects, particularly during construction, on water resources, through increased demand, and on groundwater quality, through accidental discharges are considered significant possibilities. Indirect effects on nationally and internationally designated habitats, including from the thermal impact of cooling water discharges have also been identified. This is of potential wider significance because of indirect effects on national and European designated habitat sites.			
Wylfa	-	-	-
Minor negative impacts of cooling water abstraction and discharge on water quality and capacity to meet water demand at regional scale. Potential minor negative impacts on local groundwater bodies. Adverse direct and indirect effects on water have been identified. Direct effects on water resources, including groundwater resources could be brought about through increased demand, particularly during construction. Indirect effects on nationally and internationally designated habitats, including from the thermal impact of cooling			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
water discharges, have also been identified. This is of potential wider significance because of indirect effects on national and European designated habitat sites. In addition, any marine loading facilities that might be required will interfere with the stability of the coastline and, therefore, there is the need for the carefully consideration of the impacts on coastal processes.			

Key: Significance of potential strategic effect at each development stage	
++	Development actively encouraged as it 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 "?".

A10.7 Interactions and Cumulative Effects

A10.7.1 The following table identifies the potential cumulative effects resulting from the NPS. The first column considers cumulative effects at a national scale and the second column considers effects at a regional scale. The third column considers the potential effects in-combination with those effects caused by other plans.

Table A10.5: Cumulative Effects on Water Quality and Resources of the NPS and in-combination with other plans

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
National: Water Resources – Water companies operate regionally. Increased water demand is likely to affect water companies individually. Water Quality – Receiving water bodies for cooling water discharge are not likely to be linked at a national scale	**Cumbria/North West England:** Water Resources - Combination of sites at Sellafield, Braystones, Kirksanton and Heysham, together with existing nuclear power stations at Heysham and reprocessing plant at Sellafield may impact on ability to meet future water demand in this region. Braystones and Sellafield are within the West Cumbria WRZ and Kirksanton and Heysham are within the Integrated	**Cumbria/North West England:** Water Resources – Further development initiatives in the region are planned including Carlisle Airport, a hospital campus and other employment and housing initiatives. These will increase water demand in the region and have cumulative impacts in combination with four sites in this area. Water Quality – The Morecambe Bay barrage project may have implications for the

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
	WRZ. If cooling waters are taken from non-seawater sources this will again have cumulative effects on water demand. Water Quality – The cumulative cooling water discharges from all North West sites plus Wylfa in Western Wales may have impacts on water quality, coastal processes, hydrodynamics and sediment transport within the Irish Sea.	discharge of cooling water from the Heysham and Kirksanton sites and may cause cumulative water quality impacts in Morecambe Bay.
	North East: Water Resources – The site at Hartlepool in combination with existing nuclear facility at Hartlepool may cause further demand stresses on water supply.	**North East:** Water Quality - The Tees tidal barrage project may have implications for the discharge of cooling water from the Hartlepool site and may cause cumulative water quality impacts in the Tees Estuary.
	Western Wales: Water Resources – The site at Wylfa in combination with existing nuclear facility at Wylfa may cause further demand stresses on water supply.	
	South West: Water Resources - The sites at Hinkley Point and Oldbury in combination with existing nuclear facilities at Oldbury and Hinkley Point A and B may cause further demand stresses on water supply. Water Quality – The cumulative cooling water discharges from Oldbury and Hinkley Point may have impacts on water	**South West:** Water Quality – Proposals for tidal power in the Severn Estuary may have implications for the discharge of cooling water from the Oldbury and Hinkley sites and may cause cumulative water quality impacts in the Severn Estuary.

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
	quality, coastal processes, hydrodynamics and sediment transport within the Severn Estuary.	
	East of England: Water Resources - The sites at Sizewell and Bradwell in combination with existing nuclear facilities at all three sites may cause further demand stresses on water supply. This may be more significant in the Essex and Suffolk Water area which serves both Sizewell and Bradwell.	

A10.7.2 Cumulative effects are likely to most significant where there are clusters of sites and existing sites. Where there are a number of these sites there will be additional stresses on water supply. This is particularly true in the North West of England. Cumulative effects are also likely to impact on water quality where a number of sites discharge cooling waters to the same water body. This may be particularly significant in the Irish Sea, Morecambe Bay and the Severn Estuary.

A10.8 Summary and Conclusions/Recommendations

A10.8.2 The summary table of potential effects on water quality and resources overall shows that in general the impacts will be minor negative impacts.

A10.8.3 Minor negative impacts can be expected on water quality in water bodies where cooling water is to be abstracted and discharged. These impacts can be mitigated and will be subject to Environment Agency consenting processes.

A10.8.4 A further minor negative impact will be the effect of increased water demand and a potential impact 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.

A10.8.5 There may be minor negative impacts on local groundwater bodies, where impacts may be further increased if cooling water is to be taken from non-seawater sources. Studies should be carried out to determine the impact on groundwater and surface water systems.

A10.8.6 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 impacts 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 impacts are dealt with.

Appendix A11: Flood Risk

A11.1. Introduction

A11.1.1. Flood risk is expected to increase in the UK due to the predicted changes in climate leading to more intense rainfall events, wetter winters, rising sea levels and coastal erosion. Nuclear power stations are often sited at coastal or estuarial locations to help accommodate requirements for cooling water. Such locations may be at increasing risk of flooding.

A11.1.2. The flood risk factors that are relevant and their implications for the Nuclear NPS depend on the type, scale, detailed design and locational characteristics of the proposed new nuclear power stations. As well as these site specific issues, there are certain common implications for flood risk for the Nuclear NPS as follows:

- Flooding from coastal, fluvial, surface and groundwater sources
- Cumulative effects in combination with other developments in an area
- Role of flood risk management measures in both adapting to and mitigating predicted effects as a result of climate change and the effects these could have on coastal processes, hydrodynamics and sediment transport.
- Potential indirect effects on national and international designated habitats

A11.2. Policy Context

A11.2.1. Appendix A in the Scoping Report (March 2008) sets out the review of relevant plans, programmes and environmental objectives for the appraisal of the Nuclear NPS. This was updated during April-May 2009 to take account of key policy and sustainability objectives that may have been established since the earlier scoping.

A11.2.2. The following table, A11.1, sets out the key objectives for sustainability that need to be taken in to account for appraising the effects of the Nuclear NPS with regard to Flood Risk and reflecting the updated policy review, referred to above.

Table A11.1: Key Sustainability Objectives

Plan, Policy or Programme	Key Sustainability Objective
International	
EU Marine Strategy Framework Directive	To protect, preserve and where practicable restore the marine environment with ultimate aim in maintaining biodiversity.
Water Framework Directive	To ensure long term sustainable management of the water environment.
EU Directive on the Assessment and Management of Floods	To ensure member states develop and update a series of tools for the assessment of flood risk and promote sustainable management of flood risk including co-ordination of flood risk management with the Water Framework Directive
National	
UK SD Strategy (2005)	Guiding principles include "*living within environmental limits*"
Making Space for Water (2005)	To develop better management of flood and coastal erosion risk in England Sustainable Development will be firmly rooted in all flood risk management and coastal erosion decisions and operations Account will continue to be taken of long term factors such as climate change Aiming for a mix of policies designed to minimise the creation of new risks (by the way development policy is implemented in areas of flood risk), to manage risk and to increase resistance and resilience

Plan, Policy or Programme	Key Sustainability Objective
Environment Strategy for Wales (2006)	To ensure appropriate sustainable measures are in place to manage the risk of flooding from rivers and the sea and help to adapt to climate change impacts.
Integrated Coastal Zone Management Strategy for Wales and A Strategy for promoting an integrated approach to the management of coastal areas in England	To develop a long term holistic approach of adaptive management that works with natural processes.

A11.3. Scope of the Appraisal

A11.3.1. **AoS Framework**: As a result of the scoping and ongoing consultation, the AoS framework for appraising the effects of the draft Nuclear NPS on flood risk identified the relevant AoS objectives as set out in the following table:

Table A11.2: AoS Appraisal Framework for Flood Risk

Sustainable Development Theme: Flood Risk	
AoS Objectives[149]	**Guide Questions**
14.to avoid increased flood risk (including coastal flood risk) and seek to reduce risks where possible	Will it result in demand for higher defence standards that will impact on coastal processes?
Flood risk effects may interact with other sustainability objectives on water (15, 16, 17, 18); health and well-being (6, 7, 11); biodiversity (1, 2, 3); and climate change (13). These interactions are mentioned here and addressed in more	

149 Numbers refer to objective numbers in the SEA Scoping Report and the Environmental Study

detail in the other appendices (A10, A5, A2).

A11.3.2. **Temporal and Spatial Boundaries:** The AoS followed the approach taken for the appraisal of the SSA criteria and reported in the Environmental Study[150] and update of the Environmental Study[151]. Short and long term effects relate to activity phases of nuclear power stations as follows:

- Construction: short term 5-6 years
- Operation: long term, base case of 60 years (with possible extension subject to regulatory approval)
- Decommissioning: around 30 years

It is 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.

A11.3.3. The draft Nuclear NPS sets out the Government's policy on the national strategic issues and site specific issues and mitigations which need to be taken into account when granting consent for the construction of new nuclear power stations.

A11.3.4. **Consultation:** During the appraisal process, consultation and ongoing liaison were undertaken with the statutory consultees and regional/local authorities. The most relevant consultations in relation to this AoS topic were made with the following:

- Defra with overall responsibility for securing a healthy environment
- Environment Agency , responsible for protecting the water environment
- Natural England, responsible for protecting the natural environment in England
- CCW, responsible for protecting the natural environment in Wales

150 BERR July 2008 Environmental Study http://www.berr.gov.uk/files/file47137.pdf

151 BERR January 2009 Applying the Strategic Siting Assessment Criteria: an update to the study of the potential environmental and sustainability effects http://www.berr.gov.uk/files/file49869.pdf

A11.4. The Current Situation and Likely Evolution without the Nuclear NPS

A11.4.1. The Scoping Report and the Environmental Study set out the baseline information; this was updated with key data in April-May 2009. Large parts of England are at risk from flooding from rivers and the sea. Most at risk are the Humber corridor, coastal areas in the South and East, low lying areas in East Anglia and the South West and major estuaries. There are approximately 24,000 miles of flood defences and over 46,000 flood defence structures protecting properties in England and Wales.[3]

A11.4.2. About 5 million people (over 12% of the UK population)[4] live in floodplains or areas identified as being at risk of coastal flooding in England and Wales. The most recent major flooding in the UK in the summer of 2007 resulted in the loss of 13 lives, around 7000 people were rescued from floodwaters, over 55,000 properties were flooded, and there was loss of essential services including drinking water and electricity. The flooding of the Mythe water treatment works meant that 140,000 homes were without normal water supplies for two weeks. Substantial costs were incurred for the public, the insurance sector, businesses and industries, central and local government[152]. These events highlighted that we still have much to learn about surface and groundwater flooding.

A11.4.3. Current flood risk has been highlighted above and indications are that flood risk is expected to increase in the UK due to the predicted changes in climate leading to more intense rainfall events, wetter winters, rising sea levels and coastal erosion. Scenarios of climate change for the UK have been published by the United Kingdom Climate Impacts Programme (UKCIP) in 1998 and 2002. These scenarios have been updated by UKCIP09[153] which gives information on current and projected future climate change for the UK up to 2100. In the first of the UKCIP09 reports, ' *The Climate of the UK and Recent Trends 2008' by the Met Office,* the following facts and figures were stated;

- Global sea level rise has accelerated between mid 19th century and mid 20th century and is now about 3mm per year;
- All regions in the UK have experienced an increase over the past 45 years in the contribution to winter rainfall from heavy precipitation events; in

152 See *Review of 2007 summer floods*, Environment Agency, 2007 and http://news.bbc.co.uk/1/hi/uk/6239828.stm

153 http://www.ukcip.org.uk/index.php

summer all regions except North East England and North Scotland show decreases;

- Sea level rise around the UK rose by about 1mm/per year in the 20th century, corrected for land movement. The rate for the 1990s and 2000s has been higher than this.

A11.4.4. The spatial and development planning processes are key mechanisms for helping to ensure that flood risk is adequately addressed at all stages in the planning process, to protect people and the environment. Under the existing planning regime, the Government sets out policy and requirements[154] for managing flood risk where new or redevelopment is planned. This recognises that there are three flood risk zones (low-high) for fluvial and tidal flooding. Any development proposals within the higher risk Zones 2 and 3 must be subject to Flood Risk Assessments[154] (FRAs, as well as any development over 1ha in Flood Zone 1. This situation will continue under the new planning regime brought about by the Planning Act 2008 for major infrastructure projects. FRAs continue to be part of the ongoing assessment process as proposals for development move from strategic appraisal through to project level when applications for planning consent of major projects will require EIAs and other assessments as necessary such as FRAs.

A11.5. The Likely Effects of the draft Nuclear NPS

A11.5.1. The draft Nuclear NPS is likely to have effects on flood risk at the local or sub-regional levels; these are locationally specific and will depend upon the characteristics of the receiving environments and communities. Detailed FRAs will be undertaken in accordance with the relevant planning policy statement (PPS25 in England and TAN15 in Wales). Site specific FRAs will be undertaken in accordance with the Environment Agency's requirements and consultation with the Local Authority, Internal Drainage Boards (where applicable) and the sewerage undertaker. Site specific FRAs will provide the evidence base for any mitigation required as a result of potential adverse effects for example sea level rise and also assess the potential impact of any proposed mitigation on coastal processes and biodiversity.

A11.5.2. **Construction Phase** - During construction phase there could be potential short term negative effects, arising from a potential increase in surface water runoff due to the increase in impermeable area, particularly if the surface water

154 Environment Agency http://www.environment-agency.gov.uk/

management system is not in place on site prior to construction. As nuclear power stations are generally located in coastal or estuarine areas there is a risk of them flooding during construction phase, particularly if site specific mitigation measures such as defences have not been constructed prior to building the nuclear power station. Even if flood defences are present a residual risk remains, as there is still a risk that these could overtop or breach.

A11.5.3. **Operational Phase** - During operational phase and due to the locational nature of nuclear power stations there is an ongoing risk of the site flooding. This flood risk is likely to increase during operational phase as a result of the potential effects of climate change. Mitigation measures such as flood defences will alleviate some of the risk of flooding but residual flood risk will still remain. Any defences constructed could have potential negative effects on coastal processes and biodiversity. In addition any defences constructed could potentially have positive effects on the local area, this is because flood defence assets operate as a system, and there could be areas close to the nuclear power station that benefit from any new flood risk management measures.

A11.5.4. **Decommissioning**- During decommissioning phase as a result of the effects of climate change, flood risk to a nuclear power station is likely to be more significant than it was at construction phase.

Radioactive and Hazardous waste management

A11.5.5. The The Main AoS Report (Chapter 6) and Annex K give the findings of an appraisal of sustainability of the arrangements for managing radioactive and hazardous wastes arising from the Nuclear NPS. This appraisal has used the AoS framework to consider the following waste streams:

- Spent Fuel[155]
- Intermediate Level Waste (ILW)
- Low Level Waste (LLW)
- Gaseous and Liquid Radioactive Discharges
- Non Radioactive Hazardous Wastes

A11.5.6. 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

155 In accordance with Government's view that in the absence of any proposals from industry new nuclear power stations should proceed on the basis that spent fuel will not be reprocessed, spent fuel is considered to be waste for the purposes of the appraisal.

undertaken. There may also be effects associated with the transport of waste between nuclear power stations and waste management sites. The 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 of. The findings of the appraisal in relation to the effects at new power station sites and due to transport of waste from these sites are summarised below.

A11.5.7. Provided that interim storage facilties for spent fuel are within the footprint of the site, the effect of spent fuel storage on flood risk during construction and operation should not alter the measures required to protect other facilities on the site. Interim storage of spent fuel is likely to be the factor that determines the overall lifetime of the site and could potentially be required for a period of about 100 years after the end of power generation. In the event that onsite interim storage of spent fuel is required for this length of time and that flood protection needs to be maintained for this period, there could be a significant adverse effect on flood risk.

A11.6. Summary Effects of the Potentially Suitable Sites

A11.6.1. As with any major infrastructure project, there can be positive and negative effects at each stage of development. The relative significance of these effects depends on the characteristics and scale of the receiving communities. The sustainability of each site was appraised and the findings are set out in the individual site AoS Reports (Annexes A –J). These appraisals identified strategically significant effects and locally significant effects. These effects are set out in Table A11.3 below.

Table A11.3: Summary of Potential Significant Strategic Effects on Flood Risk

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Bradwell	-	-	-
Potential significant adverse effects on coastal processes as a result of mitigation measures required in the form of the improvement to existing and construction of any new flood defences to manage potential increase in flood risk as a result of sea level rise. It is possible that these adverse effects could be mitigated. Potential, adverse effects relating to flood risk has been identified due to rising sea levels, especially during the later stages of operation and decommissioning. This is considered a wider national issue, because of the potential impact on national energy supply and infrastructure. Possible secondary impacts on coastal processes, hydrodynamics and sediment transport from any necessary new or upgraded coastal defences have also been identified. Mitigation may be possible through appropriate design and construction of defences.			
Braystones	-	-	-
Potential significant adverse effects on coastal processes as a result of mitigation measures required in the form of the improvement to existing and construction of any new flood defences to manage potential increase in flood risk as a result of sea level rise. It is possible that these adverse effects could be mitigated. Potential adverse effects have identified a relatively low risk of flooding risk due to rising sea levels. It is likely that this can be mitigated in the long-term through the provision of further defences with appropriate design and construction, taking account of coastal processes, hydrodynamics and sediment transport.			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Hartlepool	-	-	-
Potential significant adverse effects on coastal processes as a result of mitigation measures required in the form of the improvement to existing and construction of any new flood defences to manage potential increase in flood risk as a result of sea level rise. It is possible that these adverse effects could be mitigated. Potential adverse effects has identified effects relating to the measures that may be required to combat flood risk due to rising sea levels, especially during the later stages of operation and decommissioning. This is considered a wider national issue, because of the potential impact on national energy supply and infrastructure. Possible secondary impacts on coastal processes, hydrodynamics and sediment transport from any necessary new or upgraded coastal defences have also been identified. Mitigation may be possible through appropriate design and construction of defences.			
Heysham	-	-	-
Potential significant adverse effects on coastal processes as a result of mitigation measures required in the form of construction of any new flood defences to manage potential increase in flood risk as a result of sea level rise. It is possible that these adverse effects could be mitigated. Potential adverse effects has indentified effects relating to flood risk due to rising sea levels, especially during the later stages of operation and decommissioning. There are existing flood defences, but these may need improvement/upgrading. This is considered a wider national issue, because of the potential impact on national energy supply and infrastructure. Possible impacts on coastal processes, hydrodynamics and sediment transport from any necessary new or upgraded coastal defences have also been identified. Mitigation may be possible through appropriate			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
design and construction of defences.			
Hinkley Point	-	-	-
Potential significant adverse effects on coastal processes as a result of mitigation measures required in the form of the improvement to existing and construction of any new flood defences to manage potential increase in flood risk as a result of sea level rise. It is possible that these adverse effects could be mitigated. Adverse effects has identified potential effects relating to flood risk due to rising sea levels, especially during the later stages of operation and decommissioning. This is considered a wider national issue, because of the potential impact on national energy supply and infrastructure. Possible secondary impacts on coastal processes, hydrodynamics and sediment transport from any necessary new or upgraded coastal defences have also been identified. Mitigation may be possible through appropriate design and construction of defences.			
Kirksanton	-	-	-
Potential significant adverse effects on coastal processes as a result of mitigation measures required in the form of the improvement to existing and construction of any new flood defences to manage potential increase in flood risk as a result of sea level rise. It is possible that these adverse effects could be mitigated. Adverse effects has identified potential effects relating to flood risk due to rising sea levels, especially during the later stages of the development. This is considered to be a wider national issue because of the potential effects on national energy supply and infrastructure. Mitigation may be possible through appropriate design and construction of defences, taking account of coastal processes, hydrodynamics and sediment transport.			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
Oldbury	-	-	-
Potential significant adverse effects on coastal processes as a result of mitigation measures required in the form of the improvement to existing and construction of any new flood defences to manage potential increase in flood risk as a result of sea level rise. It is possible that these adverse effects could be mitigated. Adverse effects has identified potential effects relating to flood risk due to rising sea levels, especially during the later stages of operation and decommissioning. This is considered a wider national issue, because of the potential impact on national energy supply and infrastructure. Possible impacts on coastal processes, hydrodynamics and sediment transport from any necessary new or upgraded coastal defences have also been identified. Mitigation may be possible through appropriate design and construction of defences.			
Sellafield	-	-	-
Potential significant adverse effects on coastal processes as a result of mitigation measures required in the form of the improvement to existing and construction of any new flood defences to manage potential increase in flood risk as a result of sea level rise. It is possible that these adverse effects could be mitigated. Adverse effects have identified a relatively low risk of flooding due to rising sea levels. Mitigation may be possible through appropriate design and construction of defences, taking account of coastal processes, hydrodynamics and sediment transport.			
Sizewell	-	-	-
Potential significant adverse effects on coastal processes as a result of mitigation measures required in the form of the improvement to existing and construction of any new flood defences to manage potential increase in flood risk as a result of sea			

Site	Significance of potential strategic effect at each development stage		
	Construction	Operation	Decommissioning
level rise. It is possible that these adverse effects could be mitigated. Adverse effects have identified potential effects relating to flood risk due to rising sea levels, especially during the later stages of operation and decommissioning. This is considered a wider national issue, because of the potential impact on national energy supply and infrastructure. Possible impacts on coastal processes, hydrodynamics and sediment transport from any necessary new or upgraded coastal defences have also been identified. Mitigation may be possible through appropriate design and construction of defences.			
Wylfa	-	-	-
Potential significant adverse effects on coastal processes as a result of mitigation measures required in the form of the improvement to existing and construction of any new flood defences to manage potential increase in flood risk as a result of sea level rise. It is possible that these adverse effects could be mitigated. Adverse effects has identified small potential, effects relating to flood risk due to rising sea levels, especially during the later stages of operation and decommissioning. This is considered a wider national issue, because of the potential impact on national energy supply and infrastructure. However, it is considered that the hard cliff geology and elevated nature of the site will afford adequate protection and that there is no need for coastal protection measures.			

Key: Significance of potential strategic effect at each development stage	
++	Development actively encouraged as it would resolve an existing sustainability problem; effect considered to be of regional/national/international significance
+	No sustainability constraints and development acceptable; effect considered

Key: Significance of potential strategic effect at each development stage	
	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 "?"

A11.7. Interactions and Cumulative Effects

A11.7.1. There are potential adverse effects relating to the potential mitigation that may be required to manage increased flood risk due to rising sea levels, especially during the latter stages of operation and decommissioning. These could impact upon coastal processes and hydrodynamics and also biodiversity and water quality.

A11.7.2. The following table identifies the potential cumulative effects resulting consideration of new nuclear power stations at each of the potentially suitable sites. The first column considers cumulative effects at a national scale and the second column considers effects at a regional scale. The second column considers the potential effects in-combination with those effects caused by other plans.

Table A11.4: Cumulative Effects on Flood Risk of the NPS and in-combination with other plans

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
Potential national cumulative adverse effects relating to the measures that may be required to mitigate flood risk due to rising sea levels, especially in the later stages of operation and decommissioning. This is considered a wider national issue, because of the potential impact on national energy supply and infrastructure.	**North West-Cumbria**: potential adverse cumulative effects due to the proximity of the following three sites; Sellafield, Braystones and Kirksanton. The potential mitigation required to manage flood risk could have cumulative secondary impacts on coastal processes and hydrodynamics in this region as well as biodiversity. There could also be cumulative impacts to other new and existing developments in this region as a result of the potential mitigation required to manage flood risk. These impacts could be both positive and negative. 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	**National:** Potential adverse effects could arise from this NPS when considered in conjunction with requirements of the Water Framework Directive and River Basin Management Plans.WFD set out common principles for the protection and improvements of all the EU's rivers, lakes, estuaries and coastal waters. WFD requires the completion of management plans for all river basins (including estuarine and coastal waters and groundwater) by the end of 2009. Among the objectives of these management plans is the protection and improvement of the ecological and chemical water quality. Potential mitigation required to manage flood risk as a result of the Nuclear NPS could have potential adverse effects on coastal processes, hydrodynamics thus having secondary impacts on biodiversity and water quality, therefore potentially hindering the objectives and requirements of the WFD.

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
	protection for new and existing developments in the district.	
	South West- Potential cumulative impacts on coastal processes and hydrodynamics could arise in the Severn Estuary as a result of potential mitigation required to protect the sites at Hinkley Point and Oldbury. There could also be cumulative impacts to other new and existing developments in this region as a result of the potential mitigation required to manage flood risk. These impacts could be both positive and negative. 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	**South West, East of England, North West, Wales:** Potential mitigation required to manage effects of rising sea levels and increasing flood risk over the lifetime of the development is in line with the proposed draft policies contained within Shoreline Management Plan's (SMP2) for the relevant coastal cells in these regions.

Cumulative National Effects of Nuclear NPS	Cumulative Regional /District Effects of Nuclear NPS	Cumulative effects of Nuclear NPS in-combination with other plans:
	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. **Wales, North East, East of England**- as a result of potential mitigation required to protect against rising sea levels there may be cumulative impacts in the vicinity of the proposed sites. These could be negative, for example adversely impact upon coastal processes and biodiversity, and they could also be positive for example, provide extra protection from flooding to surrounding areas.	**South West:** Potential mitigation required to protect Oldbury and Hinkley Point from increasing flood risks as a result of climate change may have a potential negative impact on the Severn Estuary FRM Strategy, as the potential mitigation required at these locations may not have been considered in this long term investment strategy.

A11.7.3. Under normal circumstances flood defences in England and Wales are inspected on at least an annual basis for major assets this is 6 months. Nothing out of the ordinary has come out of the site reports, construction of defences/ mitigation of flood risk and the appropriate management of such mitigation is routine for any development in an area at risk.

A11.8. Summary and Conclusions/Recommendations

A11.8.1. The predicted effects of the draft Nuclear NPS on Flood Risk nationally are to be indirectly adverse. This is because the potential mitigation required to protect the sites from the predicted increase in flood risk due to sea level rise in the form of improvement and construction of new flood defences

could adversely affect coastal processes, hydrodynamics and sediment transport. Detailed site specific investigation would be required to firstly determine if construction of new defences or maintaining existing defences would be the most appropriate and sustainable method of protecting the sites throughout the life cycle of the nuclear power stations. Following this an investigation of the predicted impacts this mitigation would have on coastal processes, and then measures that could be taken to mitigate these potential adverse effects.

A11.8.2. At a regional/district level depending upon the type of mitigation proposed to manage flood risk there could be both positive and negative impacts. 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. These positive and negative impacts would be cumulative in the South West and North West, where sites are in relative close proximity to each other and likely to be in the same flood defence system.

Appendix 2

Nuclear AoS Recommendations to the draft Nuclear NPS

Key AoS Recommendations for the draft Nuclear NPS	Government Responses to Recommendations (including relevant changes)
AoS Recommendations applicable generally to the draft Nuclear NPS (EN-6)	
Recommendations	
1.1 The 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.	1.1 EN-6 makes specific reference for the need to take account of site level AoSs to scope studies needed for project level EIAs.
1.2 The NPS requires that for new nuclear power stations any development consent application should be subject to a further appropriate assessment at the project level (EN-6 1.7.2).	1.2 EN-6 now makes this explicit.
1.3 The NPS should highlight to the IPC that the significance of effects can only be determined through site level studies as part of the project level EIA and HRA.	1.3 EN-6 now says that the significance of effects can only be considered at the site level.
1.4 The 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.	1.4 EN-6 now makes clear that the significance of effects can only be determined through site level studies as part of the project level EIA and HRA.
1.5 The IPC should consider requesting a sustainability statement / assessment for each application to ensure full consideration of socio-economic	1.5 EN-6 now says that the IPC should expect a development consent application to contain an assessment of the considerations given to socio-

Key AoS Recommendations for the draft Nuclear NPS	Government Responses to Recommendations (including relevant changes)
issues as well as environmental issues addressed through EIA. Opportunities for enhanced socio-economic benefits are likely to be more significant at the regional level where there are clusters of potentially suitable sites for new nuclear power stations, particularly for the North West region.	economic as well as environmental issues.
1.6 The NPS should inform 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.	1.6 The EIA requirements require that proponents provide in their ES "a description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment". Information within the ES may inform a Habitat Management Plan (HMP) or other Environmental Management Plan (EMP). However, it is not necessary for developers to deliver all mitigation proposed pre-consent or to prepare an HMP or EMP in every case.
<u>Specific AoS Recommendations applicable to Sustainable Development (SD) Themes and the draft Nuclear NPS</u>	
SD Theme: Climate Change (mitigation; adaptation is considered within SD Theme Flood Risk) **AoS Objective: to minimise greenhouse gas emissions**	
Recommendations	
2.1 The UKCIP scenarios project until 2100; 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 available.	2.1 EN-6's climate change adaptation text now reflects that IPCC reports will be needed for longer term assessment of climate change.

Key AoS Recommendations for the draft Nuclear NPS	Government Responses to Recommendations (including relevant changes)
2.2 The NPS could highlight to the IPC that nuclear power generation is associated with relatively low levels of greenhouse gas (GHG) emissions, particularly when compared with conventional fossil fuel generation.	2.2 This is now made explicit in the NPS.
2.3 Minor levels of GHG emissions may arise from the transport of goods and workers during the construction phase; the significance of this depends upon the relative sustainability of local/regional transport services.	2.3 EN-6 now raises the potential issue of pressures on transport networks. A summary of transport effects and mitigations is contained in EN-1.
SD Theme: Biodiversity and Ecosystems AoS Objectives: to avoid adverse impacts on the integrity of wildlife sites of international and national importance; to avoid adverse impacts on valuable ecological networks and ecosystem functionality; to avoid adverse impacts on Priority Habitats and Species including European Protected Species	
Recommendations	
3.1 The NPS should highlight to the IPC that there are key inter-relationships between biodiversity and other sustainability effects, most notably flood risk management (climate change adaptation), health and well-being, and sustainable communities.	3.1 EN-6 now explicitly refers to the fact that the AoS has identified key inter-relationships between biodiversity and other sustainability effects.
3.2 It is likely to be very difficult to compensate for loss of internationally important shingle habitat at Dungeness and the NPS should consider whether this can be a potentially suitable site since building a new nuclear power station is likely to have an adverse impact on the	3.2 Dungeness is now no longer a listed site.

Key AoS Recommendations for the draft Nuclear NPS	Government Responses to Recommendations (including relevant changes)
integrity of a Special Area of Conservation (SAC)[156].	
3.3 Project level HRAs will be required since all potentially suitable new nuclear power station sites are adjacent to European designated sites or at a distance at which the strategic level HRAs have considered potential adverse effects to be possible or likely. The IPC should undertake an Appropriate Assessment that clarifies uncertainties highlighted in the strategic HRAs and addresses the adverse impacts considered possible or likely.	3.3 EN-6 makes it clear that development consent applications constitute projects with regard to the Habitats Directive and that the IPC must assess them accordingly, taking into account the plan level HRA.
3.4 The NPS should guide the IPC towards the potential for interactions and cumulative adverse effects on water quality, habitat loss and coastal squeeze, disturbance and air quality on European designated sites where there are clusters of potentially suitable sites for new nuclear power stations – North West and South West Regions.	3.4 EN-6 raises the potential for the potential for interactions and cumulative adverse effects on these factors.
3.5 The NPS should also highlight potential cumulative effects in these two regions with other major plans and projects; particular consideration should be given to other major developments in the SW and NW regions.	3.5 The potential for cumulative effects in regional areas has been noted in EN-6 and draws this potential cumulative effect to the attention of the IPC.
3.6 The NPS could inform the IPC that the common potential adverse effects on biodiversity from new nuclear power stations include water	3.6 EN-6 identifies for the IPC the potential for adverse effects on biodiversity from new nuclear power stations in for example, the guidance

156 E.g. any impacts on the integrity of an SAC where mitigation might not be possible.

Key AoS Recommendations for the draft Nuclear NPS	Government Responses to Recommendations (including relevant changes)
discharge, abstraction and quality; habitat and species loss and fragmentation; coastal squeeze; disturbance events (noise and visual); and air quality. These effects are likely to be most significant during construction and operation.	set out in Part 4 of the nuclear NPS.
3.7 The NPS could inform the IPC that there are various mitigation options available and including variations to building layout to avoid ecologically sensitive areas; and habitat and species protection measures on site to avoid or minimise disturbance and pollution to wildlife.	3.7 The NPS refers to these options in Part 4 of EN-6 and in EN-1.
3.8 The NPS should guide the IPC that implementation of mitigation options for significant adverse effects can be more certain if an Environmental Management Plan is included in the developer's ES.	3.8, 3.9 and 3.10 EN-6 reflects the current statutory requirements. The EIA regulations require that proponents provide in their ES " a description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment". Information within the ES may inform a Habitat Management Plan or other Environmental Management Plan (EMP). However, it is not necessary for developers to deliver all mitigation proposed pre-consent or to prepare an HMP, EMP or Green Infrastructure Strategy.
3.9 Habitat Management Plans / Nature Conservation Strategies may be requested as part of a current application (although the information that these contain may partly be required by the information under mitigation. However, the NPS may benefit from referring explicitly to the preparation of Habitat Management Plans / Nature Conservation Strategies.	
3.10 The NPS could consider highlighting to the IPC that there may be scope to consider ecological effects and mitigation in the context of wider Green Infrastructure Strategies and an ecosystems approach.	

Key AoS Recommendations for the draft Nuclear NPS	Government Responses to Recommendations (including relevant changes)
SD Theme: Communities – population, employment and viability **AoS Objectives: to create employment opportunities; to encourage the development of sustainable communities; to avoid adverse impacts on property and land values and avoid planning blight**	
Recommendations 4.1 Project EIA focuses on demographic changes rather than socio-economic effects and the NPS should consider that the IPC requires an economic/employment statement. 4.2 The NPS should highlight to the IPC that the significance of positive effects depends on whether workers are sourced from local communities. 4.3 The NPS could highlight to the IPC that the positive effects of local employment have secondary positive effects on wider community viability. 4.4 The NPS should highlight to the IPC that cumulative positive effects for economic development are likely to be more significant at the regional level where there are clusters of potentially suitable sites for new nuclear power station - particularly for the North West region, and possibly for the South West of England region.	4.1, 4.2, 4.3, 4.4 EN-6 now says that the IPC should expect a development consent application to contain an assessment of the considerations given to socio-economic issues and that positive effects of economic significance are more likely to occur at the regional level where there are clusters of potentially suitable sites.
SD Theme: Communities – supporting infrastructure **AoS Objectives: to avoid adverse impacts on the function and efficiency of the strategic transport infrastructure; to avoid disruption to basic services and infrastructure**	
Recommendations 5.1 The NPS could highlight to the IPC	5.1 This text was considered as part of

Key AoS Recommendations for the draft Nuclear NPS	Government Responses to Recommendations (including relevant changes)
that there may be adverse effects during the construction and decommissioning phases on regional transport networks already under stress, particularly where there are clusters of potentially suitable sites for new nuclear power stations; consideration could be given to rail or maritime freight, and phasing. During operation of nuclear power stations, the effects of transport are likely to be minor and local.	EN-6. Although the Nuclear AoS has assessed the effects of transport it was decided that the effects and the recommendations from the Nuclear AoS were generic to all significant energy infrastructure and instead should to be included in EN-1. For example EN-1 now includes references to Transport Assessments.
5.5 The IPC should require site (non-radioactive) waste management plans for all phases of the new nuclear power station as part of an overall commitment to sustainable waste management principles within an Environmental Management Plan as part of the ES/Sustainability Statement to help ensure implementation of mitigation proposals. Non-radioactive hazardous waste should be disposed of in accordance with current legislation including application of the principle of Best Available Technique (BAT)	5.5 The waste management impact text of EN-1 now refers to the generation of (non-radioactive) waste during the construction, operation and decommissioning phases.

SD Theme: Human Health and Well Being **AoS Objectives: to avoid adverse impacts on physical health; to avoid adverse impacts on mental health; to avoid loss of access and recreational opportunities, their quality and user convenience**	
Recommendations	
6.1 The NPS should inform the IPC that there may be common effects for health and well-being from new nuclear power stations associated with the following: • Radiation and radiological protection from permitted discharges, storage of waste, and potential hazards from accidental emissions • Safety and security • Employment • Emissions to water and air • Noise • Accessibility to green space and exercise	6.1 EN-6 does not direct the IPC to determine the effectiveness of the potential developments in reducing the negative effects on human health and well being as these are dealt with through other Government policies, guidance and regulatory regimes on which EN-6 is based.
6.2 The NPS should ensure that the IPC appreciates the regulatory systems for operation of nuclear power stations so that effects associated with safety, security, radiological doses to the public and workers are dealt with by these systems.	6.2 EN-6 sets out the regulatory regime in relation to nuclear power stations and says that consent should be granted on the basis that the regulatory regimes and the aims of the relevant legislation will be implemented.
6.3 The NPS should inform the IPC the beneficial effects of secure long term employment and community viability on health and well being.	6.3 The NPS draws the positive benefits to be gained from employment to the attention of the IPC.
6.4 The NPS should inform the IPC that operation of new nuclear power stations is unlikely to be associated with significant noise, although there may be localised effects from transport and activities during the construction phase.	6.4 The potential for the effects of noise is dealt with in EN-1. The NPS now makes reference to the correct standards and planning policy.

6.5 The 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.	6.5 This is identified as a potential impact in the NPS.
6.6 The NPS could consider the added value to decision making from a health impact assessment to accompany the ES and particularly to focus on the wider determinants of health since such health impacts would not be specifically required by the EIA Directive.	6.6, 6.7 HIA is not a current requirement for energy infrastructure applications. The applicability of HIA may be considered on a case by case basis by the IPC.
6.7 The NPS should guide the IPC that any Sustainability Assessment should include consideration of the wider determinants of health as such impacts will not necessarily be addressed within the scope of the EIA.	
SD Theme: Cultural Heritage **AoS Objectives: to avoid adverse impacts on the internationally and nationally important features of the historic environment; the avoid adverse impacts on the setting and quality of built heritage, archaeology, and historic landscapes**	
Recommendations	
7.1 The NPS should advise the IPC that significant adverse effects to cultural heritage resources may be difficult to mitigate.	7.1 EN-1 includes reference to potential impacts regarding Archaeology and Cultural Heritage.

SD Theme: Landscape **AoS Objectives: to avoid adverse impacts on nationally important landscapes; to avoid adverse impacts on landscape character, quality and tranquillity, diversity and distinctiveness**	
Recommendations 8.1 The NPS should highlight to the IPC that there are likely to be some impacts that cannot be mitigated due to the scale of new nuclear power station development. 8.2 The NPS should highlight to the IPC the potential for cumulative adverse effects from the three potentially suitable sites in Cumbria. 8.3 The NPS should highlight to the IPC the increased significance of visual impacts if cooling towers are proposed.	8.1, 8.2, 8.3 The draft EN-6 instructs the IPC to have regard to these issues: in addition EN-1 makes clear that it would expect these to be covered in the local impact reports prepared by local authorities.
SD Theme: Air Quality **AoS Objectives: to avoid adverse impacts on air quality**	
Recommendations 9.4 The NPS could highlight to the IPC that impacts on air quality are unlikely to be significant with new nuclear power stations; impacts from traffic associated with the construction phase should be considered in the scope of the EIA.	9.4 This is now raised in EN-6 and policy and guidance is now set out in EN-1.

SD Theme: Soils, Geology, Land Use **AoS Objectives: to avoid damage to geological resources; to avoid the sue of greenfield land and encourage the reuse of brownfield sites; to avoid the contamination of soils and adverse impacts on soil functions; to avoid damage to geological resources**	
Recommendations 10.1 The NPS should inform the IPC that impacts to soils may affect the soil water regime which in turn may affect various terrestrial habitats and this will need to be considered in the project level HRAs.	10.1 This is identified as a requirement in the EN-6.
SD Theme: Water Quality and Resources **AoS Objectives: to avoid adverse impacts on surface water hydrology and channel geomorphology (including coastal geomorphology); to avoid adverse impacts on surface water quality (including coastal and marine water quality) and assist achievement of Water Framework Directive objectives; to avoid adverse impacts on the supply of water resources; to avoid adverse impacts on groundwater quality, distribution and flow, and assist achievement of Water Framework Directive objectives**	
Recommendations 11.1 The NPS should guide the IPC to the findings of the site level AoSs and HRAs to help scope the studies needed for the project level EIAs and further appropriate assessments. The inter-relationships between impacts on water and ecology should be outlined. 11.2 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. The impacts are likely to be neutral on water quality and resources but there may be greater impacts where several	11.1, 11.2, 11.3, 11.4 EN-6 raises these issues. Additional policy and guidance is set out in EN-1.

sites discharge cooling water to the same water body. Such cumulative effects are possible in the North West region and the Severn Estuary. 11.3 At one potentially suitable sites (Oldbury) it is proposed to use cooling towers and the NPS should highlight to the IPC that the associated impacts of landscape and visual amenity should be considered as well as water quality. 11.4 The NPS should inform the IPC that there could be increased water demand, particularly during the construction phase, and in those regions that are already under water stress: East of England and South East regions. The IPC will need to consider the impacts of new nuclear power stations with other major infrastructure proposals and interactions with other plans such as Water Company Resource Plans, Shoreline/Estuary Management Plans and River Basin Management Plans.	
SD Theme: Flood Risk (adaptation; mitigation is considered within SD Theme Climate Change) **AoS Objectives: to avoid increased flood risk (including coastal flood risk) and seek to reduce risks where possible**	
Recommendations 12.1 The NPS should guide the IPC to the findings of the site level AoSs and HRAs to help scope the studies needed for the project level EIAs and further appropriate assessments. The inter-relationships between impacts on water and ecology should be outlined. 12.2 The NPS should inform the IPC the	12.1 EN-6 now refers the IPC to the site level AoS and HRA reports for specific site information on flood risk. 12.2 The potential effects resulting from

characteristics of cooling water for new nuclear power stations and the implications for the marine and estuarial environments.	the need for cooling water and the implications for marine and estuarial environments are set out in EN-6 and EN-1 . The Nuclear NPS states that further studies will be required at the project level.
12.3 The NPS should guide the IPC that flood risk management measures put in place to mitigate the impacts of flooding on or from individual sites, including new works and possibly marine landing jetties/docks, may impact on coastal processes, hydrodynamics and sediment transport, which in turn may impact on designated habitats.	12.3 EN-6 now contains information to this effect.
12.4 The NPS should highlight to the IPC that when scoping the EIA/HRA for sites in the Severn Estuary consideration should be given to cumulative effects on coastal erosion.	12.4 EN-6 raises this as a consideration for the IPC.
SD Theme: Radioactive and Hazardous Waste (non-radioactive waste is addressed within the SD theme on sustainable communities: supporting infrastructure)	
Recommendations	
13.1 The NPS should highlight to the IPC that the management of radioactive and hazardous waste has the potential to produce effects 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.	13.1 EN-1 covers this in detail as part of the assessment on radioactive waste.
13.2 The effects of the additional volume of spent fuel from new nuclear power stations should be taken into account	13.2, 13.3, 13.4 It is not for the Nuclear NPS to direct the NDA in this way as the NPS only has effect in relation to

by the Nuclear Decommissioning Authority (NDA) in their design and evaluation of a Geological Disposal Facility (GDF), including transportation.	the Planning Act. However the NDA will be free to take account of anything set out in the Nuclear NPS or Nuclear AoS if it chooses to do so.
13.3 The effects of the minor additional volumes of Intermediate Level Waste (ILW) from new nuclear power stations should be taken into account by the NDA in their design and evaluation of a GDF.	
13.4 The effects of the minor additional volumes of Low Level Waste (LLW) from new nuclear power stations should be taken into account in the planning for LLW disposal capacity that the NDA undertake through their National LLW Strategy programme.	
13.5 In considering authorisations for gaseous and liquid discharges at sites receiving radioactive waste from new nuclear power stations, the Environment Agency should take into account the additional quantities of radioactive waste arising from the new nuclear power stations.	13.5 It is not for the Nuclear NPS to direct the EA in this way as the NPS only has effect in relation to the Planning Act. However the EA will be free to take account of anything set out in the Nuclear NPS or Nuclear AoS if it chooses to do so.

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