

# Appraisal of Sustainability: Site Report for Sellafield

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

## **Preface:**

### **Appraisal of Sustainability of the revised draft Nuclear National Policy Statement**

The Appraisal of Sustainability (AoS), incorporating Strategic Environmental Assessment (SEA), of the revised 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 revised 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 Appraisal of Sustainability: Site Report for Sellafield.

This report has 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 Pearson Associates Ltd, Studsvik UK Ltd and Metoc plc.

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**Appendices to Sellafield AoS Report**

1	AoS/SEA Objectives for Appraisal
2	Appraisal Matrices
3	Plans and Programmes Review (available on website)
4	Baseline Information (available on website)

## Summary of Key Findings

This report considers the nomination of the site at Sellafield as a possible location for new nuclear power station(s). The purpose of this Appraisal of Sustainability Report is to assess environmental and sustainability impacts on the Sellafield site and surrounding area. This report also identifies the significance of those effects, and suggests possible ways of mitigation. For more information on the methodology and background to the assessment please refer to Section 2. The national policy context, which also provides a background to the assessment, is included in Section 3.

The key findings of this assessment are included below (reproduced from Section 6 for ease of reference). These key findings are supported by site characterisation and the appraisal of sustainability, details of which are included in Section 4 and Section 5 of this report. Further details on the key findings and suggested mitigation of the potential effects identified of developing a nuclear power station at Sellafield are included in Section 6.

### Summary of Key Findings

The Appraisal of Sustainability process has included recommendations to inform the development of the revised draft Nuclear National Policy Statement. This site report for Sellafield has helped to inform the decision-making for the Strategic Siting Assessment. It has included advice as to the strategic significant effects arising from the construction of a new nuclear power station at Sellafield, and suggestions for how adverse effects may be mitigated, including proposed mitigation measures which could be considered as part of project level Environmental Impact Assessment.

A number of the strategic effects identified for Sellafield will be similar across all the nominated sites, including positive effects for employment and well being. However, a number of potential strategic effects that are of particular note for the nominated site at Sellafield have been identified. These are discussed below.

Of particular note for the revised draft Nuclear National Policy Statement are potential negative effects on three protected nature conservation sites, including Drigg Coast and the River Ehen, and effects on water quality and migratory fish in nearby coastal waters due to the abstraction and release of sea water for cooling. Although no common sites of European nature conservation importance are assessed as being potentially affected by both power stations, there may be significant adverse effects on wider biodiversity if both Sellafield and Heysham nuclear power stations are developed.

The risk of flooding due to rising sea levels is considered relatively low at Sellafield and existing hard flood defences are in place, which may require upgrading. Mitigation opportunities could be available following further study at the project level.

A development at Sellafield would be visible from parts of the nationally significant Lake District National Park and the impact could not be fully mitigated. Although this would be set in the context of the extensive existing nuclear facilities at Sellafield, which would reduce the severity of the impact, further development is still likely to lead to a perceptible deterioration in some views. This is of potential wider (national) significance due to the proximity of the National Park although the direct effects, (with the exception of potential additional grid connectivity), will be felt primarily at the local level.

The Appraisal of Sustainability for Sellafield notes that the development of a nuclear power station at the nominated site will interact with other regional plans, programmes and projects and may lead to cumulative effects. Sellafield and Heysham form a cluster of two nominated sites in the north west. There is the potential for cumulative effects if more than one nuclear power station site were developed in this area. The potential cumulative effects arise as a result of interactions between the sites due to their relative proximity and the way in which effects may act together.

No common sites of European nature conservation importance are assessed as being potentially affected by both power stations. However, the Appraisal of Sustainability found that there may be significant adverse effects on wider biodiversity if both Sellafield and Heysham are developed, due to the prevalence of nationally designated sites at both Sellafield and Heysham sharing similar habitats or species meaning that there is a chance that if both sites were developed and impacted on similar sites, a cumulative effect could arise.

Development at the Sellafield site is appraised as having positive effects of regional economic significance on employment and community viability. The Appraisal of Sustainability identified that there are indirect positive health effects associated with enhanced prosperity and long-term employment opportunities.

The cumulative positive effects of employment, community viability and health/well-being could be more significant if more than one new nuclear power station is built and the opportunities for upskilling, education, and supporting industries to the nuclear sector are developed at the local and regional levels. The site Appraisal of Sustainability report notes that there may be negative effects, during the construction of any new power stations, if the development produces a local shortage of specialist construction labour. This negative effect could be increased if more than one power station is developed in the region. However, these effects may be mitigated if the education and upskilling opportunities noted above are taken and by appropriate phasing of construction.

There remains some uncertainty relating to the significance of some effects and the most appropriate mitigation. It is expected that the mitigation measures will be refined iteratively as part of the development of the proposals for the nominated site, and will be assessed further in the project level Environmental Impact Assessment.

# 1 Introduction

## This Appraisal of Sustainability Report

- 1.1 This report considers the site at Sellafield as a possible location for new nuclear power station(s). The report sets out the Appraisal of Sustainability (AoS) of the nomination of land alongside the existing nuclear power station at Sellafield. The nomination, together with supporting information, was put forward by a developer. The AoS, which incorporates the Strategic Environmental Assessment (SEA), is a part of the Strategic Siting Assessment (SSA). The SSA is a process for identifying and assessing sites that could be suitable for the deployment of new nuclear power stations by the end of 2025.
- 1.2 This report is one of the Appraisals of Sustainability that deal with individual sites. Together, these reports form an Annex to the Main AoS Report,<sup>1</sup> which accompanies the revised draft Nuclear National Policy Statement<sup>2</sup> (NPS). The Main AoS Report for the revised draft Nuclear NPS sets out the details of the AoS process, its methods, findings, conclusions and a summary of the appraisal of the nominated sites. The Main AoS Report also includes a non-technical summary.
- 1.3 This AoS has been undertaken at a strategic level and is intended only as a high level assessment of the suitability of the site from an environmental and sustainability perspective. The AoS is part of an assessment process that started in March 2008. The revised draft Nuclear NPS lists sites that have been assessed to be potentially suitable by the Government for the deployment of new nuclear power stations. Developers will be able to apply for development consent for these sites from the Infrastructure Planning Commission (IPC)<sup>3</sup>. Each application from the developer for consent to build a new power station will need an Environmental Statement with a detailed Environmental Impact Assessment (EIA). The sites included in the revised draft nuclear NPS will also be subject to other regulatory and licensing requirements.

## The Revised draft Nuclear National Policy Statement

- 1.4 The revised draft Nuclear NPS sets out the need for sites that are potentially suitable for the development of new nuclear power stations by 2025. The Government used an SSA to assess the potential suitability of nominated sites. This SSA process<sup>4</sup> drew on the emerging findings of the site AoSs and the Habitats Regulations Assessment (HRA)<sup>5</sup>.

<sup>1</sup> Main AoS Report <http://www.energynpsconsultation.decc.gov.uk>

<sup>2</sup> Nuclear NPS <http://www.energynpsconsultation.decc.gov.uk>

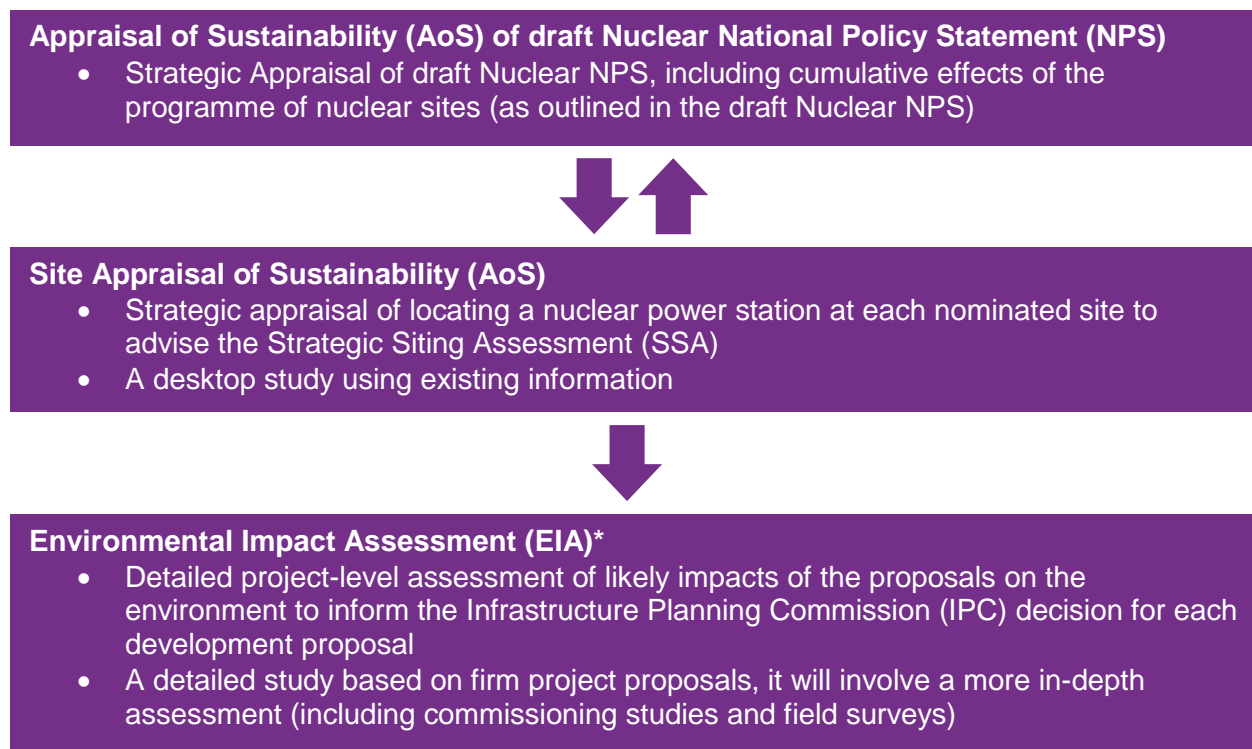
<sup>3</sup> The Government announced in June 2010 its intention to amend the Planning Act 2008 and abolish the IPC. In its place, the Government envisages that a Major Infrastructure Planning Unit (MIPU) will be established within the Planning Inspectorate. Once established, the MIPU would hear examinations for development consent and would then make a recommendation to the Secretary of State. It would not itself determine applications and decisions would be taken by the relevant Secretary of State. These proposed reforms require primary legislation. Until such time as the Planning Act 2008 is amended, the IPC will continue as set out in that Act. As a result, the NPSs will provide the framework for decisions by the IPC on applications for development consent for major infrastructure projects, and under the new arrangements will provide the framework for recommendations by the MIPU to the Secretary of State.

<sup>4</sup> Towards a nuclear national policy statement : Government response to the consultation on the Strategic Siting Assessment process and criteria, January 2009, URN 09/581 <http://www.berr.gov.uk/files/file47136.pdf>

<sup>5</sup> Sellafield HRA Report <http://www.energynpsconsultation.decc.gov.uk>

## Appraisal of Sustainability incorporating Strategic Environmental Assessment

- 1.5 The Planning Act 2008<sup>6</sup> requires an AoS for all National Policy Statements. The purpose of an AoS is to consider the social, economic and environmental implications of the policy and to suggest possibilities for improving the sustainability of the NPS. The AoS incorporates the requirements of the European Strategic Environmental Assessment Directive<sup>7</sup> which aims to protect the environment and to promote sustainable development during preparation of certain plans and programmes. This is set out in more detail in the Main AoS Report accompanying the revised draft Nuclear NPS.
- 1.6 The purpose of this AoS is to assess environmental and sustainability impacts on the Sellafield site. This AoS also identifies the significance of those effects, and suggests possible ways of mitigation. The AoS for the Sellafield site fed into the Strategic Siting Assessment (SSA) and the preparation of the revised draft Nuclear NPS. Further detailed studies would be carried out at the EIA stage of any construction project. The following diagram explains the relationship between the Main AoS Report, the Site AoS Report and an EIA.



\*as required by European Directive 85/337/EEC and Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999

<sup>6</sup> Planning Act 2008

<sup>7</sup> Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment, implemented through *The Environmental Assessment of Plans and Programmes Regulations 2004*



## Appraisal of Sustainability Methods

- 1.7 In undertaking the AoS of each nominated site, a wide range of information was considered, including the scoping report<sup>8</sup>, the Environmental Study<sup>9</sup>, the Update Report<sup>10</sup>, information from other Government departments, the statutory consultees and regulators, information from the nominators and other published reports. If additional local information was available, for example, an EIA scoping report or a locally relevant Strategic Flood Risk Assessment, it has been used to inform the appraisal where appropriate is referenced in the footnotes.
- 1.8 The methods used for AoS/SEA are detailed in the main AoS Report. The AoS uses objectives as a means of identifying and appraising the potential significant effects on the environment and communities of building new nuclear power stations. The sustainability objectives that have been agreed for the appraisal of the revised draft Nuclear NPS are detailed in Annex E of the Environmental Study and the main AoS Report. Appendix 1 of this AoS Report sets out the guide questions that are used with each sustainability objective to help focus the appraisal in a more systematic way. The sustainability objectives used in the Environmental Study were grouped into themes for sustainable development in order to help focus on the key issues for appraisal. This is set out in the following table.

**Table 1.1: Sustainable Development Themes and AoS/SEA Objectives**

<b>Sustainable Development Theme</b>	<b>AoS/SEA Objective (Numbers refer to scoping report<sup>11</sup> and Environmental Study<sup>12</sup>)</b>
<b>Air Quality</b>	to avoid adverse impacts on air quality (12)
<b>Biodiversity and Ecosystems</b>	to avoid adverse impacts on the integrity of wildlife sites of international and national importance (1) to avoid adverse impacts on valuable ecological networks and ecosystem functionality (2) to avoid adverse impacts on Priority Habitats and Species including European Protected Species (3)
<b>Climate Change</b>	to minimise greenhouse gas emissions (13)
<b>Communities: population, employment and viability</b>	to create employment opportunities (4) to encourage the development of sustainable communities (5) to avoid adverse impacts on property and land values and avoid planning blight (10)
<b>Communities: Supporting Infrastructure</b>	to avoid adverse impacts on the function and efficiency of the strategic transport infrastructure (8) to avoid disruption to basic services and infrastructure (9)

<sup>8</sup> BERR (March 2008) Consultation of Strategic Environmental Assessment for proposed National Policy Statement for new nuclear power, URN08/680

<sup>9</sup> BERR July 2008 Environmental Study

<sup>10</sup> BERR January 2009 Update Report

<sup>11</sup> BERR (March 2008) Consultation of Strategic Environmental Assessment for proposed National Policy Statement for new nuclear power, URN08/680

<sup>12</sup> BERR July 2008 Environmental Study

<b>Sustainable Development Theme</b>	<b>AoS/SEA Objective (Numbers refer to scoping report<sup>11</sup> and Environmental Study<sup>12</sup>)</b>
<b>Human Health and Well-Being</b>	to avoid adverse impacts on physical health (6) to avoid adverse impacts on mental health (7) 11. to avoid the loss of access and recreational opportunities, their quality and user convenience (11)
<b>Cultural Heritage</b>	to avoid adverse impacts on the internationally and nationally important features of the historic environment (22) to avoid adverse impacts on the setting and quality of built heritage, archaeology and historic landscapes (23)
<b>Landscape</b>	to avoid adverse impacts on nationally important landscapes (24) to avoid adverse impacts on landscape character, quality and tranquillity, diversity and distinctiveness (25)
<b>Soils, Geology, Land Use</b>	to avoid damage to geological resources (19) to avoid the use of greenfield land and encourage the re-use of brownfield sites (20) to avoid the contamination of soils and adverse impacts on soil functions (21)
<b>Water Quality and Resources</b>	to avoid adverse impacts on surface water hydrology and channel geomorphology (including coastal geomorphology) (15) to avoid adverse impacts on surface water quality (including coastal and marine water quality) and assist achievement of Water Framework Directive objectives (16) to avoid adverse impacts on the supply of water resources (17) to avoid adverse impacts on groundwater quality, distribution and flow and assist achievement of Water Framework Directive objectives (18)
<b>Flood Risk</b>	to avoid increased flood risk (including coastal flood risk) and seek to reduce risks where possible (14)

1.9 The AoS for each of the nominated sites considered the relevant policy context at regional level, which helped identify key sustainability objectives that need to be taken into account in the appraisal, and potential cumulative effects that could arise when considered along with other plans and projects. Policy context at the local Government level is changing as a result of the new planning system. However, local planning policy will be required to conform to regional plans and programmes. Existing and emerging local policy documents were considered, where relevant, for the characterisation of baseline conditions and the appraisal of effects. The regional policy context and regional baseline information is set out in Appendices 3 and 4 respectively.

## Background to Nuclear Power Stations

- 1.10 This section provides some wider context on nuclear power. Nuclear power works in a similar way to conventional electricity generation, insofar as it depends on the creation of heat to generate steam, which in turn powers a turbine.
- 1.11 This process needs to be carefully managed because of the energy released in the process. The process is controlled by the use of a “moderator”. All reactors have sufficient moderators to shut them down completely, and fail-safes to ensure that this occurs in the event of any potential incidents. The early designs of nuclear power stations in the UK used graphite as a moderator. Later designs of nuclear power stations use water as a moderator. It is likely that any new nuclear power stations built in the UK would be water moderated.
- 1.12 The nuclear reactions that take place in nuclear power stations create a high level of radioactivity in the reactor. Radioactivity occurs naturally and is a normal part of our environment, but nuclear power stations create much higher intensities that require careful management while operating and after they have finished generating electricity.
- 1.13 The UK has strict, independent, safety and environmental protection regimes for nuclear power. The Nuclear Installations Inspectorate (NII), a division of the Health and Safety Executive (HSE), and the Environment Agency (EA) regulate nuclear power stations in England and Wales. Any new nuclear power station will be subject to safety licensing conditions and will have to comply with the safety and environmental conditions set by the regulators. NII and the Environment Agency are currently assessing two new nuclear reactor designs through the Generic Design Assessment (GDA) process.
- 1.14 Generating electricity by nuclear power creates radioactive waste, some of which remains potentially hazardous for thousands of years. The storage and disposal of this waste is an important part of the nuclear fuel cycle and needs careful long-term management. In June 2008 the Government published the White Paper on Managing Radioactive Waste Safely<sup>13</sup>. This set the framework for managing higher activity radioactive waste in the long term through geological disposal, coupled with safe and secure interim storage and ongoing research and development. Geological disposal involves isolating radioactive waste deep inside a suitable rock formation, to ensure that no harmful quantities of radioactivity ever reach the surface environment. The White Paper also invites communities to express an interest in entering into discussions with the Government without commitment on the possibility of hosting a geological disposal facility at some point in the future.
- 1.15 When a nuclear power station reaches the end of its life, it has to be dismantled (normally referred to as decommissioned). This process also needs careful management. While many parts of the power station are easily decommissioned, some parts will be radioactive because they were exposed to high levels of radiation. In the UK, the Nuclear Decommissioning Authority (NDA) is responsible for the existing nuclear legacy and is decommissioning 20 civil public sector nuclear sites.

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<sup>13</sup> <http://www.defra.gov.uk/environment/radioactivity/mrws/pdf/white-paper-final.pdf>

- 1.16 Operators of new nuclear power are required to have secure funding arrangements in place to cover the full costs of decommissioning and their full share of radioactive waste management and disposal costs.

## New Nuclear Power Station Designs

- 1.17 The HSE and EA are undertaking a process of Generic Design Assessment (GDA) of new nuclear reactor designs. GDA allows the assessment of the generic safety, security and environmental implications of new nuclear reactor designs, before an application is made for permission to build a particular design on a particular site.
- 1.18 Given the strategic level of information required for the SSA and the information available at this early stage, it is not intended to consider the implications of different nuclear power station designs at each nominated site at this stage. It is considered that these are better addressed when development consent is applied for. Therefore, in order to appraise the sites, the AoS has made a number of assumptions about the generic design characteristics of new nuclear power stations, which are discussed in more detail in the Main AoS Report.
- 1.19 To provide a standardised approach to the appraisal of the nominated sites, the assumptions about generic design characteristics have been summarised into a base-case. The base-case was used to guide the assessment for each site, except in cases where a nominator has provided further detail at variance with the base case. For example, if a nominator is proposing cooling towers instead of abstracting water for cooling, this has been considered in the assessment. The key assumptions used for the site level assessments are outlined in Table 1.2, with the variations considered in the Sellafield AoS provided in the right hand column.

**Table 1.2: Base Case Assumptions and Variations Considered for Sellafield**

Base Case	Variations considered in AoS of Sellafield (as proposed in nomination)
1 nuclear reactor	The nominator's information states that a high level assessment has been undertaken based on the construction of two 1650 MW reactors (the largest potential design)
Technology neutral (i.e. unknown reactor type)	
A requirement for cooling water abstraction	The Nominator's information considers both seaward and inland cooling, but concludes that the use of seawater at a seaward site is more viable
Discharges of cooling water	
Site boundary as indicated on nomination form	
<u>Timescales:</u> Construction: approximately 5-6 yrs Operation: approximately 60 years (life extension, which is subject to regulatory approval, could mean that the operating	

Base Case	Variations considered in AoS of Sellafield (as proposed in nomination)
lifetime is longer) Decommissioning: approximately 30 years Lifetime of site: approximately 166 years <sup>14</sup>	
<u>No. of employees:</u> Construction: approx 4,000 (around 50% from within region) Operation: approx 500 Decommissioning: range of 400 – 800 at key phases <sup>15</sup> Associated employment creation: 2000	
Coastal flood and protection measures (where relevant)	Coastal defence measures for the Cumbrian West Coast railway to the south of the site may be required, potentially constructed as a joint venture with Network Rail
Infrastructure for transporting reactor (for example, jetty, landing facility)	Good potential for new shipping link direct to the nominated site, to facilitate the movement of nuclear power station components
Interim radioactive waste storage facilities will be capable for at least 160 years	
Highway improvements, access routes	
Associated transmission infrastructure	
Radioactive discharges will be within legal limits	

<sup>14</sup> The site lifetime of 166 years assumes 6 years for construction, 60 years for operation and 100 years for interim storage of spent fuel after the last defueling. 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. In making its assessment that onsite interim storage might be needed for 160 years, the Government took a conservative approach, to ensure that local communities are aware that it is possible that onsite interim storage might be required for this length of time. Following the public consultation, the Government has revised its position. The Government recognises that onsite interim storage might be required beyond 2130, particularly in the event that a GDF is not available to take the waste, but the Government does not expect onsite interim storage to be required for as long as 160 years. Further detail is set out in The Government Response to the consultation on the draft National Policy Statements for Energy, DECC, 2010, [www.energyngpsconsultation.decc.gov.uk](http://www.energyngpsconsultation.decc.gov.uk)

<sup>15</sup> Estimates for existing nuclear power stations entering the decommissioning phase indicate up to 800 full time equivalent staff for defueling, then a minimal workforce (less than 50) during the care and maintenance phases, and a second peak of up to 600 for the final demolition and site clearance (source: <http://www.nda.gov.uk/sites>)

## 2 The Site: Sellafield

- 2.1 The site at Sellafield is located in the North West Region of England, in a coastal location that has supported nuclear power facilities since 1956, when Calder Hall first began generating electricity (Figure 1). Figure 2 shows the location of the nominated site in a sub-regional context to help address any implications for cumulative effects on biodiversity and on socio-economic factors.
- 2.2 The site at Sellafield was nominated into the Strategic Siting Assessment process<sup>16</sup>. The Government has considered the nomination and, on the basis of expert advice, has found that the nominated site does not contravene the exclusionary criteria in the Strategic Siting Assessment. The nomination form includes a plan showing the boundary of the land included in the nomination at a scale of 1:10,000.
- 2.3 The existing complex at Sellafield is located on the Cumbrian coast, west of the Lake District, in the north-west of England. Apart from the existing nuclear facility, no other current industrial land use is present in the immediate area and the surrounding area is largely agricultural.
- 2.4 All assets are owned by the Nuclear Decommissioning Authority (NDA) and managed and operated by Sellafield Ltd, a wholly owned company of Nuclear Management Partners Ltd, under contract to the NDA.
- 2.5 Sellafield is a complex and compact nuclear site, with activities centred on remediation, decommissioning and clean up of the historic legacy. It also includes the Thorp and Magnox reprocessing plants, the Sellafield MOX plant and a wide range of radioactive waste management and effluent treatment facilities.
- 2.6 The nuclear history of the existing nuclear site at Sellafield dates back to 1947, when work commenced on the construction of Windscale Piles. Calder Hall reactor 1, the world's first commercial nuclear power station, began generating electricity in 1956, ceasing operation in 2003 after 46 years of electricity generation. Windscale Advanced Gas Cooled reactor operated between 1963 and 1981.
- 2.7 The complex currently employs approximately 12,000 full-time staff, with an estimated 4,000 other jobs dependent on the site. Most Sellafield workers are involved in the decommissioning of the Calder Hall and Windscale reactors.
- 2.8 The nomination identifies land within the Borough of Copeland, to the north, north-west and west of the existing Sellafield Nuclear Licensed Site. The nominated site comprises an area of approximately 250ha of tenanted farmland owned by the NDA, although it is considered that approximately 30-50ha will be needed for the new nuclear power station. Off-site work relating to highways and rail is identified, although newly improved road and existing rail facilities exist. The potential for a new shipping link is also identified.
- 2.9 The nomination is for a nuclear power station development incorporating:
- two nuclear reactors

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<sup>16</sup> SSA process and criteria

- improvement of coastal defences and/or land raising to protect the nominated site from flooding
- construction stage areas and facilities
- infrastructure and facilities related to the operation of a nuclear power station including transmission and cooling water infrastructure
- interim radioactive waste storage facilities

2.10 The site at Sellafield was nominated into the SSA process, in respect of which nominations closed on 31 March 2009. The Government is also assessing the environmental and sustainability impacts of including the nominated site in the list of potentially suitable sites in the revised draft Nuclear NPS (through this Site AoS Report).

2.11 The SSA required the site nominator to supply an annotated Ordnance Survey map at 1:10,000 scale showing the boundary of the nominated site, which is provided in Figure 3.

## 3 Policy Context

### Introduction

- 3.1 The main AoS Report sets out the national policy context in relation to nuclear power stations, energy, climate change mitigation, use of natural resources, environmental protection and sustainability of communities. During the scoping<sup>17</sup> stage, a review of national plans was undertaken to help identify key sustainability objectives that need to be met and contribute to the development of the AoS Framework of objectives for appraisal.
- 3.2 This section considers the policy context at the regional and local levels relevant to the potential new nuclear power station at Sellafield and its surroundings. It aims to identify any key significant policy objectives that need to be considered for this strategic appraisal of the nominated site. This also contributes to addressing the potential interactions and cumulative effects that may arise from the operation of a new nuclear power station on the nominated site. This is covered in Section 5 of the Site AoS Reports and Section 8 of the Main AoS Report.

### What are the other Key Sustainability Objectives that need to be considered?

- 3.3 The relevant policy documents are reviewed in Appendix 3 of this report and are as follows:
- Regional Spatial Strategy for the North West 2008 - 2021, Government Office for the North West (September 2008)
  - Regional Economic Strategy for North West England , Northwest Regional Development Agency (2006)
  - North West Climate Change Action Plan 2007 – 2009 (2007)
  - Cumbria Biodiversity Action Plan, UK Biodiversity Action Plan (2001)
  - River Wyre to Walney Island Shoreline Management<sup>ent</sup> Plan, North West and North Wales Coastal Group (2000)
  - Sustainable Communities in the North West, Office of the Deputy Prime Minister (2003)
  - Regional Waste Strategy for the North West, North West Regional Assembly (2004)
  - River Basin Management Plan for the North West, Environment Agency (2009)
  - Water Resources Management Plan, United Utilities (2009)
  - Strategic Flood Risk Assessment, Jacobs for Copeland Borough Council (August 2007)
  - North West and North Wales Shoreline Management Plan 2, North West and North Wales Coastal Group
- 3.4 The key objectives for sustainability from these regional policy documents can be summarised as follows:
- Enhancing biodiversity and protecting internationally important species/habitats
  - Mitigating and adapting to effects of climate change
  - Reducing flood risk and improving coastal defences

<sup>17</sup> BERR (March 2008) Scoping Report



- Protecting and enhancing landscape, recreation, cultural heritage
- Recovering rural economy: agriculture, tourism, employment
- Improving sustainable transport and accessibility
- Increasing recycling and improving waste management
- Protecting water quality and resources
- Accommodating increased population growth
- Increasing provision of affordable homes
- Improving quality of life: employment, health and reducing crime

3.5 The plans that are still in place may have indirect and/or cumulative interactions and are discussed further in Section 5: Interactions and Cumulative Effects with Other Key Regional Programmes and Plans and Projects.

## 4 Site Characterisation

### Introduction

- 4.1 A general description of the nominated site at Sellafield and its location is provided in Section 2.
- 4.2 This Section describes the general characteristics of the nominated site at Sellafield and its surrounding area relative to the key sustainability themes identified in Section 3. Information regarding the local and regional environment and communities has been obtained and reviewed from publicly available sources and comparisons have been made with equivalent regional and national data sources where relevant and available. This information is summarised in Appendix 4. Key strategic networks for transport are shown in Figure 2 and key environmental constraints in Figure 4.
- 4.3 The Scoping Report identified the indicators used for baseline data collation at the national scale (used in the Environmental Study). It also set out the indicators to be used for each site AoS following the nomination of sites, but recognised that the baseline data collation process would be refined at the site nomination stage. Therefore, following site nominations, the relevant national, regional and local data has been sourced. This has enabled a more detailed, but still strategic, assessment to be undertaken than at national SEA Scoping. As this AoS is a strategic study, data that would typically be collated to inform an EIA (i.e. very site-specific data or data requiring the execution of surveys) has not been gathered. However, where relevant, information from available published reports of any previous detailed studies has been referenced to inform this strategic assessment. The scope of baseline data gathered for the AoS for Sellafield is presented in Table 4.1 below.

**Table 4.1: Summary of Scope of Baseline Data Collated for Sellafield**

Sustainable Development Theme	Scope of baseline data collated in this AoS
<b>Air Quality</b>	<ul style="list-style-type: none"> <li>Regional air quality index</li> <li>Location of Air Quality Management Areas</li> </ul>
<b>Biodiversity and Ecosystems</b>	<ul style="list-style-type: none"> <li>Location and description of Special Protection Areas, Special Areas of Conservation, Ramsar Sites, Sites of Special Scientific Interest, National Nature Reserves, Local Biodiversity Action Plans, Legally Protected Species</li> </ul>
<b>Climate Change</b>	<ul style="list-style-type: none"> <li>Regional precipitation and temperatures;</li> <li>Greenhouse gas emissions – regional, county and local.</li> </ul>
<b>Communities and Supporting Infrastructure:</b> Population Employment Community Viability Transport Waste and Minerals Energy	<ul style="list-style-type: none"> <li>Location of major settlements and areas of population</li> <li>Age structure of population</li> <li>Employment/unemployment and economic activity rates</li> <li>Employment profile by industry</li> <li>Socio-economic classification of population</li> <li>Energy from low-carbon/ renewable resources:</li> </ul>

Sustainable Development Theme	Scope of baseline data collated in this AoS
	regional <ul style="list-style-type: none"> <li>• Transport network and links</li> <li>• Landfill sites and waste management facilities</li> </ul>
<b>Human Health and Well-Being</b>	<ul style="list-style-type: none"> <li>• Index of Multiple Deprivation</li> <li>• Age profile</li> <li>• General health</li> <li>• Life expectancy</li> <li>• Infant mortality</li> <li>• Proximity to medical services</li> </ul>
<b>Landscape and Cultural Heritage</b>	<ul style="list-style-type: none"> <li>• Location and description of National Parks, Areas of Outstanding Natural Beauty, Heritage Coasts</li> <li>• National landscape Character Areas</li> <li>• Local landscape character areas / types</li> <li>• CPRE Tranquil Areas and Light Pollution mapping</li> <li>• Location and description of World Heritage Sites, Scheduled Monuments, Historic Battlefields, Historic Parks and Gardens, Designated Protected Wrecks, Conservation Areas, Listed Buildings.</li> </ul>
<b>Soils, Geology, Land Use</b>	<ul style="list-style-type: none"> <li>• Agricultural land classification</li> <li>• Soil types</li> <li>• Geological SSSIs</li> <li>• Geological risks</li> <li>• Environmental hazards</li> <li>• Historic land use</li> </ul>
<b>Water Quality and Resources:</b> Hydrology Quality Resources Flood Risk	<ul style="list-style-type: none"> <li>• Location of areas at risk of flooding</li> <li>• State of surface and ground waters: in river basin district and catchment</li> <li>• Predicted water demand and availability by Water Resource Zone</li> <li>• Designated waters under EU Directives</li> </ul>

## Air Quality

- 4.4 Air quality in the North West is generally good. Emissions to air from major industrial sites have reduced substantially, however emissions from traffic sources (major route corridors and areas of congestion) are continuing to cause pressure on local air quality across the region.<sup>18</sup>
- 4.5 There are 47 Air Quality Management Areas (AQMAs) declared in the North West Region of England, the majority of which serve to control emissions of nitrogen dioxide and particulate matter from traffic. The nominated site at Sellafield lies within the area of Copeland Borough Council and no AQMAs have been declared within this council area<sup>19</sup>, although potential risk areas can be identified through the review of data held in the Air Quality Archive.
- 4.6 In the North West, the average number of days with moderate or higher air pollution in 2006 rose from 2005 levels, and was slightly higher than the average for urban sites in England, but lower than the England rural average. The increase correlates with hot, sunny weather experienced during these years, causing the production of elevated levels of ozone.
- 4.7 Traffic in the region increased by 15% between 1995 and 2005, leading to air quality problems from major route corridors, and particularly congestion areas, and at peak travelling times. Continuance of this trend will add further pressures on meeting air quality objectives.
- 4.8 The EA assesses that non-radioactive aerial emissions (sulphur dioxide, nitrogen oxides and volatile organic compounds) from nuclear power stations are extremely low compared to other regulated industries. The EA's most recent available assessment of radioactive aerial emissions for regulated nuclear power stations indicates that all fall within authorised limits.<sup>20</sup>
- 4.9 The UK nuclear industry is highly regulated. All nuclear power stations require a licence to operate provided by the HSE/NII. The licence deals with all consents and changes from initial application to decommissioning and beyond.

## Biodiversity and Ecosystems

- 4.10 The biodiversity interest within 10km of the nominated site includes two European designated sites and several Sites of Special Scientific Interest (SSSI). One ecologically designated site of national importance, Low Church Moss SSSI, is partially within the nominated site boundary. All of these sites could potentially be affected by the development. Further information on the European designated sites and their current condition is given in the separate HRA Report for Sellafield.
- 4.11 Low Church Moss SSSI is located on the north western boundary of the nominated site and it noted for its wetland habitats. Drigg Coast Special Area of Conservation (SAC) and SSSI is situated approximately 4km south of the nominated site. This is a significant estuarine area with extensive coastal sand dunes that support great

<sup>18</sup> Environment Agency: State of the Environment – North West [online] available: <http://www.environment-agency.gov.uk/research/library/publications/34061.aspx> [accessed 04 March 2009]

<sup>19</sup> UK Air Quality Archive (online) available: <http://www.airquality.co.uk/archive/laqm/laqm.php> [accessed 03 March 2009]

<sup>20</sup> Measuring Environmental Performance: Sector Report for the Nuclear Industry (Environment Agency, Nov 2005)

crested newts and natterjack toads, both European protected species. The River Ehen SAC/SSSI situated approximately 9.5km to the north supports important populations of freshwater pearl mussel and Atlantic salmon.

- 4.12 Legally protected species within the area include great crested newts, with presence records of natterjack toad, otter, red squirrel and common species of reptile falling within 10km of the nominated site. Nationally important invertebrate species and rare and uncommon plants are also known to occur.

## Climate Change

- 4.13 The potential effects of climate change on the nominated site, such as storm surges, coastal erosion, sea level rise and flooding, are explored in the sections on Flood Risk below.
- 4.14 Cumbria has a large land mass and a sparse population. Rural populations are heavily reliant on travel by car as the primary source of transport, and in the more rural areas of the county there is dependence on oil and coal for domestic heating. These factors mean Cumbria has significant carbon dioxide (CO<sub>2</sub>) emissions per capita. Cumbria has the highest per capita greenhouse gas emissions (CO<sub>2</sub> equivalent) of the five sub regions in the north west region. Cumbria is also the only sub-region where transport is the largest sector contributing to carbon emissions, representing 28% of the total.<sup>21</sup>
- 4.15 The UK's 2008 Climate Change Act<sup>22</sup> sets a legally binding target of at least an 80 percent cut in greenhouse gas emissions by 2050, to be achieved through action in the UK and abroad. The Act also sets a target to reduce emissions by at least 34 percent by 2020. Both targets are against a 1990 baseline.
- 4.16 The North West is the second largest emitter of CO<sub>2</sub> in the UK. The Cumbria Strategic Partnership has signed up to the Local Area Agreement indicator NI 186 to reduce per capita CO<sub>2</sub> emissions across Cumbria as a whole by 11.5% by 2010/11, which equates to savings of 619,000 tonnes of CO<sub>2</sub> per year.
- 4.17 Within an 80km radius of the nominated site there are three power stations with a combined capacity of 2.6 GW. The majority (2.4 GW) of this is generated by the two nuclear power stations Heysham 1 and 2.

## Communities: Population, Employment and Viability

- 4.18 Population in the North West of England has decreased slightly over the past 25 years. There are now more than seven million residents making it the third most populated English Government Office region behind the South East and London<sup>23</sup>. According to the Office for National Statistics, the region's population fell by 1.3% between 1981 and 2006.
- 4.19 The region's population is ageing, with only three districts in the North West forecast to see a reduction in the population aged 65 years and over (Liverpool, Manchester and Salford).<sup>24</sup>

<sup>21</sup> NWRA Energy and Greenhouse Gas Emissions study, Aug 2007

<sup>22</sup> [http://www.decc.gov.uk/en/content/cms/legislation/cc\\_act\\_08/cc\\_act\\_08.aspx](http://www.decc.gov.uk/en/content/cms/legislation/cc_act_08/cc_act_08.aspx)

<sup>23</sup> [http://ec.europa.eu/budget/reform/library/contributions/pgs/20080415\\_PGS\\_65.pdf](http://ec.europa.eu/budget/reform/library/contributions/pgs/20080415_PGS_65.pdf)

<sup>24</sup> An Ageing Population: Impacts for the North West (Summary Document) ([www.ageconcern.org.uk](http://www.ageconcern.org.uk))

- 4.20 Employment rates for people of working age in the North West are lower than those of the UK as a whole. From January 2009 to December 2009, 70.5% of the population of the Copeland Borough Council area was employed compared with 68.1% for the North West of England and 70.7% for England as a whole.<sup>25</sup>
- 4.21 Around 50% of the jobs in the district depend on the existing nuclear facility at Sellafield, with the catchment area predominantly being North Cumbria and the West Coast extending to Barrow. This figure includes jobs within the facility itself, as well as those which rely on the facility. Within the region, there has been a decline of around 3,500 manufacturing jobs in recent years. The decline of these manufacturing jobs has historically been masked by continued recruitment at Sellafield.

## Communities: Supporting Infrastructure

- 4.22 Transport: The strategic road transport routes in the vicinity comprise the A595(T) to the north, the A595 to the south and the A66(T) that links the A595(T) with the M6. The A595 and A66 have recently been improved. The nominated site is accessed from the A595 by unclassified roads: Nursery Road and Yottenfews Lane. This provides links to the A595 of a reasonable highway standard. The A595(T) is part of the Strategic Road Network but is not part of the Trans-European Network (TEN). The M6 is the closest road of national significance but is some 50km away. The motorway can be accessed via the A595(T) at junction 43, the A66 at junction 40 and the A590 and junction 36. Access using the A66 is through the National Park and Keswick, and access using the A590 is via Broughton-in-Furness along winding roads.
- 4.23 The Cumbrian West Coast railway is immediately adjacent to the nominated site, and currently provides transport for nuclear materials to the existing facilities at Sellafield via its own railway line. There is an existing station for site employees.
- 4.24 The nearest shipping links are located in Barrow, to the south.
- 4.25 Conventional waste<sup>26</sup>: Cumbria County Council acts as the Waste Disposal Authority (WDA) for Copeland Borough Council. In 2006/07, 351,403 tonnes of municipal wastes were generated within the area. Of this total, 68% was sent to landfill, and the remaining 32% recycled. A relatively insignificant proportion (25 tonnes) was incinerated during this period.<sup>27</sup>
- 4.26 The County Council is currently in the process of procuring a Mechanical and Biological Treatment (MBT) waste treatment plant for sites at Carlisle and Barrow (contract currently approved). Two MBT plants will be provided for the region, with a treatment capacity of 70,000 tonnes of waste each.<sup>28</sup>
- 4.27 There are currently three non-hazardous landfill sites in the region. There are currently no hazardous waste landfills or treatment facilities in the Cumbrian region,

<sup>25</sup> Official Labour Market Statistics. <https://www.nomisweb.co.uk/reports/lmp/la/2038432073/report.aspx>

<sup>26</sup> Conventional waste means waste controlled under Part II of the Environment Act 1990

<sup>27</sup> Department for Environment, Food and Rural Affairs. Municipal Waste Management Statistics [online] available: <http://www.defra.gov.uk/environment/statistics/wastats/bulletin07.htm>

<sup>28</sup> Urban Mines Municipal Waste Procurement webpage: <http://www.urbanmines.org.uk/?i=1459&s=1111>

although established waste management contractors are known to operate and provide services within the region.<sup>29</sup>

## Human Health and Well-Being

- 4.28 The nominated site is within the Super Output Area (SOA) known as Copeland 007C.<sup>30</sup> Indices of deprivation show that it is a deprived area with barriers to housing and services being a particular problem. The age profile for Copeland SOA shows that there are significantly fewer children under sixteen and significantly more senior citizens (males over 65 and females over 60) than the English average. The profile also shows that there are slightly fewer working age people than average.
- 4.29 The most recent census (2001) found that people within the Copeland SOA generally reported good or fairly good health although the number reporting poor health was slightly higher than the English average. Other health statistics show a mixed picture, in that life expectancy for males and females is slightly less than the English average but infant mortality is comparable with the national average though higher than the regional average.
- 4.30 With regard to mental health, the Health Profile 2008<sup>31</sup> for Copeland shows that estimates of the number of people claiming incapacity benefit for mental illness in the area (35.9 per 1000 population) are higher than the English average (27.5 per 1000 population).
- 4.31 Contrary to the deprivation referred to above, pupils in the Copeland Borough Council area perform better in their GCSE equivalent examinations than their peers in the rest of England.
- 4.32 As might be expected from the deprivation of the area referred to above, there are slightly more unfit houses<sup>32</sup> in Copeland Borough Council's area than either the North-west region or England as a whole.
- 4.33 Figures from the Audit Commission for 2005<sup>33</sup> suggest that the crime rate for Copeland SOA is below the average for England.
- 4.34 The economic well-being of the area is reasonably positive as can be seen from the local employment figures<sup>34</sup> (see 'Communities: Population, Employment and Viability' above - noted here as a measure of economic well-being). From July 2007 to June 2008, 74.1% of the population of the Copeland Borough Council area were employed. However, this number compares favourably with figures for the North West of England region (72.1%) but is similar to England as a whole (74.5%).
- 4.35 Local access to medical services is reasonable with one general practitioner (GP) practice with five general practitioners within 5km of the nominated site. There are, however, two further GP practices within 10km of the nominated site and a local

<sup>29</sup> A Joint Municipal Waste Management Strategy for Essex (2007 to 2032)

<http://www.essexcc.gov.uk/vip8/ecc/ECCWebsite/dis/gui.jsp?channelOid=16959&guideOid=43565>

<sup>30</sup> An SOA is a geographical unit, of roughly equivalent population size and smaller than a district council area, created in the UK by the Office of National Statistics to aid statistical analysis of data

<sup>31</sup> <http://www.apho.org.uk/resource/view.aspx?RID=50213>

<sup>32</sup> Dwellings not suitable for occupation as defined by various criteria in Section 604 of the Housing Act 1985 (as amended)

<sup>33</sup> [http://www.areaprofiles.audit-commission.gov.uk/\(rkgonp45u4sp1o55bc5scf55\)/SingleAreaSearch.aspx](http://www.areaprofiles.audit-commission.gov.uk/(rkgonp45u4sp1o55bc5scf55)/SingleAreaSearch.aspx)

<sup>34</sup> <https://www.nomisweb.co.uk/reports/lmp/la/2038431858/report.aspx?pc=IP164UR>

hospital, with an accident and emergency department, at Whitehaven (13.5km). The nearest mental health hospital is the Parkwood Hospital (73.4km).

- 4.36 One of the wider determinants of health and well-being is access to local recreational facilities. In this regard, the nominated site is not particularly well served, with only one leisure centre within 20km of the nominated site. However, Copeland is a rural and coastal location, and offers good potential for outdoor recreational activities such as walking, cycling and water sports, since the surrounding area includes the Lake District National Park and a number of local beaches.
- 4.37 The nuclear power station at Sellafield (Calder Hall) operated from 1956 until 2003. The Windscale Advanced Gas Cooled reactor operated between 1963 and 1981. Therefore, the necessary data exists to enable a comparative study between the incidence of cancer reported around this nominated site and the average incidence of cancer in the UK population as a whole.
- 4.38 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.
- 4.39 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.
- 4.40 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'*.
- 4.41 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]*.
- 4.42 In its eleventh report COMARE examined the general pattern of childhood leukaemia in Great Britain and concluded that many types of childhood cancers *'have been shown not to occur in a random fashion'*. It is also stated that *'The results of analyses ... suggest that there is no general clustering around nuclear installations.'*
- 4.43 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.

- 4.44 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.
- 4.45 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. This will be published as COMARE's 14<sup>th</sup> report later this year. COMARE is also keeping the incidence of childhood leukaemia and other cancers in the vicinity of Sellafield under surveillance and periodic review.
- 4.46 Radioactive monitoring carried out in 2008<sup>35</sup> found generally low concentrations of artificial radionuclides attributable to the former Calder Hall nuclear power station in water, sediment and beach samples and in meat and seafood samples taken from around the nominated site. However, the presence in the area of other nuclear activities (two fuel reprocessing plants, decommissioning and clean-up, manufacture of mixed oxide fuel and waste treatment and storage) makes the apportioning of radiological effects in the area very difficult. In addition, a significant proportion of the radiation dose arises from enhanced concentrations of naturally occurring radionuclides from former non-nuclear industrial activity in the Sellafield area, for example, from the legacy of past discharges from a phosphate processing works in Whitehaven<sup>36</sup>. Nevertheless, from this sampling, the estimated total dosage levels to the public from all sources within the Sellafield area were assessed as being less than 47% of the dose limit for members of the public of 1mSv per year as specified in The Ionising Radiations Regulations 1999.

## Cultural Heritage

- 4.47 There are no designated sites or structures of cultural heritage value within the nominated site, although there are a number within 1km. The nearest are the Grade II listed Sella Park building to the north east and the Scheduled Ancient Monument and Grade II\* listed building associated with St. Bridget's church to the north west. The nominated site does contain potential historic landscape and Prehistoric and Roman-British archaeology, with a number of undesigned heritage sites within the boundary.

## Landscape

- 4.48 The nominated site is situated within the West Cumbria Coastal Plain National Character Area, which is characterised by open agricultural landscapes with extensive views to the higher fells in the east. This coastal belt area has a strong industrial history and extensive urban fringe areas. Within this Character Area are

<sup>35</sup> Food Standards Agency (2008). Radioactivity In Food and the Environment (RIFE 14) report.

<sup>36</sup> RIFE Report ([www.food.gov.uk/multimedia/pdfs/publication/rife2008.pdf](http://www.food.gov.uk/multimedia/pdfs/publication/rife2008.pdf))

large factories and manufacturing and processing plants, particularly near Workington, Whitehaven, Sellafield and Barrow.

- 4.49 At a local level the nominated site is located within the low farmland landscape character area. This landscape is a mix of undulating and rolling topography with intensely farmed agricultural land and patches of woodland and tree belts. Woodland is uncommon in the western coastal areas. Fields are large with rectangular boundaries comprising hedgerow trees, fences and hedges. Views are affected by pylons.
- 4.50 The existing nuclear facility and infrastructure is a dominant feature of this area of coastline and is visible from the surrounding hills and from the Isle of Man. The boundary of the Lake District National Park is 1.5km to the east and 5km to the south of the nominated site and the St. Bees Heritage Coast lies 10km to the north. A Lake District National Park Landscape Character Assessment (LCA) was completed in 2008 and this and the forthcoming Cumbria Landscape Character Guidance will need to be considered as part of the project level EIA. Within the near future, the Lake District National Park may be nominated as a UNESCO World Heritage Site.
- 4.51 The nearby existing industrial development means that the nominated site does not lie within the most tranquil parts of the region, as shown by the Countryside Agency/CPRE tranquillity map.

## Soils, Geology and Land Use

- 4.52 The nominated site at Sellafield is located on Grade 4 land that is not of high value for agriculture. The soils are noted to be deep, well drained coarse loamy and sandy soils over gravel. The local surface geology comprises alluvium, till, river terrace deposits (undifferentiated) and glaciofluvial deposits from the Devensian Stage of glaciation, underlain by sandstones of the Calder Formation and St Bees Formation.
- 4.53 Apart from the existing nuclear facility no other current industrial land use is present in the immediate area. Several landfill sites have been identified adjacent to the north and south of the former Sellafield power stations, including Calder Landfill Extension Segregated Area regulated under a Radioactive Substances Act permit/licence, plus five closed landfills regulated under the Waste Management Licensing Regulations (now Environmental Permitting Regulations). Further information regarding these and other landfill sites, including extent, nature and quantities (of both radioactive and non-radioactive waste) will be obtained and assessed as part of a site specific EIA.
- 4.54 One mineral abstraction site is present locally: the Florence Iron Ore mine near Egremont which, although flooded and not active, is considered to be a working mine. This mine is in hydrological continuity with Beckermeth Mine, which is closed, although the existing Sellafield facility currently uses one shaft to abstract groundwater.
- 4.55 The British Geological Society (BGS) has assessed geological risks in the local area, which include:
- Potential for shrinking or swelling clay ground stability hazard - very low risk
  - Potential for compressible ground stability hazards - moderate risk
  - Potential for landslide ground stability hazards - very low risk

- Potential for running sand ground stability hazards - very low to low risk

## Water Quality and Resources

- 4.56 The nominated site is located in the North West River Basin District (RBD). Within this RBD, only 20% of rivers (by length) meet the requirements for good ecological status (GES) or good ecological potential (GEP). Of the 477 river water bodies in the RBD, 42% are candidate heavily modified or artificial water bodies.
- 4.57 Of the eleven estuaries/transitional water bodies within the RBD, only four have been assessed and these are classified as moderate. For the eight coastal water bodies in the RBD, only three have been classified, all as moderate. Of the 157 lakes and reservoirs, 40% are candidate heavily modified or artificial water bodies; 50% of these water bodies have not been assessed. Of the 12 identified transitional (estuary) water bodies, nine are candidate heavily modified bodies, while for the eight identified coastal waters, six are considered to be candidate artificial or candidate heavily modified bodies. The European Water Framework Directive sets a target of achieving good ecological and chemical status for all water bodies by 2015, therefore significant improvements in water quality in the RBD are required.
- 4.58 The nominated site is located on the Cumbria Coast, which is classified as moderate ecological status. It is also within the South West Lakes Catchment, which is nested within the NW RBD. Currently 26% of surface water bodies in this catchment are achieving either GES or GEP. The NW draft River Basin Management Plan forecasts that by 2015 this will increase to 32%, reaching 100% by 2027.
- 4.59 The nearest watercourses to the site are the River Ehen, the River Calder and its tributary the Newmill Beck. The River Ehen has good ecological quality and high chemical quality. The River Calder (including Newmill Beck) has moderate ecological quality and high chemical quality.
- 4.60 There are no identified Shellfish Waters in close proximity to the nominated site. The nearest identified Bathing Waters are at Seascale, 3km down the coast to the south-east.
- 4.61 22% of the groundwater bodies in the RBD meet the requirements for good status. The groundwater body over which the nominated site is located is the West Cumbria Permo-Triassic Sandstone, which is classified as good status for both quantity and quality.
- 4.62 There are no groundwater source protection zones located in the immediate vicinity of the nominated site.
- 4.63 The nominated site is located within the Derwent, West Cumbria and Duddon Catchment Abstraction Management Strategy (CAMS) area. Within this CAMS area there are a large number of watercourses and waterbodies designated for their environmental importance, including the River Ehen, Wast Water, the River Derwent and Bassenthwaite. The rivers are designated for several species and associated habitats, including lamprey, otter, salmon, pearl mussel and water crowfoot. Wast Water is designated because it provides a special low-nutrient habitat.
- 4.64 The nominated site is located within the South West Lakes catchment which is nested in the NW RBD. This is a mainly rural catchment, lying within the Lake District

National Park. Much of the catchment consists of designated SAC and Sites of Special Scientific Interest (SSSI).

- 4.65 Water supply to the existing facility is provided by Wast Water, which is located within the River Irt Water Resource Management Unit (WRMU). However, according to the CAMS, it is classified as “no water available”. Within the United Utilities West Cumbria Water Resource Zone, which serves the rest of the area, there is a predicted deficit through to 2032. There are plans to address this deficit by the implementation of leakage reduction and the proposed South Egremont groundwater scheme by 2014.
- 4.66 The nominated site is also located on the West Cumbria Groundwater Management Unit. This is classified as “water available” to 2013, moving to “no water available” by 2019. There is no known use made of groundwater resources in the vicinity of the nominated site.
- 4.67 The nominated site is located within United Utilities’ supply area and in the West Cumbria Water Resource Zone (WRZ). The WRZ is predicted to be in deficit through to 2032. There are plans to address this deficit by the implementation of leakage reduction and the proposed South Egremont groundwater scheme by 2014.
- 4.68 The exact water requirements for the nominated site are not yet finalised. The nomination considers both seaward and inland cooling, but concludes that the use of seawater would be more viable.
- 4.69 The nominated site at Sellafield falls within the coastal cell from St Bees Head to Drigg and comprises of a multiple headland-bay system. This is a macro-tidal environment and tidal current action is the dominant process along this coastline. Tidal residual currents are directed from the west at St Bees Head and from the North West for the remainder of the coastline.
- 4.70 The geometry of the Irish Sea and the dominant west to south-westerly direction of prevailing winds and waves tends to keep sediment close up against the coastline offering a measure of protection against erosion. There is a strong, wave driven northward longshore drift along the coast north of St Bees Head towards the Solway Firth, which helps maintain the spit at Grune Point.
- 4.71 The nominated site is characterised by a barrier beach backed by till cliffs. The Shoreline Management Plan (SMP) (phase one 1) describes the coastal processes active at the nominated site as a projected progressive retreat of the coast at 0.2 to 0.5m/year until it is prevented by coastal defences associated with the Cumbria Coastal Railway. Such a situation would result in gradual loss of much of the fine beach material and steepening of the beach. It is further expected that storm events may then result in increased draw-down of material, resulting in increased vulnerability of the existing coastline to gradual erosion. In terms of coastline movement, the section of coastline is described at present by the SMP as experiencing ‘No Movement’.

## Flood Risk

- 4.72 The nominated site is located entirely within Flood Zone 1 ‘Low Probability’, but is bounded along the coastline by Flood Zone 3 ‘High Probability’, as indicated on the Environment Agency Flood map. Several minor rivers cross the nominated site.

- 4.73 There are already coastal defence structures in place close to the nominated site, which are designed to protect the site and the railway. However, these may need to be reinforced or extended to protect against the long term climatic change effects. These defences have the potential to modify existing coastal hydrodynamics and associated movement of sediment, which may have secondary effects on marine ecosystem structure and functioning.
- 4.74 South of the nominated site, the coastline is undefended, however, it is characterised by natural headlands or shingle spits which afford some natural protection.

## 5 Appraisal of Sustainability

### Introduction

- 5.1 This section considers the potential sustainability effects of including the nominated site at Sellafield in the list of suitable/potentially suitable sites in the revised draft Nuclear NPS. Whilst the Main AoS Report considers the sustainability effects that may arise from the construction of nuclear power stations in general, the site-level appraisal of sustainability looks specifically at the sustainability effects that could occur from constructing a new power station at Sellafield, should the nominated site be listed as potentially suitable in the revised draft Nuclear NPS and should an application for development consent be successful.
- 5.2 In accordance with the strategic nature and intent of the AoS, this section focuses on potential effects that are considered to be strategically significant at the Sellafield site and, where possible, suggests possibilities for mitigation. Where mitigation is uncertain or difficult, or where effects are likely to remain even after mitigation, this is made clear. Strategic significance is defined in Table 5.1 below.
- 5.3 The findings of the appraisal were used to help the SSA process to identify those sites that are potentially suitable for new nuclear power stations and will be listed in the revised draft Nuclear NPS. The detailed matrices are presented in Appendix 2 of this report and the key findings of the appraisal are discussed in Sections 5 and 6 of this report.

## 5.4 Table 5.1: The Assessment of Significance in the Site-Level AoS

<b>Local Effects</b>
<p>The AoS Site Reports identify potentially significant benefits and disbenefits of locating a new nuclear power station at each of the nominated sites. Some of the effects identified are significant at the local level and are more appropriately addressed through the development consent process to the Infrastructure Planning Commission. Applications for development consent will include Environmental Impact Assessment, undertaken by the developer. Such locally effects may include, for example, an adverse effect on a County Wildlife Site or disturbances to local communities arising from increased construction traffic during the construction phase. Effects of local significance are discussed in the detailed appraisal matrices set out in Appendix 2 of this AoS Report and are available to inform the IPC and others of issues that are likely to arise at the next stage of the planning and assessment processes.</p> <p>As with any major infrastructure project, there are likely to be effects during construction that have the potential for nuisance<sup>37</sup> and disturbance to local communities, demands on local services and supporting community infrastructure, and the risk of pollution and/or damage to environmental assets, such as biodiversity and water. The significance of such effects will be investigated at project level through the Environmental Impact Assessment process. These effects can often be minimised and controlled through careful design, working in accordance with good site practices, and managed through the use of Construction Environmental Management Plans, which will be agreed with, and monitored by, the environmental regulators and planning authorities.</p>
<b>Strategic Significant Effects</b>
<p>Other identified adverse or beneficial effects are more significant strategically as they have the potential to affect a matter of wider regional, national or even international importance. These may include, for example, an effect on biodiversity of national and international value (see also the site level HRA Reports). Where an effect is considered to have significant implications for the wider region for example, a benefit for the regional economy, this has been considered as a strategic significant effect. Effects which are better assessed at local or district level when more detailed site specific information is available have not been considered in this category. The significance of the potential strategic effects identified for each stage of the project (construction, operation and decommissioning) is summarised in Table 6.2.</p>

## Air Quality

- 5.5 There is potential for air quality impacts during the construction, operation and decommissioning stages of developing new nuclear power stations. However, relative to some other forms of power generation, nuclear power plants do not emit significant quantities of carbon dioxide, sulphur dioxide nitrogen oxides or particulates. Therefore, significant air pollution leading to deterioration in local or regional air quality is unlikely to arise during normal operation of the new nuclear

<sup>37</sup> During the construction, operation and decommissioning of energy infrastructure there is potential for the release of a range of emissions such as odour, dust, steam, smoke, artificial light and for infestation of insects. All have the potential to have a detrimental impact on amenity or cause a common law nuisance or statutory nuisance under Part III, Environmental Protection Act 1990. For statutory nuisance effects section 4.21 of EN-1 applies.

power station. Construction and decommissioning impacts are potentially more problematic and will require control and management.

- 5.6 The construction of a nuclear power station on the nominated site is likely to have localised adverse effects on air quality, particularly inland, for example, through short term impacts from construction activities (i.e. dust/particulates, emissions from construction plant), emissions from increased traffic levels. Construction impacts can be effectively controlled and minimised through the implementation of good environmental site practices, including monitoring. There could, however, be potential effects on biodiversity. This could include impacts on European and nationally designated wildlife sites due to increases in airborne pollutants. This is discussed further in the Biodiversity and Ecosystems sections of this report.
- 5.7 In the longer term localised adverse effects on air quality during operation may arise, particularly associated with increased transport movements, but it is not expected that air quality standards would be exceeded. However, this can be appropriately planned for and mitigated through the development process (for example, engineered mitigation measures, environmental permitting and control regimes, including traffic control options and the development of green travel plans) and is not considered to have a strategically significant effect.
- 5.8 Whilst important at a local level, impacts on air quality arising from construction and increased traffic movements during operation and decommissioning are not considered to be of strategic significance. There is a small risk that increased concentrations of airborne pollutants or nutrients could have an adverse effect on adjacent sites of nature conservation interest. This is discussed further in the Biodiversity and Ecosystems Section.
- 5.9 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 accordance with limits laid down in permits issued under the Environmental Permitting (England and Wales) Regulations 2010 and subject to monitoring and reporting. Further consideration of the control of radioactive discharges to air is given in Section 7 of the Main AoS Report.
- 5.10 There is a very low risk of an accidental release of radioactive emissions from the nominated site at Sellafield, which could have a significant strategic effect on air quality. The Health and Safety Executive (HSE)/Nuclear Installations Inspectorate (NII) and the Environment Agency will consider this matter during their risk assessments, which will be carried out as part of the consenting process to ensure that risks to public health and safety through accidental release of emissions is within acceptable limits. Whilst the risk is very low, the potential for a significant population to be adversely affected means that, at this stage of assessment, the potential for strategic adverse sustainability effects has been identified.
- 5.11 Strategic Effects on Air Quality: The AoS has 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 HSE/NII 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.**

## Biodiversity and Ecosystems

- 5.12 Throughout the construction, operation and decommissioning phases of a nuclear power station, the potential exists for the accidental release of pollutants into the environment, which could have significant impacts on biodiversity. However, the risks of accidental releases would be minimised by the existing risk assessment and regulatory processes that are referred to in the sections on Air Quality and Water. Construction activities, such as earthworks, and new buildings and infrastructure could lead to direct habitat loss, increased noise disturbance and impacts on air and water quality and quantity, which, in turn, could affect sensitive ecosystems. During operation, cooling and discharge of heated water and routine discharge of radioactive material could affect aquatic habitats and species.
- 5.13 Of greatest concern are activities which might lead to detrimental effects on coastal, estuarine and river habitats associated with the Drigg Coast, Wast Water, Crummock Water, River Eden and River Ehen SAC/SSSI sites (see Figure 4) and the species utilising these habitats, such as great crested newt, freshwater pearl mussel and migrating and spawning Atlantic salmon and lamprey. For example, should a marine off-loading facility be proposed, a new crossing of the River Ehen may be required.
- 5.14 Biodiversity would also be affected at a more local level if important habitats/species (for example, UK Biodiversity Action Plan habitats/species or legally protected species) are present within, or in close proximity to the nominated site
- 5.15 Direct impacts to Low Church Moss Site of Special Scientific Interest (SSSI) may occur as this ecological site is partially within the nomination site boundary, but could be easily avoided. Indirect impacts may also occur at a number of other SSSI's within close proximity to the nominated site, including Hallsenna Moor and St. Bees Head. These areas are primarily significant for their wetland habitats or important seabird populations, as is the case at St. Bees Head. Biodiversity will also be impacted at the local level if important habitats/species (for example UK Biodiversity Action Plan habitats/species or legally protected species) are present within or in close proximity to the nominated site.
- 5.16 Construction activities, such as earthworks, new buildings and associated infrastructure could lead to direct habitat loss, increased noise and visual disturbance and impacts on air and water quality (for example through increased nutrient input) in turn affecting sensitive ecosystems. Offshore development could lead to altered coastal processes and accelerated erosion, resulting in impacts to coastal habitats and species. During operation, cooling and discharge of heated water/routine discharge of pollutants is particularly significant and could affect aquatic habitats and species. Similarly, the abstraction of surface and groundwater could also affect habitats and species they support. In addition, throughout the construction, operation and decommissioning phases there is the potential for accidental release of pollutants into the environment which could have significant impacts on biodiversity.
- 5.17 Further studies carried out by the nominator through the EIA process will be required in order to fully understand the potential effects on designated sites and on biodiversity in the area as a whole. Design and mitigation measures should in the

first instance seek to avoid and minimise loss of habitat (particularly SAC/SPA habitats and species) and avoid disturbance of legally protected species. Once defined, mitigation measures could be implemented through an ecological mitigation and management plan or similar document. Opportunities for biodiversity enhancement may be possible.

- 5.18 A separate report, documenting the Habitats Regulation Assessment (HRA) for Sellafield<sup>38</sup> has been undertaken. This report should be referred to for further information relating to the effects of a new nuclear power station at Sellafield on European-designated habitat sites.
- 5.19 **Strategic Effects on Biodiversity and Ecosystems: The potential for adverse effects on the sites and species considered to be of UK-wide and European nature conservation importance (Drigg Coast SAC/SSSI, River Ehen SACs, River Ehen (Ennerdale Water to Keekle Confluence) SSSI, Low Church Moss SSSI, Hallsenna Moor SSSI and St. Bees Head SSSI) means that significant strategic effects on biodiversity cannot be ruled out at this stage of the appraisal. There is, however, potential for the mitigation or compensation of biodiversity effects on UK designated sites<sup>39</sup>, including the avoidance of Low Church Moss SSSI and careful siting of the development. Detailed baseline studies will form part of the project level Environmental Impact Assessment. The Habitats Regulations Assessment for Sellafield should be referred to for further details and advice for international designated sites.**

## Climate Change

- 5.20 The establishment of a new nuclear power station will contribute positively to the North West region's climate change objectives, as well as contributing to national targets. Short term increases in greenhouse gases during the construction and decommissioning phases of a new nuclear power station will be outweighed by the savings in overall emissions during the lifetime of the facility compared to fossil-fuel powered stations of equivalent output.
- 5.21 A new nuclear power station at Sellafield may result in emissions from the transport of goods and labour throughout the construction, operation and decommissioning phases. However, there is some potential for the nominator to promote increased use of public transport through provision of appropriate transport links to the power station.
- 5.22 Complementary carbon emissions mitigation measures should include sustainable design and construction, sustainable and low carbon technologies and transport, and potential increased investment in public transport and renewable energy services infrastructure.
- 5.23 **Strategic Effects on Climate Change: A new nuclear power station on the nominated site would have positive long-term effects on climate change during the operational stage compared to conventional sources of energy, contributing positively to the North West's climate change objectives.**

<sup>38</sup> Habitat Regulations Assessment Pilot Sellafield: HRA Screening and Appropriate Assessment Report.

<sup>39</sup> For European Sites, compensation measures, such as creation of replacement habitat, may only be considered if it has been established that there are no alternative solutions and the plan or project is necessary for imperative reasons of overriding public interest

## Communities: Population, Employment and Viability

- 5.24 Whilst likely to have significant positive effects for employment and local economy, there is some potential for short term negative effects during the construction phase. For example, the influx of construction workers will boost the local economy through the use of local support services, such as accommodation, local shops and leisure facilities; however, they will also put additional pressure on local services which may already be over-stretched.
- 5.25 The magnitude of these effects is reduced at a regional and national scale. Construction on the nominated site may lead to a shortage of construction workers to meet the needs of other industries and major projects within the region.
- 5.26 Job losses from closure of the existing power station adjacent to the nominated site are likely to be offset by labour demands from construction and operation of a new nuclear power station. However, the time lag between job losses and job creation and possible differences in skill requirements may require workers to seek temporary employment elsewhere.
- 5.27 Increased labour demand within the region could lead to improved provision of education and training for the local population. Upskilling of employees and contractors associated with the new nuclear power station would also be beneficial to the region as a whole.
- 5.28 Measures to maximise local benefits to the community could include the provision of training in relevant skills, enabling a higher proportion of construction and operational workforces to be locally based, and utilising local suppliers and contractors.
- 5.29 It is commonly perceived that proximity to a nuclear facility such as a power station would have an adverse effect on property values. However, the evidence for this is inconclusive and contradictory. A study of effects in America<sup>40</sup> found that property values were actually increased in the vicinity of nuclear facilities, although the authors caution that this finding is subject to several caveats including being based on a small sample and may be unrepresentative. It is suggested that in relatively poor areas, or where the local economy is depressed, the income generated by employment at a new nuclear facility may have a positive effect on local property values. For the present appraisal, any effect on property values is not considered to be strategically significant because it is limited to the local area.
- 5.30 Strategic Effects on Communities: Population, Employment and Viability: Positive effects of regional economic significance may occur when the project is considered cumulatively with other projects within the North West. A potential negative effect of regional significance is the project leading to a shortage of local construction labour available to other industries.**

## Communities: Supporting Infrastructure

- 5.31 Transport: There is potential for negative effects on local and strategic road infrastructure through increased congestion/disruption of traffic on the A595(T), particularly north of the nominated site towards Whitehaven where traffic is known to

<sup>40</sup> Bezdek, R.H. and Wendling, R.M. (2006) 'The impacts of nuclear facilities on property values and other factors in the surrounding communities', Int. J. Nuclear Governance, Economy and Ecology, Vol. 1, No. 1, pp.122–144

travel slowly during peak periods. The A595 south of the nominated site could also potentially be severely affected during construction with an increase in HGV traffic. In addition, some local settlements along the A595(T) may be negatively impacted as a result of the construction, operation and decommissioning traffic, for example, affecting access to local services. An increase in accident rates, involving both vehicles and pedestrians, may also arise resulting in a measurable human health effect. Notwithstanding this, the effect of a nuclear power station at the nominated site on the local road network, can likely be mitigated, throughout all stages of the development, through transportation plans, green travel plans, road safety improvements and consideration of alternatives to road, such as the existing coastal rail line or sea transport for the transport of aggregates and other construction materials.

- 5.32 Conventional waste: Waste material will be generated during construction, operation and decommissioning of a development, including sewage. Local impacts may be expected upon local regional facilities, including sewage treatment plants, however the scale of operation is not considered to be significant in the long/ medium term. Waste management facilities will be available to deal with construction projects for the foreseeable future and waste/recycling sites should not be detrimentally impacted. Good site practices and the site-specific EIA should look to further mitigate these risks and many impacts may be positive such as the generation of significant quantities of secondary aggregate during demolition.
- 5.33 Radioactive Waste<sup>41</sup>: The operation of a new nuclear power station at the nominated site would require the interim storage of spent fuel and intermediate level waste on site for a period of up to 100 years after operation has ceased. Nominators were asked that when nominating a site for the SSA, they make provision within the area of land nominated for the safe and secure storage of all the spent fuel and intermediate level waste produced through operation and decommissioning until it can be sent for disposal in a geological disposal facility. The detailed design and location of the storage facility within the nominated site boundary will be determined at the project level, within the design submitted by the developer. The generic process for dealing with all types of radioactive and hazardous waste arising from the operation and decommissioning of new nuclear power stations, (including gaseous and liquid radioactive discharges), are appraised in Chapter 7 of the Main AoS Report.
- 5.34 Electricity transmission: The development of a nuclear power station at Sellafield would require new power lines to be built, or existing lines to be upgraded, to connect the facility with the National Grid. The potential impact of new power lines will be considered in a separate Electricity Networks NPS.
- 5.35 **Strategic Effects on Communities: Supporting Infrastructure: There is the potential for adverse effects on supporting infrastructure, including conventional waste, transport and basic services. These effects are of local significance and mitigation opportunities are likely to be available.**

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<sup>41</sup> Radioactive waste is waste regulated under Environmental Permitting (England and Wales) Regulations 2010. The Radioactive Substances Act 1993 still applies in Scotland and Northern Ireland.

## Human Health and Well-Being

### Radiological Health Issues

- 5.36 Radiation occurs naturally in the environment. The Health Protection Agency (the HPA) which regularly reviews the radiation exposure of the UK population, has calculated that the overall average annual dose to a member of the general public from all sources of radioactivity is 2.7 millisieverts (mSv, a measure of dose) per year, about 84% of which is from natural sources and about 15% is from medical procedures. The HPA calculates that the average dose to a member of the public due to radioactive discharges from the nuclear power industry is less than 0.01% of the annual dose from all sources<sup>42</sup>.
- 5.37 By law, the radiation to which members of the public are exposed by the operations of a nuclear power station is limited to 1 mSv per year.<sup>43</sup> This limit applies to all members of the public, including those who receive the highest doses as a result of the location of their homes and their habits of life. It also applies to the cumulative effects of planned exposures from all sources of radiation, excluding medical exposures of patients and natural background radiation. Therefore, the exposures of people living near to a new nuclear power stations have to be less than the dose limit taking into account exposures from any other nearby sites and any past controlled releases. This statutory dose limit is reinforced by the concept of ALARP (As Low As Reasonably Practicable), which is used by the nuclear regulators to reduce doses to as low as is reasonably practicable.
- 5.38 The environment agencies run monitoring programmes to provide an independent check on the impacts of radioactive discharges. In 2008, they published a report covering 2007, showing that radiation doses to people living around nuclear sites remained below the statutory dose limit of 1 mSv per year<sup>44</sup>. In England and Wales, the main regulatory bodies are the Nuclear Installations Inspectorate (NII), a division of the Health and Safety Executive and the EA. 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 all disposals, including discharges to air, water and land, of radioactive waste off or on nuclear sites is regulated under the Environmental Permitting (England and Wales) Regulations 2010<sup>45</sup>. This regulatory system will apply to a potential new nuclear power station at Sellafield and should ensure that permitted radioactive discharges do not cause unacceptable risk to health.

<sup>42</sup> Ionising Radiation Exposure of the UK Population: 2005 Review HPA-RPD-001

<sup>43</sup> This is through the Ionising Radiations Regulations 1999 <http://www.statutelaw.gov.uk> (which includes all activities carried out under a nuclear site licence granted by the Nuclear Installations Inspectorate under the Nuclear Installations Act 1965) [http://www.opsi.gov.uk/RevisedStatutes/Acts/ukpga/1965/cukpga\\_19650057\\_en\\_1](http://www.opsi.gov.uk/RevisedStatutes/Acts/ukpga/1965/cukpga_19650057_en_1), the Radioactive Substances Direction 2000

<http://www.defra.gov.uk/ENVIRONMENT/radioactivity/government/legislation/pdf/rsd2000.pdf> and the Radioactive Substances (Basic Safety Standards) (Scotland) Regulations 2000

<http://www.opsi.gov.uk/legislation/scotland/ssi2000/20000100.htm>

<sup>44</sup> Radioactivity in Food and the Environment, 2007 RIFE-13, Environment Agency, Scottish Environment Protection Agency, Food Standards Agency, Northern Ireland Environment Agency 2008 <http://publications.environment-agency.gov.uk/pdf/GEHO1108BPBH-e-e.pdf?lang=e> (see Table S.1 "Radiation doses due to discharges of radioactive waste in the United Kingdom, 2007" of this publication).

<sup>45</sup> The Radioactive Substances Act 1993 applies in Scotland and Northern Ireland [http://www.opsi.gov.uk/acts/acts1993/ukpga\\_19930012\\_en\\_1](http://www.opsi.gov.uk/acts/acts1993/ukpga_19930012_en_1)

### Regulatory Justification

- 5.39 European Council Directive 96/29/Euratom of 13 May 1996 (the Basic Safety Standards Directive)<sup>46</sup> requires Member States to ensure that, in advance of being first adopted or first approved, all new classes or types of practice resulting in exposure to ionising radiation are justified by their economic, social or other benefits in relation to the health detriment they may cause. This process is known as Regulatory Justification and the Secretary of State for Energy and Climate Change has decided, following public consultation, that two nuclear reactors, Westinghouse's AP-1000 and Areva's EPR, should be Justified<sup>47</sup>.
- 5.40 The basic safety standards for the protection of the workforce and general public against the dangers of ionising radiation set out in the Directive are further enforced before, during and after operation of nuclear power stations, including the management and disposal of waste by the UK's regulatory framework. This aims to reduce potential health impacts to acceptable levels and ensure that radiation doses are within internationally agreed limits.

### Construction and Operational Effects

- 5.41 During the operation of a nuclear power station, there is a risk of unplanned radioactive discharges into the environment which could potentially lead to adverse health impacts. However, the risk of such an accident is judged to be very small because of the strict regulatory regime in the UK. The 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.
- 5.42 The transportation of radioactive materials to and from a nuclear power station increases the possibility of an accident resulting in an unplanned radioactive discharge. However, the safety record for the transport of nuclear material suggests that the risks are very low. Data from the Radioactive Materials Transport Event Database (RAMTED) for the period 1958 to 2008 showed that of the recorded 913 events associated with the transport of radioactive materials no 'significant dose events' were associated with the nuclear power industry<sup>48</sup>.
- 5.43 The scale of construction work associated with a potential new nuclear power station at Sellafield may result in higher risk of health and safety incidents at the site. Construction would be subject to the Construction (Design and Management) Regulations and other relevant regulations applicable to construction.
- 5.44 During the operation of a potential nuclear power plant at Sellafield, activities will be regulated in accordance with the Health and Safety at Work Act 1974, Nuclear Installations Act 1965 and the Ionising Radiations Regulations 1999. The potential operator must have a Nuclear Site Licence from the Nuclear Installations Inspectorate (NII) prior to the construction commencing and this licence will only be granted if the NII is satisfied that the power station can be built, operated and

<sup>46</sup> 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 (OJ L 159, 29.6.1996, p.1) [http://ec.europa.eu/energy/nuclear/radioprotection/doc/legislation/9629\\_en.pdf](http://ec.europa.eu/energy/nuclear/radioprotection/doc/legislation/9629_en.pdf)

<sup>47</sup> [www.decc.gov.uk](http://www.decc.gov.uk)

<sup>48</sup> <http://www.hpa.org.uk/HPA/Publications/Radiation/HPARPDSeriesReports/>

decommissioned safely with risks being kept to 'as low as reasonably practicable' (ALARP) at all times. The licence will, therefore, have conditions attached to it which will allow the NII to monitor safety risks throughout the lifetime of the project.

- 5.45 It is possible that the proposed power station will require an upgrade to existing electricity transmission lines or additional transmission lines to link its output to the National Grid. The potential impact of new power lines will be considered in a separate Electricity Networks National Policy Statement, due to be published by the Government in autumn 2009. Given the current uncertainty regarding the health effects of prolonged low level exposure to electromagnetic fields (EMFs) it is recommended that, in keeping with Health Protection Agency advice<sup>49</sup>, a precautionary approach is adopted to the routing of any required power lines.
- 5.46 The presence of, and more particularly the construction of, a new nuclear power station at the Sellafield site will increase community disturbance to some degree. Such disturbance may include noise and vibration, dust in the construction phase and increased traffic in all phases (including an increased risk of traffic accidents). To mitigate construction phase disturbances an environmental management plan should be developed, implemented and monitored for effectiveness throughout the construction period. Potential traffic issues in all the project's phases can be mitigated through the adoption of a transport plan aimed at minimising community disturbance whilst also promoting 'green' travel.
- 5.47 Noise emissions will arise from both the construction and operational phases. Construction noise will arise from plant/activity and transportation sources. Similarly, operational noise levels will arise from both fixed installation and mobile transport sources. Construction noise will be variable and transient in nature and will need to be mitigated by the use of good construction practice, regulation and timing of construction operations, the use of noise controlled plant and equipment and noise and vibration monitoring. These would be strategically managed through the construction management plan procedures.
- 5.48 Noise emissions from nuclear power stations are relatively low. Minimisation of operational noise emissions would require consideration at the design/ layout stage of the scheme. In particular, significant benefits would result if potential sources of noise emissions could be reduced through a combination of engineering design solutions. These could include the careful siting of noise emitting plant within the overall facility (at high or low level and in relation to local noise sensitive locations) and careful selection of trafficking routes and access points. Particular emphasis would need to be taken of any low frequency and constant emission sources. Overall background noise and noise prediction assessment, following relevant international (ISO) and British (BS) standards, would need to be applied so that the noise impact of the proposals could be determined for planning purposes. Given the relatively lightly populated locality, it is considered that noise and vibration impacts would not be a significant issue and pose a constraint to development at Sellafield.

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<sup>49</sup> [http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb\\_C/1195733817602](http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb_C/1195733817602)

### Local Health and Recreation

- 5.49 With regard to recreation, there is a potential impact associated with the Cumbria Coastal Way<sup>50</sup>, which passes the nominated site. It is likely that this path may need to be closed during some phases of power station construction, but this effect will be temporary and can readily be mitigated by providing a bypass path around the nominated site.
- 5.50 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 and lead to community integration and conflict issues. 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 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.
- 5.51 It is possible that the presence of a nuclear power plant may lead to increased stress levels in certain individuals, due to potential perception of risk associated with living or working near a power station. However, there is little literature available on this potential impact which suggests that it has not been a significant problem in the past. In any event, in the case of the nominated site, people living and working nearby have had a long time to get used to there being an adjacent nuclear plant so this is unlikely to be a problem at this location.
- 5.52 Due to the presence of existing nuclear facilities at Sellafield, including reprocessing, low level waste disposal and former power stations under decommissioning, a skilled workforce is already present in the area which is economically dependent on the site. The existing site also draws employees from the nearby towns of Barrow, Workington, Whitehaven and Egremont. It is likely that building, operating and decommissioning a new nuclear power station at Sellafield will maintain and probably lead to an increase in employment, community wealth, housing stock and other associated neighbourhood infrastructure. These positive effects on the community are likely to be much more significant than any potential negative consequences of the project assuming there are no adverse effects on the health of the local population.
- 5.53 Strategic Effects on Human Health and Well-Being: The rigorous system of regulation of routine discharges from the new nuclear power station at Sellafield should ensure that there are no unacceptable risks to the health of the local population when the plant is operating normally. There is also a very small risk of adverse health impacts arising from an accidental release of radiation but the multiple safety features within modern nuclear plants makes such an event exceedingly unlikely. It is possible that the presence of a nuclear power plant may lead to increased stress levels in certain individuals although this is less likely at this site where there is a history of nuclear power generation. Overall, the likely enhancement in employment, community wealth,**

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<sup>50</sup> This path might in future form part of an English coastal route, in accordance with the objectives of the Marine and Coastal Access Act 2009



**housing stock and other associated neighbourhood infrastructure should improve community well-being and health generally.**

## Cultural Heritage

- 5.54 The main effects of the development would be local and within the footprint of the facility on the nominated site, although any physical effect on the historic landscape could be of regional importance. Potential setting effects upon scheduled monuments, the conservation areas and listed buildings could, depending on distance and sight lines, could be of regional or national importance. However, this could be mitigated by placement of the new station adjacent to existing nuclear facilities and through appropriate planning and design of construction activities and operational facilities, including adherence to the principles of good design<sup>51</sup>. Detailed assessment, including consultation of the Cumbria Historic Landscape Characterisation, will be required at project level EIA stage.
- 5.55 In addition there may be potential off-site effects on cultural heritage assets caused by an increase in traffic and the development of new infrastructure. Detailed assessment will be required at the project level EIA stage. An archaeological (buried) resource could be present within the nominated site. Detailed investigations (including consultation with the Local Authority Archaeologist, geophysical survey, trial trenching etc.) may be required to inform the project level EIA. Depending on the results this may lead to an excavation prior to construction and/or watching brief during the construction phase (during ground preparations and excavations).
- 5.56 Strategic Effects on Cultural Heritage: The AoS has identified potential adverse effects on the settings of cultural heritage features of regional and national importance, as well as on buried archaeology of potentially high importance. Further detailed assessment at project level will be required.**

## Landscape

- 5.57 During construction and operation, the main direct impacts on landscape from a new power station and its associated infrastructure would be local, for example the loss of farmsteads, farmland, hedgerows and tree belts, and areas of buffer planting. However, there are likely to be long lasting adverse direct and indirect landscape and visual impacts on the surrounding area, including many areas of the Lake District National Park, with limited potential for mitigation. These impacts are likely to include adverse effects from the necessary additional grid connectivity infrastructure and potential cumulative impacts from other infrastructure project including other power stations along the coastal plain. The existing power station and reprocessing plant already make a prominent feature in views from western areas of the National Park and more distant high fells, such as Scafell Pike. Further development is highly likely to lead to a perceptible deterioration in some views, which could not be mitigated, given the scale of possible new buildings and infrastructure.
- 5.58 In light of the potential scale of a new power station on the nominated site, and the extent of the likely transmission infrastructure, fully effective mitigation of adverse effects during the construction and operational phases is unlikely. The decommissioning of the facilities may allow some landscape restoration of previously

<sup>51</sup> Adherence to good design is outlined in Planning Policy Statement 1: Delivering Sustainable Development

developed areas in the long term. However, long term land uses for the restored areas are difficult to predict.

- 5.59 Strategic Effects on Landscape: The AoS has identified potential adverse effects on landscape. These include lasting direct and indirect adverse landscape and visual impacts on the surrounding area, including the nationally significant Lake District National Park. There are also likely to be cumulative impacts associated with other onshore and offshore energy projects. Overall, the new power station would be seen in the context of the existing large scale nuclear complex. However, further development is still likely to lead to a perceptible deterioration in some views, which would not be able to be fully mitigated, given the scale of possible new buildings and infrastructure. Whilst this is of potential wider significance due to the proximity of the National Park, the direct effects (with the exception of potential additional grid connectivity) will be felt primarily at the local level. The nature, magnitude and significance of these effects including the cumulative effects need to be assessed fully as part of the landscape and visual impact assessment (LVIA) that would form part of a full EIA.**

## Soils, Geology and Land Use

- 5.60 The construction of a new power station within the nominated site will result in the loss of 30-50ha of Grade 4 agricultural land.
- 5.61 Construction at Sellafield and the associated infrastructure (including transmission lines/towers) could lead to the direct loss of soil structure. This may include impacts on soils that maintain terrestrial habitats (see the biodiversity appraisal of this AoS Report). Effects could be mitigated through limitation of the footprint of the development, thereby reducing the area of soils affected.
- 5.62 The development of the nominated site may result in the increased risk of pollution and potential contamination of soils and controlled waters. These risks can be mitigated by the use of Environmental Management Plans during the construction and decommissioning stages of the site redevelopment. Any decommissioning would be required to meet specific clean-up criteria approved by the regulators.
- 5.63 Blight of land is a likely effect of the development of a new nuclear power station on the nominated site, but is considered of local or district significance. Likewise, effects on existing land uses including surrounding tourist areas, are considered to be of local impact only.
- 5.64 Strategic Effects on Soils, Geology and Land Use: 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.**

## Water Quality and Resources

- 5.65 It is not envisaged that the nominated site will require extensive coastal protection measures that will interfere in any detrimental way to the sediment transport pathways that could impact on the estuarine sediment dynamics that are host to the protected flora and fauna.

- 5.66 Any marine loading facilities that might be required would need to consider the impact on coastal processes. Any structures situated across the beach face from the nominated site out into the Irish Sea to where the depth of water is great enough for the passage of vessels, will greatly impact on the longshore sediment transport processes and reduce the amount of sediment input to other sections of the coastline. Sand will most likely pile up on the updrift side of the structure causing a deficit of sediment on the down drift side of the structure which if unaided would severely reduce the amount of sediment reaching the down-drift areas. This is one of the primary mechanisms for shoreline erosion. These processes if disrupted by any proposed coastal engineering works will directly impact on the existing natural defence barriers and can and can result in changes in vegetation composition or loss of habitat to other sensitive areas. In the case of the cooling water facilities, a detailed sediment transport model should be incorporated to assess the impacts that the proposed engineering works would have on the sediment transport regime and surrounding areas that may also include marine and estuarine/terrestrial protected areas.
- 5.67 Cooling water is likely to be abstracted from coastal waters, under Environment Agency licence. Returning cooling water off the Cumbria Coast at elevated temperatures could potentially bring significant environmental and ecological impacts, particularly on aquatic biodiversity. Past assessments have indicated the likely outline engineering requirements to minimise these impacts. These include options to minimise the disturbance of existing radioactive sediments close to the nominated site on the seabed and spacing of outfalls to achieve thermal and chemical dispersion.
- 5.68 To maintain water quality standards, a more detailed appraisal is required at the project EIA level to assess the implications of any future discharges, including thermal discharges, and taking into account existing discharges from the current facilities and from Heysham. This process will include an assessment of the impacts of any discharges to the aquatic environment, including impacts on specific designated sites under both the Habitats and Shellfish Directives. Any future thermal discharge will require an Environmental Permit<sup>52</sup> from the Environment Agency and will need to meet existing regulatory standards and the requirements of the Water Framework Directive, including the objective of no deterioration in ecological status (whichever is the most stringent). In addition to the thermal effects from direct cooling, there are other potential water quality issues, for example from discharge of radioactive or non-radioactive materials, such as anti-fouling agents, associated with the cooling water process. These discharges will also be subject to permitting by the EA.
- 5.69 The Marine and Coastal Access Act 2009 makes provision for the production of Marine Policy Statements. It is intended to produce a Marine Policy Statement (MPS) that, for the first time, brings together the policies for all UK administrations. The second stage in the new planning system will consist of a series of Marine Plans. The Marine Management Organisation (MMO) set up under the Marine and Coastal Access Act, is responsible for preparing marine plans for the English inshore and offshore regions according to the policies and objectives set out by the Government. Similar plans will be produced for Welsh marine waters. The MPS will

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<sup>52</sup> The Environmental Permitting (England and Wales) Regulations 2010 came into force on 6 April 2010 and cover all water discharge activities. Water discharge consents will become Environmental Permits, and applications for new discharges will fall under the new regulations

interact with National Policy Statements and, in reaching its decisions, the IPC must have regard to the MPS but, subject to certain exceptions, must decide in accordance with the relevant National Policy Statements.

- 5.70 Potential impacts may also arise with regard to the rivers Calder, Irt and Ehen, in terms of their surface water and groundwater, and the habitats and species they support. In addition, abstraction of water has the potential to impact on the West Water, Crummock Water and River Ehen SAC/SSSI sites. A full assessment of the potential impacts is required at project EIA level.
- 5.71 The development of a new nuclear power station on the nominated site may have the short-term effect of increasing water demand during the construction phase due to an increased population. The potential magnitude and duration is dependent on the timing of new development in relation to the activities (operation or decommissioning) of the existing nuclear facilities. It is anticipated that no adverse long-term impacts are expected on water resources, but this will need to be confirmed as part of the planning for this site. Similar comments apply to wastewater production from the nominated site, although there is likely to be a short-term increase in wastewater production due to an increased population during the construction phase.
- 5.72 It is unlikely that any additional water resources to the current supply from West Water will be available for use at the nominated site. Although the West Cumbria Water Resource Zone does have a significant deficit, the water companies will try to satisfy additional requirements for water demand from large industrial clients and United Utilities has a number of schemes in place to address projected supply demand balance deficit through to 2032, including leakage reduction and the implementation of the South Egremont groundwater scheme. The magnitude and timing of water supply needs through any development of the nominated site will need to address these regional water resources issues. A more detailed appraisal of options of supply and the likely requirements of potable water quality is required at project EIA level.
- 5.73 There is no known use made of the groundwater resources underlying the site for water supply, but springs on the beach are fed by groundwater and groundwater may also flow into the lower reaches of nearby rivers. There may be some disruption of local groundwater flows during construction, but in the long term impacts are expected to be minimal.
- 5.74 **Strategic Effects on Water Quality and Resources:** The AoS has identified potential adverse 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.

## Flood Risk

- 5.75 A new nuclear power station on the nominated site is not likely to increase the risk of flooding. However, as a result of climate change and sea level rise, flood risks to the nominated site over the lifetime of the development are likely to increase.
- 5.76 Several minor watercourses cross the nominated site, for which the Environment Agency has no hydraulic modelling information. These will need to be assessed as part of a site level flood risk assessment. Likewise, flood risk from the River Ehen to the west will need to be assessed within a site level flood risk assessment.
- 5.77 The nominated site is not currently situated in an area the Environment Agency considers to be at risk from coastal flooding, but upgraded defences may be required to counteract coastal retreat as a result of longer term climate change impacts on sea-level rise. These defences have the potential to modify existing coastal hydrodynamics and associated movement of sediment, which may have secondary effects on marine ecosystem structure and functioning. However, the use of an appropriate design, construction and management techniques and a full understanding of the hydrodynamics and sediment transport within the coastal zone could minimise the potential effects.
- 5.78 In the absence of any formal or informal defensive works, the coastline is expected to remain relatively stable. While storm events would be expected to draw-down shingle from the beach, crest, erosion rates would remain low, although the beachside properties at the foot of the railway embankment may become damaged. It is anticipated that long term sea level rise may impact the coastline, resulting in some observable coastal change, and exposure of the railway embankment to wave action. With continued present management practices the SMP predicts that defences will continue to protect and maintain the railway embankment, although further extension to defences may be required.
- 5.79 The North West England and North Wales Coastal Group are currently preparing a revised Shoreline Management Plan (Phase 2) for the coast between Great Orme's Head and the Scottish Border, taking in the coastline potentially affecting the nominated site. The revised SMP will provide assessments of existing defences and the residual life of assessment along the shoreline in the event of no active intervention and with continued present management and also an assessment of shoreline stability taking into account projections derived from the UK Climate Impacts Programme (UKCIP). It will be advisable when the report becomes available to reassess the stability of the present coastline at Sellafield in order to reassess whether there is a need for coastal protection measures against coastal erosion.
- 5.80 Further mitigation with respect to flood risk could be provided by local land raising at the nominated site.
- 5.81 **Strategic Effects on Flood Risk: The AoS has 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 but the effectiveness is unknown at this stage.**

## Key Interactions between Sustainable Development Themes

- 5.82 Interactions and synergistic effects can occur between the different topics or sustainable development themes being appraised. A number of interactions and potential interactions have been identified for the AoS Site Reports. For example, rising sea levels and increased predictions for coastal flooding due to climate change will require new coastal defences. Construction of coastal defences could have adverse effects on water quality and biodiversity through changes to hydrology, sedimentation and loss of habitat.
- 5.83 Where applicable, key interactions have been considered in the topic-specific paragraphs above.

## Interactions and Cumulative Effects with other Key Regional Plans, Programmes and Projects

- 5.84 Interactions and cumulative effects can occur between the plan or proposal being appraised and other key plans and policies. This AoS has identified other relevant plans and programmes with sustainability objectives, which need to be considered. These are reported in Section 3: Policy Context and Appendix 3: Plans and Programmes Review. The key plans that might lead to cumulative effects when combined with the revised draft Nuclear NPS and the nominated site at Sellafield were identified as follows:
- River Wyre to Walney Island Shoreline Management Plan, North West and North Wales Coastal Group (2000)
  - River Basin Management Plan for the North West, Environment Agency (2009)
  - Water Resources Management Plan, United Utilities (2009)
- 5.85 Other key projects that might have significant interactions with the proposals for a new nuclear power station at Sellafield were identified as follows:
- The existing nuclear facilities at Sellafield and Drigg.
  - Nominations for new nuclear power stations at Heysham (located to the south, on the Lancashire coast - see Figure 1)
  - Existing and proposed offshore wind farm projects – Walney I and II (operational and approved), Ormonde (approved), West of Duddon Sands (under construction), Solway Firth/Robin Rigg A and B (under construction), plus Round 3 Potential Development Zone 9 (Irish Sea).
  - Major projects listed within Cumbria's revised Economic Strategy and Sub-Regional Action Plan (February 2009), including:
    - Britain's Energy Coast™ Masterplan - a £2 billion package of regeneration projects to establish West Cumbria as a centre of excellence for nuclear and other energy technologies including wind power, tidal, oil and gas<sup>53</sup>. The presence of at least one new nuclear power station within Cumbria is a key component, and driver, of the Masterplan
    - Academy Schools – Barrow, Carlisle, West Cumbria and Energus, in Lillyhall
    - Waterfront Business Park and Marina Village, both part of the Waterfront Barrow-in-Furness
    - Carlisle Airport

<sup>53</sup> [www.britainsenergycoast.com](http://www.britainsenergycoast.com)

- New hospital and health campus in West Cumbria
- Housing Market Renewal – Barrow and West Cumbria;
- Carlisle Northern Development Route
- M6 Employment Sites – Junction 44

5.86 The appraisal of cumulative sustainability effects arising through interactions between the nominated site at Sellafield and the other key plans, programmes and projects is presented in Table 5.2.

**Table 5.2: Interactions with Other Key Regional Plans, Programmes and Projects**

<b>AoS Sustainable Development Theme</b>	<b>Interactions and Cumulative Effects</b>
<b>Biodiversity and Ecosystems</b>	<ul style="list-style-type: none"> <li>• Although no common sites of European nature conservation importance are assessed as being potentially affected by both power stations, there may be significant adverse effects on wider biodiversity if both Sellafield and Heysham nuclear power stations are developed.</li> <li>• Coastal and inland designated areas are likely to be affected by other energy proposals including tidal, wave, biomass and wind farm (onshore and offshore) proposals as part of the wider Britain's Energy Coast™ Masterplan, plus other potential nuclear power stations within Cumbria and the region. The cumulative effects on biodiversity could be significant</li> <li>• Potential cumulative effects on biodiversity and fisheries with existing facilities at Sellafield and Drigg</li> <li>• Potential conflicts with the North West Biodiversity Action Plan which aims to protect regional habitats and species</li> </ul>
<b>Climate Change</b>	<ul style="list-style-type: none"> <li>• Coastal defence requirements of other projects (for example developments as part of the Energy Coast™ Masterplan) may have adverse cumulative effects on coastal processes, hydrodynamics and sediment transport</li> <li>• Reductions in greenhouse gas emissions, resulting from the cumulative benefit of a nuclear power programme, will have positive long-term effects during the operational stage when compared to fossil fuel powered plants</li> <li>• Locating a new nuclear power station at the nominated site could have a positive multiplier effect on the further investment and implementation of renewable (low carbon) energy sources in the region (as proposed within the Britain's Energy Coast™ Masterplan).</li> </ul>
<b>Communities: Supporting Infrastructure</b>	<ul style="list-style-type: none"> <li>• Construction workforce supply shortages may result, particularly with regard to specialist workers required for possible multiple builds within the region as part of the nuclear new build programme. Transient workforces may put additional strain on local services</li> <li>• Interactions with Britain's Energy Coast™ Masterplan may result in improvements in transport links, in rail, air, road and freight movements, and the range of housing types available within the area. Other positive benefits to the community are also likely to be generated</li> <li>• Decommissioning of existing nuclear facilities at Sellafield may coincide with construction of a new nuclear power station to create adverse effects on supporting infrastructure, in particular transport networks</li> </ul>
<b>Human Health and Well-Being</b>	<ul style="list-style-type: none"> <li>• Enhanced prosperity and long-term employment benefits resulting from the plans are likely to have positive effects on health and well-being.</li> </ul>
<b>Landscape</b>	<ul style="list-style-type: none"> <li>• In-combination effects through associated off-site grid connectivity works carried out by the National Grid.</li> </ul>



AoS Sustainable Development Theme	Interactions and Cumulative Effects
	<ul style="list-style-type: none"> <li>• The coastline and adjoining lowland/upland landscape including the Lake District National Park is likely to be affected by other energy projects including: tidal, wave, biomass and additional onshore and onshore/offshore wind farm proposals as part of the wider West Cumbria Energy Coast Master plan. Also, other potential nuclear sites in this area will add further cumulative effects.</li> </ul>
<p><b>Water Quality and Resources</b></p>	<ul style="list-style-type: none"> <li>• Water supply issues may result during the construction stages when large increases in local population are likely.</li> <li>• Discharges, including thermal discharges, are already present associated with the existing facilities at Sellafield</li> </ul>

## 6 Summary Appraisal of Sustainability, Key Findings and Possible Mitigation

- 6.1 This Section summarises the key findings of the AoS assessment and explores possible mitigation which could be undertaken to reduce impacts. Table 6.1 presents a summary of significance of potential effects and Table 6.2 provides a more detailed breakdown of the potential effects and possible mitigation,
- 6.2 The Appraisal of Sustainability has explored the potential effects, adverse and beneficial, of building a new nuclear power station at Sellafield. Certain effects were identified as potentially significant at the local level and it is recommended that these need to be further considered by the developer, regulators and the decision-maker, the Infrastructure Planning Commission, at the project level.
- 6.3 The Appraisal of Sustainability process has included recommendations to inform the development of the revised draft Nuclear NPS. This site report for Sellafield has helped to inform the decision-making for the Strategic Siting Assessment. It has included advice as to the strategic significant effects arising from the construction of a new nuclear power station at Sellafield, and suggestions for how adverse effects may be mitigated, including proposed mitigation measures which could be considered as part of project level Environmental Impact Assessment.
- 6.4 A number of the strategic effects identified for Sellafield will be similar across all the sites, including positive effects for employment and well being. However a number of potential strategic effects have been identified that are of particular note for the nominated site at Sellafield. These are discussed below:
- 6.5 Of particular note for the revised draft Nuclear NPS are potential negative effects on three protected nature conservation sites, including Drigg Coast and the River Ehen; and effects on water quality and migratory fish in nearby coastal waters due to the abstraction and release of sea water for cooling. Although no common sites of European nature conservation importance are assessed as being potentially affected by both power stations, there may be significant adverse effects on wider biodiversity if both Sellafield and Heysham nuclear power stations are developed.
- 6.6 The risk of flooding due to rising sea levels is considered relatively low at Sellafield and existing hard flood defences are in place, which may require upgrading. Mitigation opportunities could be available following further study at the project level.
- 6.7 The development would be visible from parts of the nationally significant Lake District National Park and the impact could not be fully mitigated. Although this would be set in the context of the extensive existing nuclear facilities at Sellafield, which would reduce the severity of the impact, further development is still likely to lead to a perceptible deterioration in some views. This is of potential wider (national) significance due to the proximity of the National Park, although the direct effects (with the exception of potential additional grid connectivity) will be felt primarily at the local level.
- 6.8 There will be significant positive effects associated with long term employment and enhanced prosperity for communities locally. These benefits are likely to be significant at the sub-regional level if two power stations (Sellafield and Heysham)

are built in the North West. , Benefits may be further enhanced if other proposals for regeneration in the region go ahead.

- 6.9 There remains some uncertainty relating to the significance of some effects and the most appropriate mitigation. It is expected that the mitigation measures will be refined iteratively as part of the development of the proposals for the nominated site, and will be assessed further in the project level EIA.
- 6.10 Table 6.1 provides a summary of the significance of the overall environmental and sustainability effects associated with the Sellafield site. Each sustainable development theme and each development stage has been considered. The symbols and colours used are explained in the key.

**Table 6.1: Summary of the Significance of Potential Strategic Sustainability Effects**

Sustainable Development Themes:	Significance of potential Strategic effect at each Development Stage:		
	Construction	Operation	Decommissioning
Air Quality	-	-?	-?
Biodiversity and Ecosystems	--?	--?	--?
Climate Change	-	++	-?
Communities: Population, Employment and Viability	+	+	0
Communities: Supporting Infrastructure	-?	-?	-?
Human Health and Well-Being	+	+	+
Cultural Heritage	-	-	-
Landscape	--	--	0?
Soils, Geology and Land Use	-	-?	-
Water Quality and Resources	-	-	-
Flood Risk	-	-	-
<b>Key: Significance and Categories of Potential Strategic Effects</b>			
++	Development would resolve an existing sustainability problem; effect considered to be of regional/national/international significance		
+	No sustainability constraints and development acceptable; effect considered to be of regional/ national/international significance		
0	Neutral effect		
-	Potential sustainability issues, mitigation and/or negotiation possible; effect considered to be of regional/national/international significance		
--	Problematical because of known sustainability issues; mitigation or negotiation difficult and/or expensive; effect considered to be of regional/national/ international significance		
<b>Uncertainty</b>			
?	Where the significance of an effect is particularly uncertain, for example because insufficient information is available at the plan stage to fully appraise the effects of the development or the potential for successful mitigation, the significance category is qualified by the addition of '?'		

6.11 Potential environmental and sustainability effects considered to be of a wider strategic significance were also identified. These are summarised in Table 6.2. This table includes a summary of how the potential adverse effects may be mitigated and includes possible feasible suggestions for mitigation to be considered at the project level. Some of these mitigation options could be addressed by the HSE, EA, HPA and others when they consider the development consent application stage. Other mitigation options could be proposed by the developer as part of the project design process and through EIA. However, mitigation measures can in themselves produce impacts and these would need to be assessed at the project level.

6.12 At this strategic level of appraisal, there are some uncertainties on the significance of some impacts and the effectiveness of suggested mitigation measures. Further

detailed studies should therefore be carried out by the developer and the regulators at the project level stage.

- 6.13 Mitigation measures should be considered in all stages of the project with the aim to develop a strategy that avoids impacts, and if they cannot be avoided, to reduce them. The suggested mitigation measures shown in Table 6.2 include examples from all levels of the mitigation hierarchy that comprises:
- Enhance
  - Avoid
  - Reduce
  - Repair
  - Compensate
- 6.14 Options for mitigating through project design or management should firstly consider avoidance, addressing impacts at source before considering impacts at the receptor, and ensuring that a commitment is made to implementing and monitoring the effectiveness of the proposed mitigation. For European Sites, compensatory measures to offset damage to biodiversity and ecosystems and ensure coherence of the Natura 2000 network may only be considered if it has been established that there are no alternative solutions and the plan or project is necessary for imperative reasons of overriding public interest.

**Table 6.2: Summary of Potential Strategic Significant Effects and Mitigation Possibilities (for Adverse Effects)**

Potential Strategic Significant Effects (adverse and beneficial effects)	Suggested Mitigation for Adverse Effects and Recommendations for the revised draft Nuclear NPS and IPC
<b>Air Quality</b>	
<p><b>Adverse Effects:</b></p> <ul style="list-style-type: none"> <li>• Potential for related effects on national and European-designated wildlife sites due to increase in airborne pollutants and nutrients during construction</li> </ul>	<p><b>Mitigation Possibilities:</b></p> <ul style="list-style-type: none"> <li>• Please refer to mitigation measures contained in the Biodiversity and Ecosystems sections of this AoS Report</li> </ul>
<ul style="list-style-type: none"> <li>• Potential accidental release of radioactive emissions could have a significant strategic effect on air quality</li> </ul>	<ul style="list-style-type: none"> <li>• The nuclear regulators 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.</li> </ul>
<b>Biodiversity and Ecosystems</b>	

Potential Strategic Significant Effects (adverse and beneficial effects)	Suggested Mitigation for Adverse Effects and Recommendations for the revised draft Nuclear NPS and IPC
<p><b>Adverse Effects:</b></p> <ul style="list-style-type: none"> <li>Noise, visual and light disturbance during construction on fauna and protected species</li> </ul>	<p><b>Mitigation Possibilities:</b></p> <ul style="list-style-type: none"> <li>Nominator should ensure further studies to fully assess impacts; careful design of the nominated site to avoid entering sensitive areas (for example, Low Church Moss SSSI); Construction Environmental Management Plan; habitat replacement if required; Ecological Mitigation and Management Plan adopted</li> </ul>
<ul style="list-style-type: none"> <li>Loss, damage or alteration of important marine and terrestrial habitats and subsequent disturbance to protected and/or species due to new buildings and infrastructure, including potential offshore infrastructure and coastal defences</li> </ul>	<ul style="list-style-type: none"> <li>Nominator to ensure further studies to assess operational impacts of new build and essential infrastructure</li> </ul>
<ul style="list-style-type: none"> <li>Abstraction of water and discharges of heated water could impact on nationally and European designated sites and aquatic ecosystems</li> </ul>	<ul style="list-style-type: none"> <li>Further studies on behalf of nominator required to assess impacts. Suitable intake system design could be adopted</li> <li>Impacts to be avoided through safe operations; further water quality studies required to determine impacts; water quality monitoring</li> </ul>
Climate Change	
<p><b>Adverse Effects:</b></p> <ul style="list-style-type: none"> <li>Potential short term increases in emissions during construction and decommissioning</li> </ul>	<p><b>Mitigation Possibilities:</b></p> <ul style="list-style-type: none"> <li>Monitor greenhouse gas emissions</li> </ul>
<ul style="list-style-type: none"> <li>Emissions from the transport of goods and labour throughout construction, operation and decommissioning phases</li> </ul>	<ul style="list-style-type: none"> <li>Green travel plans</li> <li>Further investment in public transport</li> </ul>
<p><b>Beneficial Effects</b></p> <ul style="list-style-type: none"> <li>A nuclear power station on the nominated site would result in lower greenhouse gas emissions during the operational stage compared to fossil fuel sources, with positive long-term effects on climate change</li> </ul>	
Communities: Population, Employment and Viability	
<p><b>Adverse Effects:</b></p> <ul style="list-style-type: none"> <li>Pressure on basic services from likely large scale in-migration of construction workers</li> </ul>	<p><b>Mitigation Possibilities:</b></p> <ul style="list-style-type: none"> <li>Potential negative effects/difficulties in sourcing labour need to be addressed with regard to the effects on the local/regional construction industry</li> </ul>

Potential Strategic Significant Effects (adverse and beneficial effects)	Suggested Mitigation for Adverse Effects and Recommendations for the revised draft Nuclear NPS and IPC
<ul style="list-style-type: none"> <li>Project may lead to a shortage of local construction workers to meet the needs of other industries and major projects in the region</li> </ul>	<ul style="list-style-type: none"> <li>Measures to address likely difficulties in sourcing labour and the effects of this on the local/regional construction industry</li> </ul>
<p><b>Beneficial Effects:</b></p> <ul style="list-style-type: none"> <li>Short to medium-term positive effects due to creation of new jobs for local and regional populations</li> <li>Provision of education, training, upskilling for employees and contractors in the region</li> <li>Positive multiplier effects as income from new population of workers will help support local economy</li> <li>Potential for property values to increase within vicinity of nominated site, based on previous studies support local economy</li> </ul>	
<p><b>Communities: Supporting Infrastructure</b></p>	
<p><b>Adverse effects:</b></p> <ul style="list-style-type: none"> <li>Potential significant impacts on national road infrastructure due to increased congestion/traffic movements</li> </ul>	<p><b>Mitigation Possibilities:</b></p> <ul style="list-style-type: none"> <li>Further studies required to assess impacts on road infrastructure</li> <li>Transport Management and Green Travel Plans to minimise effects</li> <li>Consideration of port and rail transport options</li> </ul>
<ul style="list-style-type: none"> <li>Potential for significant impacts regarding radioactive waste and conventional waste</li> </ul>	<ul style="list-style-type: none"> <li>Conventional waste: good site practices, implementation of waste hierarchy (reduce, reuse, recycle) and waste management</li> <li>Radioactive waste: appropriate storage and management</li> </ul>
<p><b>Human Health and Well-Being</b></p>	
<p><b>Adverse effects:</b></p> <ul style="list-style-type: none"> <li>Possibility of local and regional health risks from authorised discharges</li> </ul>	<p><b>Mitigation Possibilities:</b></p> <ul style="list-style-type: none"> <li>Adherence to the UK’s strict regulatory framework, to restrict both routine discharges from nuclear power stations and direct radiation exposures to workers and the general public, should reduce potential health impacts to acceptable levels and ensure that radiation doses are well within internationally agreed limits.</li> </ul>

Potential Strategic Significant Effects (adverse and beneficial effects)	Suggested Mitigation for Adverse Effects and Recommendations for the revised draft Nuclear NPS and IPC
<ul style="list-style-type: none"> <li>Possibility of local and regional health risks from accidental discharges.</li> </ul>	<ul style="list-style-type: none"> <li>Adherence to the Nuclear Installations Inspectorate (NII)’s regulatory regime for the safe operation of nuclear power stations, including the Nuclear Site licensing Safety Assessment Principles and the continual monitoring by NII of safety risks throughout the lifetime of the station.</li> </ul>
<ul style="list-style-type: none"> <li>The potential requirement for appropriate additional health service capacity for the influx of both construction and operational workers.</li> </ul>	<ul style="list-style-type: none"> <li>The nominator should carry out a review of local health provision to ensure it is adequate for the expected influx of power station workers.</li> </ul>
<ul style="list-style-type: none"> <li>The construction and operation of a nuclear power station may lead to unacceptable community disturbance.</li> </ul>	<ul style="list-style-type: none"> <li>The nominator should ensure a Construction Environmental Management Plan and an all-phase Travel Plan are produced, observed and monitored.</li> </ul>
<p><b>Beneficial Effects:</b></p> <ul style="list-style-type: none"> <li>Likely positive effects on health via increase in employment, community wealth, additional housing and other associated neighbourhood infrastructure.</li> </ul>	
<p><b>Cultural Heritage</b></p>	
<p><b>Adverse effects:</b></p> <ul style="list-style-type: none"> <li>Immediately surrounding the nominated site there may be potential effects on the settings of historic assets</li> </ul>	<p><b>Mitigation Possibilities:</b></p> <ul style="list-style-type: none"> <li>Appropriate landscape/planting schemes</li> <li>Application of principles of good design in accordance with PPS1</li> </ul>
<ul style="list-style-type: none"> <li>Potential effects on unknown buried archaeology of high importance</li> </ul>	<ul style="list-style-type: none"> <li>Further consideration at project stage EIA, for example detailed investigations</li> </ul>
<p><b>Landscape</b></p>	
<p><b>Adverse effects:</b></p> <ul style="list-style-type: none"> <li>Potential for longer-term adverse indirect landscape and visual impacts on the surrounding area, including western areas of the Lake District National Park and the St Bees Heritage Coast</li> </ul>	<p><b>Mitigation Possibilities:</b></p> <ul style="list-style-type: none"> <li>Some limited visual impact mitigation associated with detailed siting of main buildings and application of principles of good design in accordance with PPS1 may be possible</li> <li>Improvement to existing site possible through reduction of existing clutter and overhead infrastructure.</li> <li>Decommissioning of nominated site may allow landscape restoration in the long term</li> </ul>
<p><b>Soils, Geology and Land Use</b></p>	



<b>Potential Strategic Significant Effects (adverse and beneficial effects)</b>	<b>Suggested Mitigation for Adverse Effects and Recommendations for the revised draft Nuclear NPS and IPC</b>
<p><b>Adverse effects:</b></p> <ul style="list-style-type: none"> <li>The construction of the power station and associated infrastructure could lead to the direct loss of soil structure. This may include impacts on soils that maintain terrestrial habitats, including designated nature conservation sites, considered further in the Biodiversity and Ecosystems sections of this AoS Report</li> </ul>	<p><b>Mitigation Possibilities:</b></p> <ul style="list-style-type: none"> <li>Limitation of the footprint of the development reducing the area of soils affected</li> <li>Avoidance of any soils within designated sites of ecological importance</li> </ul>
<b>Water Quality and Resources</b>	
<p><b>Adverse effects:</b></p> <ul style="list-style-type: none"> <li>New coastal defences and marine landing station potential effects on coastal processes, hydrodynamics and sediment transport, and potential indirect effects on nationally and internationally designated habitats</li> </ul>	<p><b>Mitigation Possibilities:</b></p> <ul style="list-style-type: none"> <li>Further investigations required.</li> <li>Suitable design and location of coastal and fluvial flood defence works and marine landing station, may include the use of SUDS</li> <li>Selection of appropriate construction methods</li> <li>Sediment transport modelling</li> </ul>
<ul style="list-style-type: none"> <li>Works to abstract cooling water and subsequent discharge of cooling water could have potential effects on coastal processes, hydrodynamics and sediment transport, and potential indirect effects on nationally and internationally designated habitats</li> </ul>	<ul style="list-style-type: none"> <li>Further investigations required.</li> <li>Selection of appropriate construction methods</li> </ul>
<ul style="list-style-type: none"> <li>Thermal impact of cooling water discharges, potential indirect effects on nationally and internationally designated habitats</li> </ul>	<ul style="list-style-type: none"> <li>Further investigations required.</li> <li>Abstraction of water and thermal discharges will be subject to Environment Agency permitting</li> </ul>
<ul style="list-style-type: none"> <li>Increased demand for water during construction stage and potentially during the operation phase. Magnitude and duration dependent on source of cooling water, timing of activities at the existing nuclear power stations and other nominated sites. Similar comments apply to wastewater production</li> </ul>	<ul style="list-style-type: none"> <li>Further investigations required.</li> <li>Appraisal of water resource options and alternatives</li> <li>Detailed planning study to determine that capacity of water and wastewater is adequate to meet estimated demand</li> </ul>

<b>Potential Strategic Significant Effects (adverse and beneficial effects)</b>	<b>Suggested Mitigation for Adverse Effects and Recommendations for the revised draft Nuclear NPS and IPC</b>
<ul style="list-style-type: none"> <li>Potential impact on local groundwater through construction disturbances. Impact on rivers and beach springs fed by local groundwater body.</li> </ul>	<ul style="list-style-type: none"> <li>Further investigations into local groundwater bodies and potential pathways. Ongoing monitoring of impacts</li> <li>Suitable design to mitigate potential adverse effects</li> </ul>
<b>Flood Risk</b>	
<p><b>Adverse effects:</b></p> <ul style="list-style-type: none"> <li>Sea level rise could be a threat during the latter stages of the operational and decommissioning phases</li> </ul>	<p><b>Mitigation Possibilities:</b></p> <ul style="list-style-type: none"> <li>Further flood/coastal defence measures may be required</li> </ul>

## Abbreviations

AA	Appropriate Assessment
AGR	Advance Gas Cooled Reactors
ALARP	As Low As Reasonably Practicable
AOD	Above Ordnance Datum
AONB	Area Of Outstanding Natural Beauty
AoS	Appraisal of Sustainability
AoS Report	Report setting out environmental and sustainability effects of the Nuclear NPS. It will incorporate the requirements of the SEA Directive
AQMA	Air Quality Management Area
BAP	Biodiversity Action Plan
BGS	British Geological Survey
BS	British Standard
CAMS	Catchment Abstraction Management Plan
CO	Carbon Monoxide
CO <sub>2</sub>	Carbon Dioxide
COMARE	Committee on Medical Aspects of Radiation in the Environment
CPRE	Campaign to Protect Rural England
DECC	Department of Energy and Climate Change
Defra	Department for the Environment, Food and Rural Affairs
EA	Environment Agency
EfW	Energy from Waste
EIA	Environmental Impact Assessment
EMF	Electromagnetic fields
EU	European Union
GEP	Good Ecological Potential
GES	Good Ecological Status
GP	General Practitioner
GW	Giga Watt
GWMU	Groundwater Management Unit
HRA	Habitats Regulations Assessment
HSE	Health and Safety Executive
IPC	Infrastructure Planning Commission.
ISO	International Organization for Standardization
LAQM	Local Air Quality Management
MBT	Mechanical Biological Treatment
MMO	Marine Management Organisation
MOLF	Marine Off Loading Facility
MRF	Materials Recycling Facility
mSv	Millisievert
MWe	Mega Watt (electrical)
MWt	Mega Watt (thermal)
NCA	National Character Area
NDA	Nuclear Decommissioning Authority
NETA	North European Transport Axis
NII	Nuclear Installations Inspectorate
NO <sub>2</sub>	Nitrogen Dioxide
NO <sub>x</sub>	Oxides of Nitrogen
Nuclear NPS	The proposed National Policy Statement for new nuclear power

	stations
NPS	National Policy Statement
OSPAR	Oslo and Paris Conventions
PM <sub>10</sub>	Particles Measuring 10µm or less
PWR	Pressurised Water Reactor
RAMTED	Radioactive Materials Transport Events Database
RBD	River Basin District
RSS	Regional Spatial Strategy
SA	Sustainability Appraisal
SAC	Special Area of Conservation
SAM	Scheduled Ancient Monument
SEA	Strategic Environmental Assessment
SMP	Shoreline Management Plan
SOA	Super Output Area
SPA	Special Protection Area
SRF	Solid Recovered Fuel
SSA	Strategic Siting Assessment
SSSI	Site of Special Scientific Interest
SWCCAP	South West Climate Change Action Plan
TEN	Trans European Network
UKCIP	UK Climate Impacts Programme
WDA	Waste Disposal Authority
WHO	World Health Organisation
WFD	Water Framework Directive
WRMP	Water Resources Management Plan
WRMU	Water Resources Management Unit

## Appendices Available Separately

- 1 Sustainable Development Themes and AoS/SEA Objectives
- 2 Appraisal Matrices
- 3 Plans and Programmes Review (Regional)
- 4 Baseline Information (Regional and Local)

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Office for Nuclear Development  
Department of Energy & Climate Change  
3 Whitehall Place  
London SW1A 2AW  
[www.decc.gov.uk](http://www.decc.gov.uk)