DEPARTMENT OF ENERGY & CLIMATE CHANGE

Appraisal of Sustainability: Site Report for Kirksanton

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

Planning for new energy infrastructure

November 2009

Preface:

Appraisal of Sustainability of the draft Nuclear National Policy Statement

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

The AoS/SEA Reports are presented in the following documents:

AoS Non-Technical Summary

Main AoS Report of draft Nuclear NPS
Introduction
Approach and Methods
Alternatives
Radioactive Waste
Findings
Summary of Sites
Technical Appendices

Annexes to Main AoS Report: Reports on Sites
Site AoS Reports
Technical Appendices

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

This document is the Appraisal of Sustainability: Site Report for Kirksanton of the draft Nuclear NPS and is subject to consultation alongside the draft Nuclear NPS for a period of a minimum of 12 weeks from the date of publication.

This report has been prepared by the Department of Energy and Climate Change (DECC) 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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Summary of Key Findings

This report considers the nomination of the site at Kirksanton 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 Kirksanton site and surrounding area. This report also identifies the significance of those effects, and suggests possible ways of mitigation. 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 potentially developing a nuclear power station at Kirksanton are included in Section 6.

Summary of Key Findings

The Appraisal of Sustainability process has included recommendations to inform the development of the Nuclear National Policy Statement. This site report for Kirksanton 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 potential construction of a new nuclear power station at Kirksanton, 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 Kirksanton will be similar across all the nominated 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 Kirksanton. These are discussed below:

There are potential negative effects on two national and internationally protected conservation sites, namely the Duddon Estuary and Morecambe Bay; and effects on water quality in the region due to the abstraction and release of sea water for cooling. A coastal flood defence scheme already exists in the area of the nominated site, but undefended areas in the vicinity show signs of coastal erosion. The existing defences may need to be upgraded to protect against sea level rise and coastal erosion during the lifetime of the facility. These effects are significant, but mitigation opportunities are likely to be available following further study.

There is limited existing development at Kirksanton, with the exception of a wind farm, prison and disused airfield. The development of a new nuclear power station will have a negative visual impact on the landscape and could be seen from parts of the Lake District National Park, which could not be fully mitigated. New power lines and transport links would also be needed in the vicinity. This would therefore have a significant negative impact on the landscape at a local and sub-regional level.

Kirksanton forms one of a cluster of three nominated sites in the Cumbria area. The potential cumulative effects of the issues discussed above would increase if more than one power station was developed in the Cumbria area.

There will be significant positive effects associated with long term employment and enhanced prosperity for communities locally and this is likely to be significant at the sub-regional level if three power stations are built in Cumbria with enhanced benefits from the draft Nuclear National Policy Statement in combination with other proposals for regeneration in the North West.

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 Kirksanton as a possible location for new nuclear power station(s). The report sets out the Appraisal of Sustainability (AoS) of the nomination of land. This report also considers supporting information 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 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,[1] which accompanies the draft Nuclear National Policy Statement[2] (NPS). The Main AoS Report for the 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 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 draft Nuclear NPS lists sites that have been assessed to be potentially suitable by the Government for new nuclear power stations. Developers will be able to apply for development consent for these sites from the Infrastructure Planning Commission (IPC). 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 draft Nuclear NPS will also be subject to other regulatory and licensing requirements.

The draft Nuclear National Policy Statement

1.4 In the White Paper on Nuclear Power[3], the Government set out its policy on the role that new nuclear power stations could play alongside other low-carbon sources in the UK's future energy mix. The 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[4] drew on the emerging findings of the site AoSs and the Habitats Regulations Assessment (HRA)[5].

[1] Main AoS Report http://www.energynpsconsultation.decc.gov.uk
[2] Draft Nuclear NPS http://www.energynpsconsultation.decc.gov.uk
[3] BERR (Jan 2008) Meeting the energy challenge: a white paper on nuclear power, URN 08/525
[4] 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
[5] Kirksanton HRA Report http://www.energynpsconsultation.decc.gov.uk

Appraisal of Sustainability incorporating Strategic Environmental Assessment

1.5 The Planning Act (2008)[6] 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[7] 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 of the draft Nuclear NPS.

1.6 The purpose of this AoS is to assess environmental and sustainability impacts on the Kirksanton site. This AoS also identifies the significance of those effects, and to suggest possible ways of mitigation. The AoS for Kirksanton site fed into the Strategic Siting Assessment (SSA) and the preparation of the draft Nuclear NPS. There would be further detailed studies 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.

Appraisal of Sustainability (AoS) of Nuclear National Policy Statement (NPS)
- Strategic Appraisal of Nuclear NPS, including cumulative effects of the programme of nuclear sites (as outlined in the draft Nuclear NPS)

Site Appraisal of Sustainability (AoS)
- Strategic appraisal of locating a nuclear power station at each nominated site to advise the Strategic Siting Assessment (SSA)
- A desktop study using existing information

Environmental Impact Assessment (EIA)*
- Detailed project-level assessment of likely impacts of the proposals on the environment to inform the Infrastructure Planning Commission (IPC) decision for each development proposal
- A detailed study based on firm project proposals, it will involve a more in-depth assessment (including commissioning studies and field surveys)

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

[6] Planning Act 2008
[7] 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[8], the Environmental Study[9], the Update Report[10], 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 and referenced as 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 of building new nuclear power stations on the environment and communities. The sustainability objectives that have been agreed for the appraisal of the draft Nuclear NPS are detailed in Annex E of the Environmental Study and the Main AoS Report. Appendix 1 of this AoS Site 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

Sustainable Development Theme	AoS/SEA Objective (Numbers refer to Scoping Report[11] and Environmental Study[12])
Air Quality	to avoid adverse impacts on air quality (12)
Biodiversity and Ecosystems	to avoid adverse impacts on the integrity of wildlife sites of international and national importance (1) to avoid adverse impacts on valuable ecological networks and ecosystem functionality (2) to avoid adverse impacts on Priority Habitats and Species including European Protected Species (3)
Climate Change	to minimise greenhouse gas emissions (13)
Communities: population, employment and viability	to create employment opportunities (4) to encourage the development of sustainable communities (5) to avoid adverse impacts on property and land values and avoid planning blight (10)

[8] BERR (March 2008) Consultation of Strategic Environmental Assessment for proposed National Policy Statement for new nuclear power, URN08/680
[9] BERR July 2008 Environmental Study
[10] BERR January 2009 Update Report
[11] BERR (March 2008) Consultation of Strategic Environmental Assessment for proposed National Policy Statement for new nuclear power, URN08/680
[12] BERR July 2008 Environmental Study

Sustainable Development Theme	AoS/SEA Objective (Numbers refer to Scoping Report[11] and Environmental Study[12])
Communities: Supporting Infrastructure	to avoid adverse impacts on the function and efficiency of the strategic transport infrastructure (8) to avoid disruption to basic services and infrastructure (9)
Human Health and Well-Being	to avoid adverse impacts on physical health (6) to avoid adverse impacts on mental health (7) to avoid the loss of access and recreational opportunities, their quality and user convenience (11)
Cultural Heritage	to avoid adverse impacts on the internationally and nationally important features of the historic environment (22) to avoid adverse impacts on the setting and quality of built heritage, archaeology and historic landscapes (23)
Landscape	to avoid adverse impacts on nationally important landscapes (24) to avoid adverse impacts on landscape character, quality and tranquillity, diversity and distinctiveness (25)
Soils, Geology, Land Use	to avoid damage to geological resources (19) to avoid the use of greenfield land and encourage the re-use of brownfield sites (20) to avoid the contamination of soils and adverse impacts on soil functions (21)

1.9 The AoS for each of the nominated sites considered the relevant policy context at a regional level, which helped to identify key sustainability objectives that need to be taken into account in the appraisal and potential cumulative effects that could arise with other plans and projects. Policy context at the local government level is changing as a result of the new planning system[13]. 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.

[13] The Planning and Compulsory Purchase Act 2004 established a new system for plan making, including the replacement of Local Plans and Unitary Development Plans with Local Development Documents.

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 environment protection regimes for nuclear power. The Nuclear Installations Inspectorate (NII), a division of the Health and Safety Executive, and the Environment Agency 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[14]. 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 opening up without commitment discussions with Government 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.

[14] 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 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. It is considered that these are better addressed at the planning application stage. 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 nominated site, except in cases where a nominator has provided further detail at variance to 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 Kirksanton Site AoS Report provided in the right hand column. In their submission, the nominator has indicated that the form, scale, reactor type and configuration of supporting infrastructure would be dependent on findings from detailed site surveys and studies and a site optimisation process.

Table 1.2: Base Case Assumptions and Variations Considered for Kirksanton

Base Case	Variations considered in AoS of Kirksanton (as proposed in nomination)
1 nuclear reactor	At least 1 reactor
Technology neutral (i.e. unknown reactor type)	
A requirement for cooling water abstraction	The nominator's preference is for direct cooling with seawater abstraction
Discharges of cooling water	

Base Case	Variations considered in AoS of Kirksanton (as proposed in nomination)
Site boundary as indicated on nomination form	
Timescales: Construction: approximately 5-6 yrs Operation: approximately 60 years (life extension, which is subject to regulatory approval, could mean that the operating lifetime is longer) Decommissioning: approximately 30 years Lifetime of site: approximately 166 years[15]	
No. of employees: Construction: approx 4,000 (around 50% from within region) Operation: approx 500 Decommissioning: range of 400 – 800 at key phases[16] Associated employment creation: 2000	
Coastal flood and protection measures (where relevant)	The nominator has indicated that he expects to provide measures such as land raising, flood defence improvements and strengthening of coastal defences to protect the site from flooding
Infrastructure for transporting reactor (for example, jetty, landing facility)	
Interim radioactive waste storage facilities will be capable for at least 160 years	
Highway improvements, access routes	
Associated transmission infrastructure	
Other associated infrastructure/plant, where identified by nominator shown in the next column	
Radioactive discharges will be within legal limits	

[15] 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 therefore possible to envisage a scenario in which onsite interim storage might be required for around 160 years from the start of the power station's operation, to enable an adequate cooling period for fuel discharged following the end of the power station's operation. However, this is based on some conservative assumptions and there are a number of factors that could reduce or potentially increase, the total duration of onsite spent fuel storage.

[16] 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: Kirksanton

2.1 The site at Kirksanton is situated on the Cumbrian coast on the West coast of England, facing the Irish Sea and the Isle of Man. It is located approximately 30km south of the Sellafield nuclear facility. Heysham, which lies approximately 20km to the south east, is also nominated as a potential new power station development site (see Heysham AoS Report). The location of the site is illustrated in Figure 1. Figure 2 shows the location of the site in a sub-regional context to help address any implications for cumulative effects on biodiversity and on socio-economic factors.

2.2 Kirksanton lies on the mouth of the Duddon Estuary which is an internationally important habitat and, as such, has been awarded SSSI (Site of Special Scientific Interest), SAC (Special Area of Conservation) and Ramsar status. The area is also designated as a Special Protection Area, as it supports large populations (at least 20,000) of waterfowl species listed in Annex 1 of the EU Birds Directive. In addition, it is designated due to its breeding Sandwich Tern colony and important overwintering populations of Pintail, Red Knot and Common Redshank.

2.3 There is no existing nuclear power station at Kirksanton. The site comprises an area of 131 hectares of land, south and west of the settlement of Kirksanton and south east of Southfield. The site boundary partially overlaps with the Haverigg Wind Farm. In addition to the land within the site boundary shown by the nominator (see Figure 3), some works are expected to lie outside the boundary, including a marine off-loading facility and inlet and outlet pipework associated with the cooling water system which may extend for up to 3km beyond the seaward limit of the site boundary.

2.4 The nomination is for a nuclear power station development incorporating:

- at least one nuclear reactor
- improvement of coastal defences and/or land raising to protect the site from flooding
- construction stage areas and facilities
- infrastructure and facilities related to the operation of a nuclear power station
- new access road; transmission and cooling water infrastructure
- interim waste storage facilities

2.5 The site at Kirksanton was nominated into the Strategic Siting Assessment (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 site in the list of potentially suitable sites in the draft Nuclear NPS (through this Site AoS Report).

2.6 The SSA required the site nominator to supply an annotated Ordnance Survey map at 1:10,000 scale showing the boundary of the 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[17] 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 levels relevant to the potential new nuclear power station at Kirksanton and its surroundings. It aims to identify any key significant policy objectives that need to be considered for this strategic appraisal of the site. This also contributes to addressing the potential interactions and cumulative effects that may arise from development and operation of a new nuclear power station on the 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:

- North West Climate Change Action Plan 2007 - 2009, North West Regional Development Agency (2007)
- Regional Spatial Strategy for the North West 2008 - 2021, Government Office for the North West (2008)
- Regional Economic Strategy for the North West 2006 - 2026, North West Regional Assembly (2006)
- Future Generation: A Strategy for Sustainable Communities in West Cumbria 2007 - 2027, West Cumbria Partnership
- Cumbrian Biodiversity Action Plan (2000-2010), UK Biodiversity Action Plan (2001)
- Draft River Basin Management Plan for the North West, Environment Agency (2008)
- Shoreline Management Plan 2 (SMP2) – River Wyre to Walney Island, Northwest and North Wales Coastline
- Joint Municipal Waste Management Strategy: Cumbria Strategic Waste Partnership (2008-2020)
- Strategic Flood Risk Assessment, Jacobs for Copeland Borough Council (August 2007)

3.4 The key objectives for sustainability from these regional policy documents can be summarised as follows:

[17] BERR (March 2008) Scoping Report

- Enhancing biodiversity and protecting internationally important species/habitats
- Mitigating and adapting to effects of climate change
- Reducing flood risk and improving coastal defences
- 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 crime

3.5 These may have indirect and/or cumulative interactions and this is discussed further in Section 5: Interactions and Cumulative Effects with Other Plans and Projects.

4 Site Characterisation

Introduction

4.1 A general description of the site at Kirksanton and its location is provided in Section 2.

4.2 This section describes the general characteristics of the site at Kirksanton 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 this stage in the AoS for Kirksanton is presented in Table 4.1 below.

Table 4.1: Summary of Scope of Baseline Data Collated for Kirksanton

Sustainable Development Theme	Scope of baseline data collated in this AoS
Air Quality	• Regional air quality index • Location of Air Quality Management Areas
Biodiversity and Ecosystem	• Location and description of Special Protection Areas, Special Areas of Conservation, Ramsar sites, Sites of Special Scientific Interest, National Nature Reserves, Local Nature Reserves, Local Wildlife sites
Climate Change	• Regional precipitation and temperatures; • Greenhouse gas emissions – regional, county and local.

Sustainable Development Theme	Scope of baseline data collated in this AoS
Communities and Supporting Infrastructure: Population Employment Community Viability Transport Waste and Minerals Energy	• Location of major settlements and areas of population • Age structure of population • Employment/unemployment and economic activity rates • Employment profile by industry • Socio-economic classification of population • Energy from low-carbon/ renewable resources: regional • Transport networks • Waste Management facilities
Human Health and Well-Being	• Index of Multiple Deprivation • Age profile • General health • Life expectancy • Infant mortality • Proximity to medical services
Landscape and Cultural Heritage	• Location and description of National Parks, Areas of Outstanding Natural Beauty, Heritage Coasts • National landscape Character Areas • Local landscape character areas / types • CPRE Tranquil Areas and Light Pollution mapping • Location and description of World Heritage sites, Scheduled Monuments, Historic Battlefields, Historic Parks and Gardens, Designated Protected Wrecks, Conservation Areas, Listed Buildings.
Soils, Geology, Land Use	• Agricultural land classification • Soil types • Geological SSSIs • Geological risks • Environmental hazards • Historic land use
Water: Hydrology Quality Resources Flood Risk	• Location of areas at risk of flooding • State of surface and ground waters: in river basin district and catchment • Predicted water demand and availability by Water Resource Zone • Designated waters under EU Directives

Air Quality

4.1 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 pressures on local air quality across the region.[18]

4.2 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. No AQMAs have been declared within the Copeland Borough Council area,[19] which contains the site. The conclusions of air quality reviews and assessments indicate that the standards and objectives set out in the National Air Quality Strategy are likely to be achieved in respect of all pollutants under Local Air Quality Management.

4.3 The average number of days with moderate or higher levels of air pollution in the region rose between 2005 and 2006. It was slightly higher than the average for urban sites in England, but lower than the England rural average. The increase in 2006 (as with a similar increase in 2003) correlates with hot, sunny weather experienced during these years, causing the production of elevated levels of ozone.

4.4 Traffic in the region increased by 15% between 1995 and 2005, leading to air quality problems from major route corridors, and particularly in congestion areas and at peak travelling times. Continuance of this trend will add further pressures on meeting air quality objectives.

Biodiversity and Ecosystems

4.5 The biodiversity interest around the site is high and includes a number of European and nationally designated sites, which are primarily designated for their valuable coastal and estuarine habitats, which support important bird assemblages. Further information on the European designated sites and their current condition is given in the separate HRA Report for Kirksanton.

4.6 The site is immediately adjacent (0.5km) to the Duddon Estuary, which is designated as a Special Protection Area (SPA) for birds, a Special Site of Scientific Interest (SSSI) and a Ramsar[20] wetland site. A section of the estuary also forms part of the Morecambe Bay Special Area of Conservation (SAC). Collectively these areas form a European Marine site. The Duddon Estuary is also interlinked with the Morecambe Bay SPA and Ramsar site. In addition, the Duddon Mosses SAC is located 6.5km to the north east, and

[18] 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]
[19] UK Air Quality Archive (online) available: http://www.airquality.co.uk/archive/laqm/laqm.php [accessed 03 March 2009]
[20] Ramsar sites are wetlands of international importance designated under the Ramsar Convention, first designated in the UK in 1976. The initial emphasis was on selecting sites of importance to waterbirds within the UK, and consequently many Ramsar sites are also SPAs; however non-bird features have been increasingly taken into account.

Millom Ironworks Local Nature Reserve lies 4.5km to the east of the site (see Appendix 4).

4.7 Important bird species associated with both the Duddon Estuary and Morecambe Bay areas include breeding sandwich terns and overwintering pintail, red knot and common redshank. The site is also designated for an important assemblage of over 20,000 wintering wildfowl.

4.8 The North Walney and Sandscale Shaws National Nature Reserves also form part of the Duddon Estuary SPA/Ramsar and support important bird populations and up to 25% of the UK's entire natterjack toad population. Other important sites along the coast and estuary include the Hodbarrow RSPB reserve (a coastal lagoon with breeding tern populations), Drigg Coast SAC, Duddon Mosses SAC and Shaw Meadow and Sea Pasture SSSI.

4.9 UK Biodiversity Action Plan (UKBAP) priority species within the local area include bats, great crested newts, natterjack toad, common species of reptile, brown hare, otter and water vole. Of these, bats, great crested newts, natterjack toad and otter are European Protected Species. Additional UKBAP species may be identified following a more detailed investigation of local records, which will need to be undertaken by the nominator at the EIA stage.

4.10 The Cumbria Biodiversity Action Plan (BAP) for the River Eden which includes the easement of migratory fish passage for the Atlantic Salmon (*Salmo salar*) and Brown Trout (*Salmo rutta*).[21] Sea Lamprey (*Petromyzon marinus*) which are an Annex II listed species, are also know to migrate along the Cumbrian coast and have spawning and nursery grounds within the River Eden SAC and the River Derwent SAC.[22]

Climate Change

4.11 The potential effects of climate change on the site, such as storm surges, coastal erosion, sea level rise and flooding, are explored in the sections on Flood Risk.

4.12 Cumbria has a large land mass and a sparse population. Rural populations are heavily reliant on travelling 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 make Cumbria a significant emitter of CO_2 per capita. Cumbria has the highest per capita greenhouse gas emissions (CO_2 equivalent) of the 5 sub regions in the North West region. Cumbria is also the only sub-region where transport is the largest contributing sector contributing to carbon emissions, representing 28% of the total.[23]

[21] (UK BAP Reporting Website http://www.ukbap-reporting.org.uk/plans/action.asp?X=%7B0C518660%2DB882%2D4311%2DBF96%2D50E19FC7525C%7D&WES=&P=1&O=2&CTY={701CA0D8-8EC0-41C7-89D6-21445E69D233}&CTRY={7C884413-1AC7-48B6-ADCD-23CBA1482CD6}&H={CD142216-9921-4A54-A34A-F67C4CA6FE48}&S [accessed June 2009])
[22] (JNCC Website http://www.jncc.gov.uk/ProtectedSites/SACselection/species.asp?FeatureIntCode=S1095 [accessed June 2009])
[23] NWRA Energy and Greenhouse Gas Emissions study, Aug 2007

4.13 The North West is the second largest emitter of carbon dioxide in the UK. The submitted Regional Spatial Strategy (RSS) for the North West suggests that plans and strategies should "Develop and implement policies to reduce emissions of greenhouse gases (principally CO_2) from all sources, including energy generation and supply, buildings and transport, to contribute towards national targets (and) identify, assess and apply measures to ensure effective adaptation to the likely environmental, social and economic impacts of climate-related changes." [24]

4.14 This RSS outlines the following:

- Promote and exploit low carbon and renewable energy technologies and increase the amount of electricity and energy for heating from renewable sources supplied and consumed within the Region
- Policy EM 18: Decentralised Energy Supply
- Plans and strategies should encourage the use of decentralised and renewable or low-carbon energy in new development

4.15 The Cumbria Strategic Partnership has signed up to the Local Area Agreement indicator NI 186 to reduce per capita CO2 emissions across Cumbria as a whole by 11.5% by 2010/11, which equates to savings of 619,000 tonnes CO2 per year.

4.16 Within an 80km radius of the 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.

4.17 The area outlined by the nominator for establishment of a potential new nuclear power station at Kirksanton encompasses five turbines of an operational eight turbine wind farm. The Haverigg wind power development has a combined capacity of 5.8MW and the potential to supply over 3,200 households per year.[25]

Communities: Population, Employment and Viability

4.18 Population in the North West of England has decreased slightly over the past 25 years and there are now more than 7 million residents, the third most populated English Government Office region behind the South East and London[26]. According to the Office for National Statistics, the region's population fell between 1981 and 2006 by 1.3%.

4.19 The region's population is also ageing, with only three districts in the North West forecast to experience a reduction in the population aged 65 years and over (Liverpool, Manchester and Salford). An increase of over 30% in this age group is forecast in many districts between 1996 and 2021.[27] Copeland

[24] NWRA Energy and Greenhouse Gas Emissions study, Aug 2007
[25] http://www.bwea.com/ukwed/operational.asp
[26] http://ec.europa.eu/budget/reform/library/contributions/pgs/20080415_PGS_65.pdf
[27] An Aging Population: Impacts for the North West (Summary Document) (www.ageconcern.org.uk)

District currently has an average population aged 65 and over of 16.4%, which is slightly higher than the regional and national averages.

4.20 Employment rates for people of working age in the North West are similar to those of the UK as a whole; 73 % (2007) compared to the overall rate of 74%. However, unemployment levels for the Copeland District are higher than the regional and national averages.

4.21 Around 50% of the jobs in the district depend on the Sellafield nuclear power station. This includes jobs on the Sellafield site, and those which rely on the site.[28]

Communities: Supporting Infrastructure

4.22 Transport: The strategic road transport routes in the vicinity of Kirksanton comprise the A595 to the north and east, the A590/A5092 to the east, which links with the M6 at junction 36. The site at Kirksanton is accessed from the A5093, which links to the A595 via Millom to the east and Kirksanton to the west. In addition, there is a railway line which runs through Kirksanton to the north of the site.

4.23 The A595 is not part of the Strategic Road Network or the Trans-European Network (TEN) in this location. The A590 is a duelled road for most of its length, being recently upgraded. The sections beyond Ulverston, the A5092 and A595 are not duelled roads and Heavy Goods Vehicles (HGVs) may cause congestion in peak hours. The M6 is the closest road of national significance, but is some 30km away. The motorway can be accessed via the A590/A6 at junction 36. The route is along winding roads and is not direct.

4.24 The nearest railway station is Millom, which is 5km from the site and served by the Cumbrian Coast Line. In the Transport chapter of the Copeland Local Plan[29], Copeland Borough of Council reports that there has been limited investment in the Cumbrian Coast Line, resulting in significant travel times and costs of moving people and freight. The Council further reports that the physical state of the Cumbria Coastal Railway does not assist easy expansion of rail freighting and associated facilities.

4.25 The nearest shipping links are located in Barrow, to the south.

4.26 Conventional waste[30]: 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% was recycled. A relatively insignificant proportion (25 tonnes) was incinerated during this period.[31]

[28] Copeland Borough Council http://www.copeland.gov.uk/default.aspx?Page=341
29 http://www.copeland.gov.uk/pdf/CopelandLocalPlanCHAPTER7Transport.pdf
[30] Conventional waste means waste controlled under Part II of the Environment Act 1990
[31] Department for Environment, Food and Rural Affairs. Municipal Waste Management Statistics [online] available:
http://www.defra.gov.uk/environment/statistics/wastats/bulletin07.htm

4.27 The County Council is currently in the process of procuring Mechanical Biological Treatment (MBT) waste treatment plants in Carlisle and Barrow (contract currently approved). Two MBT plants will be provided for the region, each with a treatment capacity of 70,000 tonnes of waste.[32]

4.28 There are currently three non-hazardous landfill sites in the region. No detailed information exists on their projected capacity. There are currently no hazardous waste landfills or treatment facilities in the Cumbria County region, although established waste management contractors are known to operate and provide services within the region.[33]

Human Health and Well-Being

4.29 The site is within the Super Output Area (SOA) known as Copeland 008E[34]. Indices of deprivation show that it is a deprived area with barriers to housing and services being a particular problem. The age profile for this SOA shows that there are significantly less children under sixteen and significantly more senior citizens (males over 65 and females over 60) than the UK average. The profile also shows that there is approximately an average percentage of working age people.

4.30 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, with life expectancy for males and females slightly greater than the English average, and infant mortality slightly less than the national average but higher than the regional average.

4.31 With regard to mental health, the Health Profile 2008[35] 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 significantly higher than the English average (27.5 per 1000 population).

4.32 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.

4.33 As might be expected from the deprivation of the area referred to above, there are slightly more unfit houses[36] in Copeland Borough Council's area than either the north west region or England as a whole.

4.34 Figures from the Audit Commission for 2005[37] suggest that the crime rate in the Copeland Borough Council area is generally lower than national average.

[32] Urban Mines Municipal Waste Procurement webpage: http://www.urbanmines.org.uk/?i=1459&s=1111
[33] Cumbria County Council. Joint Municipal Waste Management Strategy: Cumbria Strategic Waste Partnership (2008-2020). http://www.cumbria.gov.uk/planning-environment/waste-management/JMWMS.asp
[34] 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

[35] http://www.apho.org.uk/resource/view.aspx?RID=50213
[36] Dwellings not suitable for occupation as defined by various criteria in Section 604 of the Housing Act 1985 (as amended)

4.35 The economic well-being of the area is reasonably positive as can be seen from the local employment figures[38] (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. This number compares favourably with figures for the North West of England region (72.1%) and is much the same as the English average (74.5%).

4.36 Local access to medical services is reasonable with one general practitioner (GP) practice within 5km of the site. There are, however, four other GP practices within 10km of the site and a local hospital, though with no accident and emergency department, at Millom (3.7km). The nearest hospital with an accident and emergency department is Furness General at Barrow-in-Furness (11.6km). The nearest mental health hospital is Parkwood Hospital (48.4km).

4.37 One of the wider determinants of health and well-being is access to local recreational facilities. In this regard, the site is reasonably well served, with four leisure centres within 20km of the site. However, Copeland, being a rural and coastal location, 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.

4.38 As there is no existing power station at Kirksanton, no specifically targeted radiological monitoring has been carried out in the immediate vicinity. However, as the site is close to the former Calder Hall nuclear power station at Sellafield, conclusions drawn from this site are also relevant to Kirksanton.

4.39 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.

4.40 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.

4.41 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'.

4.42 COMARE's tenth report did however conclude that the situation for the other nuclear sites is more complicated. Studies confirmed previous COMARE

[37] http://www.areaprofiles.audit-commission.gov.uk/(rkgonp45u4sp1o55bc5scf55)/SingleAreaSearch.aspx
[38] https://www.nomisweb.co.uk/reports/lmp/la/2038431858/report.aspx?pc=IP164UR

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].

4.43 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.'

4.44 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.

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

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

4.47 There is no historical analysis of childhood leukaemia, non-Hodgkin lymphoma and other malignant tumours at this site. However, as discussed above, the Committee on Medical Aspects of Radiation in the Environment's (COMARE) data for Sellafield[39] is relevant due to its proximity to the Kirksanton site. In this regard, COMARE found that the incidences of childhood leukaemia, non-Hodgkin lymphoma and other malignant tumours

[39] Committee on Medical Aspects of Radiation in the Environment (COMARE) (2005). Tenth Report. The incidence of childhood cancer around nuclear installations in Great Britain. Health Protection Agency, June 2005.

around Sellafield were no greater than would be found in similarly sized areas elsewhere in the country.

4.48 Radioactive monitoring carried out in 2007 around Sellafield[40] 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 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. 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 38% of the dose limit for members of the public of 1mSv per year as specified in The Ionising Radiations Regulations 1999.

Cultural Heritage

4.49 There are eight scheduled monuments, one Conservation Area and around 21 listed buildings within a distance of 5km of the site. The site also contains, or is close to RAF Millom, a World War II airfield and potential historic landscape. Neolithic axes and a Bronze Age habitation have been found in the immediate vicinity of the site, and it is therefore reasonable to assume that prehistoric archaeology may also be present.

Landscape

4.50 The northern boundary of the site is situated directly adjacent to the south western boundary of the Lake District National Park. A Lake District National Park Landscape Character Assessment (LCA) was completed in 2008 and will need to be considered as part of the landscape and visual impact assessment within the EIA. The St. Bees Heritage Coast lies 30km to the north.

4.51 The site lies within the West Cumbria Coastal Plan National Character Area 7, which is characterised by open agricultural landscapes that have extensive views to the higher fells in the east. This coastal belt area has a strong industrial history and extensive urban fringe areas with large, highly visible factories and manufacturing and processing plants, particularly near Workington, Whitehaven, Sellafield and Barrow. At a local level the site sits within the low farmland landscape character area and adjacent to the coastal urban fringe landscape character area. The local landscape is a mix of flat land comprising a former airfield, which is now a wind farm, agricultural land, marshy open ground, patches of woodland and an area of sandy beach and sand dunes. Fields are large and rectangular with boundaries comprising hedgerows, fences and hedges. Views are dominated by the nearby Black Combe Mountain.

4.52 The existing Sellafield nuclear power station, reprocessing plant and associated infrastructure to the north and the large industrial sheds at Barrow-

[40] Food Standards Agency (2007). Radioactivity In Food and the Environment (RIFE 13) report.

in-Furness are dominant visual landmarks in this area of coastline and feature in views from the surrounding hills.

4.53 Saltmarshes are a valued landscape character feature on the Morecambe Coast and Lune Estuary and are one of the distinguishing characteristics of the national landscape character area (See Appendix 4).

4.54 The site does not lie within the most tranquil part of the region, as shown by the Countryside Agency/CPRE tranquillity map.

Soils, Geology and Land Use

4.55 The site at Kirksanton is located on Grade 4 land that is not of high value for agriculture. The soils are noted to be either deep stoneless silty and fine sandy soils, or reddish fine and coarse loamy soils. The local geology is Permian and Triassic sandstones, undifferentiated, including Bunter and Keuper beds.

4.56 Apart from the disused airfield, which has wind turbines currently, there is no other industrial land use in the area. HMP Haverigg is located within the area of the site.

4.57 There are no current or historical landfill sites within 1km of the site.

4.58 No mineral abstractions have been identified locally.

4.59 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 Landslide Ground Stability Hazards - very low risk
- Potential for Running Sand Ground Stability Hazards – very low to low risk
- Potential for Compressible Ground Stability Hazards – moderate risk

Water Quality and Resources

4.60 The site is located in the North West River Basin District (RBD). Within this District, 20% of rivers (by length) meet the requirements for good ecological status (GES) or good ecological potential (GEP). In total, 2% of all surface waters are designated as artificial and 41% of all surface waters are designated as heavily modified.

4.61 The draft River Basin Management Plan (dRBMP) for the area states that the target for 2015 will remain at 20%. The majority of water bodies failing to achieve GES or GEP do so because of pressures on fish populations. A greater number of groundwater bodies (44%) meet the requirements for good status. The NW RBD contains 18% of England's derelict land and a third of the poorest quality rivers in England and Wales. The European Water Framework Directive sets a higher target of achieving good ecological and chemical status for all water bodies by 2015.

4.62 The coastal waters near the site are classed as having moderate ecological quality and passing chemical quality status. The dRBMP expects no changes in the status of the coastal waters by 2015.

4.63 Pressures on water bodies within the RBD come predominantly from diffuse pollution from rural sources. There are also localised pressures as a result of historic mining and isolated landfill sites. Non-native invasive species are becoming an increasing problem.

4.64 The site is located within the South West Lakes catchment, which is nested within the NW RBD. 26% of surface water bodies in this catchment currently achieve either good status or good potential. The dRBMP expects that by 2015 this number will increase to 32%.

4.65 The nearest watercourse to the site is Haverigg Pool which has moderate ecological quality and moderate chemical quality.

4.66 Sensitive bathing waters under the EC Urban Waste Water Directive are located to the north of the site at Silecroft ("Excellent" in 2008) and to the south at Haverigg ("Good"). The coastal areas around Haverigg and Duddon estuary are protected under the Bathing Water Directive. Black Beck, Haverigg Pool, and Duddon are protected under the Freshwater Fisheries Directive. Approximately 30 km further down the coastline, Morecambe Bay is protected under the Shellfish Directive.

4.67 The site lies close to the boundary between the West Cumbria Permo-Triassic Sandstone aquifer (which also underlies the Sellafield area) and the South Cumbria Lower Palaeozoic and Carboniferous aquifer. Both aquifers have good quantitative and chemical status.

4.68 Groundwater source areas in the district are within Drinking Water Protected Areas, but there are no groundwater source protection zones.

4.69 Kirksanton is located within the Derwent, West Cumbria and Duddon Catchment Abstraction Management Strategy (CAMS) area. The site falls outside of the Rivers Duddon and Esk Water Resource Management Unit (WRMU9). This WRMU has water available status until 2013, but from 2019 will have no water available status. The site is not within a Groundwater Management Unit (GWMU).

4.70 There are a large number of sites designated for their environmental importance within this CAMS area. The Duddon Estuary, which is immediately adjacent to the site (0.5km), is designated a water related Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and Ramsar site, it also falls in the boundary of the Lake District National Park.

4.71 The site is located in United Utilities' (UU) 'Integrated' Water Resource Zone (WRZ), which supplies 6.5 million people in South Cumbria, Lancashire, Greater Manchester, Merseyside and most of Cheshire. In the Integrated

Resource Zone no deficit is forecast until 2010/2011, with a maximum deficit of 106.8 Ml/d expected in 2020/2021. After this, the magnitude of the deficit begins to decline. The draft Water Resources Mananagement Plan proposes a range of measures to address this deficit. Included within this programme are measures to improve water efflciency, leakage detection, promotion of new groundwater sources (Southport, Widnes & Warrington) and upgrade an existing WTW at Huntington.

4.72 The exact water requirements for the site are not yet finalised. The nomination expresses a preference for employing direct water cooling using seawater for any new nuclear power station on the site.

4.73 The site falls within the coastal cell which extends from St Bees Head in the north to Morecambe Bay just south of the site.

4.74 Suspended sediment transport along this stretch of coastline in the nearshore is dominant towards the south. The Duddon Estuary and Morecambe Bay are both believed to be sinks/stores of sediment and so exert an influence on the adjacent shoreline. Within the estuaries themselves, the configuration of the low water channels is a key control on local patterns of accretion and erosion and the proximity of these channels to the shoreline controls the degree of exposure and tidal scour along the coastline.

Flood Risk

4.75 Hard coastal defences are infrequent along this stretch of Cumbrian coastline where the risk of flooding is generally minimal. However, the site is defended by a coastal defence scheme comprising of armoured protection and constructed in 1993. There is evidence of coastal erosion in the vicinity of the site that may be a direct result of the existing defences as they will disrupt the coastal sediment processes, reduce sediment inputs from erosion at one point which damage the natural features, which depend on their free functioning, and as a result, increase the risk of erosion downdrift and destroy habitats and features of importance.

4.76 The Environment Agency flood map indicates that the majority of the site is located in Flood Zone 1 (low probability) and is naturally protected from flooding by the existing beach and sand dune system. However, there is a small area of the site in Flood Zone 2 (medium probability) and a smaller area in Flood Zone 3 (high probability) that is at risk of flooding from both fluvial and tidal influences.

5 Appraisal of Sustainability

Introduction

5.1 This section considers the potential sustainability effects of including the site at Kirksanton in the list of suitable/potentially suitable sites in the draft Nuclear NPS. Whilst the Main AoS Report considers the environmental and sustainability effects that may arise from the construction of nuclear power stations in general, the site-level appraisal of sustainability looks specifically at the potential sustainability effects that could occur from constructing a new power station at Kirksanton, should the site be listed as potentially suitable in the 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 Kirksanton site and suggests possibilities for mitigation, where possible. 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.

5.3 The findings of the AoS 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 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.

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

Local Effects
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 IPC. Applications for development consent will include EIA undertaken by the developer. Such local 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. As with any major infrastructure project, there are likely to be effects during construction that have the potential for nuisance[41] 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 EIA 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.
Strategic Significant Effects
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.

Air Quality

5.4 There is potential for air quality impacts during the construction, operation and decommissioning stages of developing new nuclear power stations. However,

[41] 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.

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

5.5 The construction of a nuclear power station on the site is likely to have some localised adverse effects on air quality in the short term (5-6 years), including dust and emissions from construction vehicles, HGVs, and traffic movements generated by the construction workforce. This has the potential to affect residential properties along local access/haul routes in the immediate surrounding area. Similar local impacts may arise during the decommissioning phase of the project, at the end of the plant's operational life.

5.6 During operation, the traffic generated by the operational workforce has the potential to create longer-term adverse effects on air quality. Traffic and air quality assessments will be undertaken as part of the detailed EIA process, and likely mitigations may include highway improvements, traffic and construction management plans and the use of rail and port facilities where possible.

5.7 Based on the current air quality and likely emissions from the proposed nuclear power station, significant deterioration of air quality in the local area in the vicinity of the villages of Silecroft and Kirksanton or the wider region is unlikely.

5.8 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 sections. In addition, prevailing winds in the region are from the south west which could cause pollutants to be blown over nationally important areas to the north east such as areas of the Lake District.

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 authorisations issued under the Radioactive Substances Act 1993 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 Kirksanton, 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 **<u>Strategic Effects on Air Quality:</u> The AoS has identified that the potential for a large urban population to be affected by any accidental release of radioactive emissions from the Kirksanton site, combined with potential transboundary effects, has a potentially strategic effect on sustainability. However, it is noted that there is a very low risk of such an event occurring. Prevention measures include existing risk assessment and regulatory processes. The 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. However, there is unlikely to be any detrimental impact from air quality during the operation phase and impacts during construction and decommissioning are deemed to be slight.**

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, new buildings and infrastructure could lead to direct habitat loss, increased noise disturbance and impacts on air and water quality, 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. Similarly, the abstraction of surface or groundwater could also affect habitats and the species they support.

5.13 Of greatest concern are activities which might lead to detrimental effects on coastal and estuarine habitats within the Duddon Estuary Ramsar/SSSI and Morecambe Bay SAC/Ramsar and activities which could have an adverse impact on important assemblages of birds within the Duddon Estuary SPA and Morecambe Bay SPA. Impacts on biodiversity may also result at Hodbarrow RSPB reserve and Shaw Meadow and Sea Pasture SSSI. Fish migration along the coastal strip may be impacted by coastal access routes (marine off-loading facilities) and the abstraction/discharge of cooling water.

5.14 Biodiversity will 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. The nominated site is known to support important populations of Natterjack toad which is a European Protected Species.

5.15 Impacts need to be considered in the wider context due to the complex nature of the Duddon Estuary and Morecambe Bay designations and the fact that

these sites are interlinked. Key bird species, for example, may constantly move between designated sites.

5.16 Consideration also needs to be given to the cumulative impacts on biodiversity from other ongoing or potential developments in the area, for example nuclear power stations at Braystones and Sellafield, Walney Wind Farm, Gateway off-shore gas storage facility and Morecambe Bay Barrage.

5.17 Locating the marine loading facility (if required) within the Duddon Estuary will require extensive dredging prior to construction and during operation to meet the required depths necessary to facilitate the marine vessels. Dredging a channel will not only destroy habitats but will seriously degrade the amount of natural sediment available to sustain the estuarine morphodynamics and coastline to the south of the Duddon Estuary. Structures will directly interfere with the sediment transport pathways within the estuarine system, causing loss of habitat and interference to the protected species of birds and plants indigenous to the Duddon Estuary.

5.18 Further investigations regarding impacts on biodiversity would be undertaken during the EIA process for the nominated site. Design and mitigation measures should seek, in the first instance, to avoid and minimise loss of habitat (particularly SAC/SPA/Ramsar habitats and species) and avoid disturbance of legally protected species. During the design phase, careful consideration should be given to layout and location of potential sources of impact. During construction, good site environmental management practices should be employed and implemented through a construction environment management plan or similar document. Opportunities should also be sought for positive improvements to biodiversity within and around the development, for example, through habitat creation and enhancement.

5.19 A separate report, documenting the Habitats Regulation Assessment (HRA) for Kirksanton[42] has been undertaken. This report should be referred to for further information relating to the effects of a new nuclear power station at Kirksanton on European-designated habitat sites.

5.20 <u>Strategic Effects on Biodiversity and Ecosystems:</u> The potential for adverse effects on sites and species considered to be of UK-wide and European nature conservation importance (the Duddon Estuary SPA/Ramsar/SSSI site and the Morecombe Bay SAC/SPA/Ramsar site, Shad Meadow and Sea Pasture SSSI) means that significant strategic effects on the biodiversity cannot be ruled out at this stage of the appraisal. There is, however, potential for the mitigation or compensation of biodiversity effects, including the creation of replacement habitat for UK designated sites. Detailed baseline studies will form part of the project level Environmental Impact Assessment. The Habitats Regulations Assessment for Kirksanton should be referred to for further details and advice on internationally designated sites.

[42] Habitat Regulations Assessment Pilot Kirksanton: HRA Screening and Appropriate Assessment Report.

Climate Change

5.21 The establishment of a new nuclear power station could contribute positively to the North West region's climate change objectives. 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.

5.22 However, the area outlined by the nominator encompasses five turbines of an operational eight turbine wind farm, which has a combined capacity of 5.8MW. If the establishment of a new nuclear power station on the nominated site were to lead to the closure of the wind power development, or to any interruption in its operations, the effect on regional greenhouse gas emissions would be significantly less positive than if it was sited in an area with no existing renewable energy generation and the Haverigg wind farm could continue generation. The North West Regional Spatial Strategy promotes the expansion of renewable energy generation, which would be undermined by the ceasing the operation of an efficient, operational wind farm.

5.23 A new nuclear power station at Kirksanton may also 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.

5.24 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.

5.25 <u>Strategic Effects on Climate Change</u>: A new nuclear power station on the nominated site could have a negative effect on the operation of the existing Haverigg wind power development, which falls within the nominated site boundary. However, because the energy generating potential of a new nuclear power station is much greater than the existing wind farm, development of a new nuclear power station would still make a positive contribution to the North West's climate change objectives. This contribution would be greater if the wind farm were to remain completely unaffected by development of a new nuclear power station on the nominated site.

Communities: Population, Employment and Viability

5.26 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.

5.27 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.

5.28 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.

5.29 There could be positive cumulative effects of a new nuclear power station at Kirksanton for the region as a whole when considered with nominations for additional nuclear power stations in the North West. This could contribute to the regional economy and employment, with potential for a specialist nuclear industry hub.

5.30 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[43] 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.

5.31 <u>Strategic Effects on Communities: Population, Employment and Viability</u>: 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

5.32 Negative effects at the local scale are likely due to increased pressure on basic services and infrastructure, including on local transport networks, waste water treatment, electricity, and waste management facilities. However, these effects are not considered of strategic significance.

5.33 Transport: There is potential for negative effects on local and strategic road infrastructure through increased congestion/disruption of traffic on the A595 and A5093. This could be a problem north of the nominated site towards Whitehaven where traffic is known to travel slowly during peak periods. In addition, some local settlements along the A595 and A5093 may be negatively impacted as a result of the construction, operational and

[43] 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

decommissioning traffic. Notwithstanding this, the effect on the local road network of a nuclear power station at this nominated site is likely to be mitigated through transportation plans, green travel plans and consideration of alternatives to road use for the transport of aggregates and other construction materials, such as the existing coastal rail line.

5.34 Conventional waste: Waste material will be generated during the construction, operation and decommissioning of a development. Local impacts may be expected upon local/regional facilities, 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. Some impacts may be positive, such as the generation of significant quantities of secondary aggregate during demolition.

5.35 Radioactive Waste[44]: 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.

5.36 Onshore wind: The boundary of the nominated site partially overlaps with the existing Haverigg Onshore windfarm. There is therefore potential for construction of the nuclear power station to cause an adverse impact on the windfarm, if it is still operational at the time of construction. Detailed design at the project development phase would need to take account of the existing wind farm in order to avoid or minimise significant adverse impacts.

5.37 Electricity transmission: The development of a nuclear power station at Kirksanton would require new electricity power lines to be built to connect the facility with the National Grid. The potential impact of new power lines will be considered in a separate Networks National Policy Statement (NPS).

5.38 <u>Strategic Effects on Communities: Supporting Infrastructure</u>: There is the potential for adverse effects on supporting infrastructure, including conventional waste, transport, onshore wind energy, and basic services. These effects are of local significance and mitigation opportunities are likely to be available.

[44] Radioactive waste is waste regulated under Radioactive Substances Act 1993.

Human Health and Well-Being

Radiological Health Issues

5.39 Radiation occurs naturally in the environment. The Health Protection Agency (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.[45]

5.40 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.[46] 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.

5.41 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.[47]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 Radioactive Substances Act 1993[48]. This regulatory system will apply to a potential new

[45] Ionising Radiation Exposure of the UK Population: 2005 Review HPA-RPD-001

[46] 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, 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

[47] 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).

[48] Radioactive Substances Act 1993 http://www.opsi.gov.uk/acts/acts1993/ukpga_19930012_en_1

nuclear power station at Kirksanton and should ensure that permitted radioactive discharges do not cause unacceptable risk to health.

Regulatory Justification

5.42 Before the UK can adopt any new class or type of practice involving the use of ionising radiation, it must first be 'Justified', i.e. it must be demonstrated that any benefits resulting from its introduction outweigh the associated health detriment. European Council Directive 96/29/Euratom of 13 May 1996 (the Basic Safety Standards Directive)[49] 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 is the Justifying Authority[50].

5.43 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

5.44 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[51]. 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.

5.45 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

[49] 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

[50] Completion of the Regulatory Justification process is not dependent on consent being granted by the IPC and similarly there is no need for the IPC to wait for completion of the Regulatory Justification process before granting consent.

[51] White Paper Website Ref

radioactive materials no 'significant dose events' were associated with the nuclear power industry[52].

5.46 The scale of construction work associated with a potential new nuclear power station at Kirksanton 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.

5.47 During the operation of a potential nuclear power plant at Kirksanton, 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 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 allowing the NII to monitor safety risks throughout the lifetime of the project.

5.48 There is no existing nuclear power station at Kirksanton, therefore new electricity transmission lines will be required 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. 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[53], a precautionary approach is adopted to the routing of any required power lines.

5.49 The presence of, and more particularly the construction of, a new nuclear power station at the Kirksanton 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. 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.

5.50 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.

[52] http://www.hpa.org.uk/HPA/Publications/Radiation/HPARPDSeriesReports/
[53] http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb_C/1195733817602

5.51 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 would need to be carried out, according to relevant international (ISO) and British (BS) standards, 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 Kirksanton.

Local Health and Recreation

5.52 With regard to recreation, there is a potential impact associated with the Cumbria Coastal Way, which is likely to pass the nominated site. It is probable 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.

5.53 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.

5.54 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.

5.55 It is probable that building, operating and decommissioning a potential new nuclear power station at Kirksanton will 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.

5.56 **<u>Strategic Effects on Human Health and Well-Being</u>: The rigorous system of regulation of routine discharges from the proposed nuclear power station at Kirksanton 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. Overall, the likely enhancement in employment, community wealth, housing stock and other associated neighbourhood infrastructure should improve community well-being and health generally.**

Cultural Heritage

5.57 The main effects of the development would be local, within the footprint of the proposed facility. However, any physical impacts on the wartime airfield and historic landscape could be of regional or national importance. Potential setting effects on scheduled monuments, the conservation area and listed buildings could also be of regional or national importance, depending on distance and sight lines. However, there is a possibility that these effects can be mitigated, for example, depending on the availability of land, there is likely to be potential for some off-site mitigation through woodland planting.

5.58 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.

5.59 An unknown archaeological (buried) resource is potentially present within the nominated site. Detailed investigations (including consultation with 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 a watching brief during the construction phase (during ground preparations and excavations).

5.60 **<u>Strategic Effects on Cultural Heritage</u>: 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 that may be present on the nominated site. However, there is a possibility that these effects can be mitigated. Further detailed assessment at project level will be required.**

Landscape

5.61 During construction and decommissioning of the power station, the main direct impacts on landscape would be local, for example, the loss of farmland and possibly sand dunes and beach areas resulting from the installation of new cooling culverts. However, during operation 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 projects along this coastal plain.

5.62 The existing wind farm and prison already feature in views from the National Park, and from nearby Black Combe fell and adjoining fells. Further development is highly likely to lead to a perceptible deterioration of some views.

5.63 There may be scope for off-site landscaping (as on-site landscaping is not possible) which could reduce potential visual effects on above ground cultural heritage assets. This will need to be fully explored at the project level stage. However given the scale of any development on the nominated site and its proximity to the Lake District National Park, fully effective mitigation of adverse effects during the construction and operational phases is unlikely. Depending on the available land area including off-site land, there could be opportunity for the development to sit within a strong new landscape framework with the creation of tree belts, lakes and replacement public rights of way. Careful design and consideration of alternatives is needed to avoid or reduce landscape impacts, for example using tunnelling techniques to reduce the impact of cooling infrastructure.

5.64 <u>Strategic Effects on Landscape</u>: The AoS has identified potential adverse effects on landscape. These include lasting direct and indirect adverse landscape and visual impacts on the surrounding area and coastline, including the Lake District National Park which is of national landscape importance. Overall, the new power station would be assessed in the context of the existing wind farm, prison and disused airfield, prior to any decommissioning. However, development of the nominated site is still likely to lead to a perceptible deterioration in views, which would not be able to be fully mitigated, given the scale of possible new buildings, and the necessary upgrades to electricity transmission infrastructure to connect the facility to the UK electricity grid. At a local level, there is also the potential for long term adverse effects on the coast adjacent to the nominated site, if cooling culverts cannot be incorporated using tunnelling techniques. The construction of sea defences and the incorporation of a new marine landing platform could also give rise to adverse impacts on the appearance of the existing shoreline. The nature and magnitude of these effects need to be assessed fully as part of the landscape and visual impact assessment that would form part of a full EIA.

Soils, Geology and Land Use

5.65 The construction of a new power station within the nominated site will result in the loss of 131ha of Grade 4 agricultural land and parts of the disused airfield, where the wind turbines are located.

5.66 Construction at Kirksanton 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 (please refer to the Biodiversity and Ecosystems sections of this AoS Report for further details). Effects could be mitigated through limitation of the footprint of the development, thereby reducing the area of soils affected.

5.67 The development of the 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.

5.68 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.

5.69 <u>Strategic Effects on Soils, Geology and Land Use</u>: 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

5.70 The nominated site is surrounded by areas which are shown on Environment Agency (EA) maps as being at risk of flooding from rivers and sea without defences. During the lifespan of the proposed nuclear power station, and as a result of potential sea-level rises, the nominated site is likely to require the construction of new flood defences. These defences would be designed to counteract the effects of existing fluvial and coastal processes, but are likely to have the secondary effect of impacting the movement of sediment in the river system and along the coast. The effects of the construction and long-term presence of upgraded coastal defences on coastal process, hydrodynamics and sediment transport along the coast could be reduced or possibly eliminated by the adoption of suitable, environmentally-friendly designs.

5.71 A potentially significant effect could result from the returning of cooling water to the sea at elevated temperatures. A more detailed appraisal would be required at the project EIA level to assess the implications of this thermal discharge and its effects on both water quality and coastal processes, including sediment transport. Any future thermal discharge will be subject to consent from the Environment Agency and will require the discharge to meet existing regulatory standards or to avoid any further deterioration (whichever is the most stringent).

5.72 In addition, the new Marine Management Organisation (MMO) set up under the forthcoming Marine and Coastal Access Bill will have a role in advising the

Infrastructure Planning Commission (IPC) on conditions that should be imposed to mitigate any adverse impacts the development may have on the marine environment or other uses of the sea.

5.73 To maintain water quality standards, any future discharges from the power station will need to be considered as part of the EIA for the proposed development. 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.

5.74 Environment Agency consenting policy is currently under modification with proposed risk-based consents as part of the Environmental Permitting Procedures. This new framework accounts for the specific risks from discharges to surface waters and in particular requires assessment of specific receptors, such as shell fisheries.

5.75 Environment Agency policy states that chemical forms of disinfection, including chlorination, will not be acceptable for discharges directly into, or in close proximity to, shellfish waters. This will need to be taken into account in the detailed arrangements for controlling fouling of the power station cooling water system. As part of the process of consenting discharges, the Environment Agency may require modelling and other studies to assess the impacts of any proposed discharges, including thermal impacts, on water quality and ecology in the estuarial and coastal waters.

5.76 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 of increased water demand will depend upon the timing and size of the final plant. Similar comments apply to wastewater production from the nominated site.

5.77 As previously stated, there are strategically significant limitations to available water resources in West Cumbria. Further abstractions within the West Cumbria Water Resource Zone may have significant impacts on several SACs upon which there is currently a heavy reliance. Also local Resource Zones are already expected to have a significant deficit of water resources.

5.78 A minor impact could occur as a result of the effect of the development on the quality and quantity of groundwater at the nominated site. The underlying aquifer could be used locally for private water supplies, and discharges from this groundwater body may support local groundwater-dependent surface water aquatic ecosystems. Localised groundwater pathways are likely to exist, hence accidental discharges or construction disturbance at Kirksanton could cause deterioration in groundwater quality and flow quantity. In addition, any increased groundwater abstraction locally during construction/operation could lead to impacts on groundwater dependent surface water features and aquatic ecosystems.

5.79 <u>Strategic Effects on Water Quality and Resources</u>: The AoS has identified potential adverse effects on water quality and coastal processes, including sediment transport. Direct effects on water resources, including groundwater resources, could be brought about through increased demand, particularly during construction. Indirect effects, of potentially wider significance, on nationally and internationally designated habitats, including from the thermal impacts of cooling water discharges on water quality, have also been identified.

Flood Risk

5.80 Development of the 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 site over the lifetime of the development are likely to increase.

5.81 To mitigate against this risk, ongoing management and/or improvement of the existing defences may be required. This may have an impact on coastal processes, but could be mitigated through appropriate design, construction and management techniques.

5.82 The nominated site is indirectly defended by man-made defences built in 1993 and directly defended by natural defences. However, it is situated adjacent to an area that the Environment Agency considers as being at risk from flooding by rivers and sea and which is currently without defences. A new nuclear power station on the nominated site may require new coastal defences and flood protection works (i.e. embankments, sea walls, or groynes) to safeguard the site from future coastal erosion and coastal flooding.

5.83 The presence of artificial structures could disrupt the natural pattern of sediment movement, by concentrating and magnifying the effect of erosion on other unprotected parts of the coast, such as sand dunes and beaches, and generally interfering with the sediment transport pathways to the Duddon Estuary and Morecambe Bay. It must also be noted that any broad scale changes in the systems hydrodynamics will be reflected in the positions of the channel banks and networks, and in the erosion and accretion of the mud/sand flats and saltmarshes, including the saltmarsh ecosystem in the highest reaches of the estuary. This may directly impact on the bird populations and biodiversity.

5.84 If further coastal defences are constructed at Kirksanton this would be outside of the Shoreline Management Plan (part of Defra's 'Making Space for Water' strategy) in the region which is to "do nothing".

5.85 Further mitigation with respect to flood risk could be provided by local land raising of the nominated site which would be a less damaging option than erecting more coastal defence structures,

5.86 To fully assess the flood risks to the nominated site it is recommended that a detailed site-specific flood risk assessment is undertaken by the nominator.

5.87 **<u>Strategic Effects on Flood Risk</u>: The AoS has identified potential adverse effects relating to flood risk due to rising sea levels, especially during the later stages of the development. This is considered to be a wider national issue because of the potential effects on national energy supply and infrastructure. Mitigation may be possible through appropriate design and construction of defences, taking account of coastal processes, hydrodynamics and sediment transport.**

Key Interactions between Sustainable Development Themes

5.88 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.

5.89 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

5.90 The operation of a new nuclear power station at Kirksanton could interact with other key plans and policies to create cumulative effects. 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 draft Nuclear NPS and development at the nominated site at Kirksanton were identified as follows:

- Regional Spatial Strategy for the North West 2008 - 2021, Government Office for the North West (2008)
- Regional Economic Strategy for the North West 2006 - 2026, North West Regional Assembly (2006)
- North West Climate Change Action Plan 2007 - 2009, North West Regional Development Agency (2007)
- Cumbrian Biodiversity Action Plan (2000-2010), UK Biodiversity Action Plan (2001)
- Shoreline Management Plan 2 (SMP2) – River Wyre to Walney Island, Northwest and North Wales Coastline
- Future Generation: A Strategy for Sustainable Communities in West Cumbria 2007 - 2027, West Cumbria Partnership
- Joint Municipal Waste Management Strategy: Cumbria Strategic Waste Partnership (2008-2020)
- Draft River Basin Management Plan for the North West, Environment Agency (2008)

5.91 Other relevant key projects that might have significant interactions with the proposals for a new nuclear power station at Kirksanton include:

- The operation and decommissioning of the existing nuclear facilities at Sellafield, and also at Drigg
- Nominations for new nuclear power stations at nearby Heysham, Sellafield and Braystones
- Major projects listed within Cumbria's revised Economic Strategy and Sub-Regional Action Plan (February 2009):
  - Waterfront Business Park and Marina Village (Barrow)
  - Housing Market Renewal (Barrow and West Cumbria)
  - Morecambe Bay Barrage
  - Duddon Estuary Road Bridge
- 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.[54] The presence of at least one new nuclear power station within Cumbria is a key component, and driver, of the Masterplan.
- 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)

5.92 In addition, there may be in-combination effects with the marine off-loading facility which could be required for this nominated site.

5.93 The appraisal of cumulative sustainability effects arising through interactions between the Kirksanton and the other key plans is presented in Table 5.2.

[54] www.britainsenergycoast.com

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

AoS Sustainable Development Theme	Interactions and Cumulative Effects
Biodiversity and Ecosystems	• Potential conflicts with the RSS which aims to protect habitats and species in accordance with the North West Biodiversity Action Plan • Potential for interaction with the Cumbria Biodiversity Action Plan target to halt disruption to coastal processes through the use of Shoreline Management Plans • Cumulative impacts of other high profile developments/plans in the area must be considered in terms of their overall effect on local biodiversity. Ongoing or potential new development projects include Walney Wind Farm, Duddon Estuary Road Bridge, Morecambe Bay Barrage, Gateway Off-shore Gas storage facility and existing/potential new nuclear facilities at Sellafield and Heysham • In combination with other projects that may impact on the coast within the Duddon Estuary and Morecambe Bay European Marine Sites, there may be a cumulative adverse impact on coastal process, hydrodynamics and sediment transport, and potential indirect effects on nationally and internationally designated habitats.
Climate Change	• The North West Climate Change Action plan identifies objectives for reducing greenhouse gas emissions • Low carbon economy promoted by nuclear power proposals and reducing unsustainable travel patterns all seek to minimise the effects of climate change. • 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). • Potential conflict with the RSS which promotes the careful siting of infrastructure along the coast to avoid future loss or excessive costs of coastal defence. It also aims to minimise the loss of coastal habitats and avoid damage to coastal processes. • The Regional Spatial Strategy for North West England contains targets for increasing electricity supply from renewable sources in the region. Potential cumulative effect due to proposals for onshore and offshore wind farm projects in region.
Communities: Supporting Infrastructure	• Potential interaction with the Regional Transport Strategy of the RSS (Regional Spatial Strategy), which aims to reduce private car use and increase use of public transport due to increase in traffic from workers.

AoS Sustainable Development Theme	Interactions and Cumulative Effects
	• 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. • Decommissioning of existing power stations at Sellafield may combine to have adverse effects on supporting infrastructure; in particular transport networks. • Potential conflict with the RSS which promotes plans and strategies for waste management to reflect the Waste Strategy for England 2007, aims to reduce growth in municipal waste to zero by 2014, and promotes reuse, recycling and composting.
Human Health and Well-Being	• Potential positive interaction with Future Generations proposal for Copeland Borough Council to be globally recognised as a leading nuclear, energy, environment and related technology business cluster, building on its nuclear assets and its technology and research strengths.
Cultural Heritage	• Potential conflict with the RSS which aims to protect the historic environment.
Landscape	• In-combination effects through associated off-site works carried out by the National Grid. • The coastline and adjoining lowland landscape including the Lake District National Park is likely to be affected by other energy proposals, including: tidal, wave, biomass and additional onshore and offshore wind farm proposals as part of the wider West Cumbria Energy Coast™ Masterplan. Also, other nuclear sites in this area will add further cumulative effects.
Water Quality and Resources	• Potential negative impact on Draft River Basin Management Plans to improve estuarine and coastal areas. • Potential negative impact on the capacity to meet future water demands in West Cumbria • The requirement of inland water for cooling has yet to be excluded for both the Braystones and Sellafield nominated sites. Therefore cumulative impacts during operation phases of these developments may be created which could have strategically significant impacts across West Cumbria.
Flood Risk	• Potential negative impact in relation to Shoreline Management Plan review for cell 11 for the reconciliation of coastal defences and nature conservation interests

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 AoS has explored both adverse and beneficial potential effects of building a new nuclear power station at Kirksanton. Both beneficial and adverse 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 IPC), during project level assessments.

6.3 The AoS process has included recommendations to inform the development of the draft Nuclear NPS. This site report for Kirksanton 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 Kirksanton, 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 Kirksanton will be similar across all the nominated 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 Kirksanton. These are discussed below:

6.5 There are potential negative effects on two national and internationally protected conservation sites, namely the Duddon Estuary and Morecambe Bay; and effects on water quality in the region due to the abstraction and release of sea water for cooling. A coastal flood defence scheme already exists in the area of the nominated site, but undefended areas in the vicinity show signs of coastal erosion. The existing defences may need to be upgraded to protect against sea level rise and coastal erosion during the lifetime of the facility. These effects are significant, but mitigation opportunities are likely to be available following further study.

6.6 There is limited existing development at Kirksanton, with the exception of a wind farm, prison and disused airfield. The development of a new nuclear power station will have a negative visual impact on the landscape and could be seen from parts of the Lake District National Park, which could not be fully mitigated. New power lines and transport links would also be needed in the vicinity. This would therefore have a significant negative impact on the landscape at a local and sub-regional level.

6.7 Kirksanton forms one of a cluster of three nominated sites in the Cumbria area. The potential cumulative effects of the issues discussed above would increase if more than one power station was developed in the Cumbria area.

6.8 There will be significant positive effects associated with long term employment and enhanced prosperity for communities locally and this is likely to be significant at the sub-regional level if three power stations are built in Cumbria with enhanced benefits from the draft Nuclear NPS in combination with other proposals for regeneration in the North West.

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 The table following provides an overall summary of the significance of the environmental and sustainability effects for the Kirksanton 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	-	-	-

Key: Significance and Categories of Potential Strategic Effects	
++	Development would resolve an existing sustainability problem; effect considered to be of regional/national/international significance
+	No sustainability constraints and development acceptable; effect considered to be of regional/ national/international significance

0	Neutral effect
-	Potential sustainability issues, mitigation and/or negotiation possible; effect considered to be of regional/national/international significance
--	Problematical because of known sustainability issues; mitigation or negotiation difficult and/or expensive; effect considered to be of regional/national/ international significance
Uncertainty	
?	Where the significance of an effect is particularly uncertain, for example because insufficient information is available at the plan stage to fully appraise the effects of the development or the potential for successful mitigation, the significance category is qualified by the addition of '?'

6.11 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.

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. Levels of mitigation can range from the highest (avoidance at source), through to minimisation, and lastly to compensation. 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.

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 draft Nuclear NPS and IPC
Air Quality	
Adverse Effects: • Potential for related effects on national and European-designated wildlife sites due to increase in airborne pollutants and nutrients during construction	**Mitigation Possibilities:** • Please refer to mitigation measures contained in the Biodiversity and Ecosystems sections of this AoS Report
• Potential accidental release of radioactive emissions could have a significant strategic effect on air	• The nuclear regulators will need to be satisfied that the radiological and other risks to the public associated

Potential Strategic Significant Effects (adverse and beneficial effects)	Suggested Mitigation for Adverse Effects and Recommendations for the draft Nuclear NPS and IPC
quality	with accidental releases of radioactive substances are as low as reasonably practicable and within the relevant radiological risk limit.
Biodiversity and Ecosystems	
Adverse Effects: • Potential for loss, damage or fragmentation of ecologically important habitats and species from construction activities	**Mitigation Possibilities:** • Construction screening, avoiding sensitive periods for birds, effective management of construction to minimise potential disturbance to ecologically important areas
• Potential damage to important habitats or species from discharge of heated water	• Careful design and siting of the discharge system to avoid/minimise any impacts on habitats and species of value.
• Routine releases of radioactive discharges, abstraction of water and discharges of heated water could impact on nationally and internationally designated sites as well as non-designated aquatic systems. • Potential for accidental release of toxic substances and material waste during construction	• Effective management through good site techniques to avoid the potential for accidental release into the environment
• Construction of new coastal defences could potentially affect biodiversity, especially if additional defences are required at other existing and potential nuclear sites along the coast. • Locating a marine off-loading facility (if required) in the Duddon Estuary could potentially affect biodiversity, both through habitat removal and by interfering with sediment transport, and degrading the amount of natural sediment available to sustain the estuary and dependent SAC and SPA habitats and species.	• Nominator should ensure further studies and detailed modelling of sediment processes required to further understand the issue. There is, however, limited potential to mitigate this impact. Should the Habitat Regulation Assessment conclude that the development should proceed for imperative reasons of overriding public interest, creation of replacement habitat will need to be undertaken.
Climate Change	
Adverse Effects: • Negative effect on the North West's climate change objectives if new nuclear power station necessitates	**Mitigation Possibilities:** • Ensure construction of a new nuclear power station does not necessitate land take from existing

Potential Strategic Significant Effects (adverse and beneficial effects)	Suggested Mitigation for Adverse Effects and Recommendations for the draft Nuclear NPS and IPC
closure or disruption of operational wind farm	wind farm • Ensure nuclear power station structures do not interfere with wind patterns and reduce wind farm output
• Potential short term increases in emissions during construction and decommissioning	• Monitor greenhouse gas emissions
• Emissions from the transport of goods and labour throughout construction, operation and decommissioning phases	• Green travel plans • Further investment in public transport
Beneficial Effects • 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	
Communities: Population, Employment and Viability	
Adverse effects: • Pressure on basic services from likely large scale in-migration of construction workers	**Mitigation Possibilities:** • Measures to manage potential negative effects on local communities; enhance employment capacity through training; provision of services for staff and local community
• Project may lead to a shortage of local construction workers to meet the needs of other industries and major projects in the region.	• Measures to manage potential negative effects on local communities; enhance employment capacity through training; provision of services for staff and local community
Beneficial Effects: • Short to medium-term positive effects due to creation of new jobs for local and regional populations • Provision of education, training, up-skilling for employees and contractors in the region • Positive multiplier effects as income from new population of workers will help support local economy • Potential for property values to increase within vicinity of nominated site, based on previous studies	
Communities: Supporting Infrastructure	
Adverse effects: • There is potential for negative effects on local and strategic road infrastructure through increased congestion/disruption of traffic,	**Mitigation Possibilities:** • Appropriate mitigation measure to reduce the effects of transportation could include a Transport Management Plan (construction and

Potential Strategic Significant Effects (adverse and beneficial effects)	Suggested Mitigation for Adverse Effects and Recommendations for the draft Nuclear NPS and IPC
particularly north of the site towards Whitehaven • Some local settlements may be negatively impacted as a result of the construction, operational and decommissioning traffic	decommissioning) and Green Travel Plan (construction, operation and decommissioning) Consideration of alternatives to road for the transport of large loads
• As the boundary of the nominated site partially overlaps with an existing windfarm, there is the potential for an adverse impact on the windfarm	• Detailed design at the project development phase in order to avoid or minimise significant adverse impacts
• Potential for adverse impacts from grid connectivity	• Detailed design at the project development phase in order to avoid or minimise significant adverse impacts
• Potential for significant impacts regarding radioactive and conventional waste	• Conventional waste: good site practices, implementation of waste hierarchy (reduce, reuse recycle) and waste management • Radioactive waste: appropriate detailed design, storage and management
Human Health and Well-Being	
Adverse effects: • Possibility of local and regional health risks from accidental discharges.	**Mitigation Possibilities:** • Ensure continuation of current programme of monitoring power station discharges and their effects on health.
• The potential requirement for appropriate additional health service capacity for the influx of both construction and operational workers.	• The nominator should carry out a review of local health provision to ensure it is adequate for the expected influx of power station workers.
• The construction and operation of the proposed nuclear power station may lead to unacceptable community disturbance.	• The nominator should ensure a Construction Environmental Management Plan and an all-phase Travel Plan are produced, observed and monitored.
Beneficial Effects: • Likely positive effects on health via increase in employment, community wealth, additional housing and other associated neighbourhood infrastructure.	
Cultural Heritage	
Adverse effects: • If a buried archaeological resource or the wartime airfield is present the	**Mitigation Possibilities:** • Detailed investigations (trial trenching etc.) with an excavation

Potential Strategic Significant Effects (adverse and beneficial effects)	Suggested Mitigation for Adverse Effects and Recommendations for the draft Nuclear NPS and IPC
main effects would be at a local scale, within the footprint of the nominated new facility. Effects would be permanent and irreversible	and/or watching brief potentially required prior to and during the construction phase • If structures and features associated with the wartime airfield are present detailed survey will probably be required prior to construction
• Immediately surrounding the site, there may be potential effects on the settings of historic assets. The significance will depend on distance, topography and ability to mitigate	• It may be possible to mitigate against potential adverse setting effects on heritage assets through appropriate landscaping/planting schemes
Landscape	
Adverse effects: • Potential for longer-term adverse direct landscape and visual impacts on the surrounding area including western and coastal areas of the Lake District National Park	**Mitigation Possibilities:** • Some limited visual impact mitigation may be possible, although given the proximity of the Lake District National Park, fully effective mitigation is unlikely. • The creation of a strong landscape framework may provide enhancement opportunities to the local environment
Soils, Geology and Land Use	
Adverse effects: • Localised loss of soil structure that might adversely affect nationally/internationally designated sites (please refer to the Biodiversity and Ecosystems sections of this report for further details)	**Mitigation Possibilities:** • Limitation of the footprint of the development, reducing the area of soils affected • Avoidance of any soils within designated sites of ecological importance
Water Quality and Resources	
Adverse effects: • Effects of potential new flood defence works on fluvial and coastal processes, hydrodynamics and sediment transport, and any indirect effects on internationally designated habitats • Potential negative effects of works to provide and discharge cooling water on coastal processes, hydrodynamics and sediment transport, and any indirect effects on	**Mitigation Possibilities:** • Further investigations required • Sediment transport modelling • Suitable design, which may include use of sustainable drainage systems (SUDS) • Selection of appropriate construction methods • Appropriate management of the defences

Potential Strategic Significant Effects (adverse and beneficial effects)	Suggested Mitigation for Adverse Effects and Recommendations for the draft Nuclear NPS and IPC
internationally designated habitats	
• Thermal impact of cooling water discharges (if this mode of cooling were to be adopted). This effect is of local and regional significance	• Further investigation required • Modelling impact of thermal plume on shellfisheries • Thermal discharges will need to be consented by the EA. The discharge quality will need to comply with existing standards or meet the no deterioration standard
• Increased demand for water during construction stage and potentially during operation phase. Magnitude and duration dependent on source of cooling waters and timing of activities at the existing and other nominated nuclear sites • Similar comments apply to wastewater production • There are two nominated sites in the United Utilities Integrated Zone (Kirksanton and Heysham) and two nominated sites in the West Cumbria Resource Zone (Braystones and Sellafield). All would have their own water requirements which would have to be satisfied from Resource Zones which are already expected to have a significant deficit of water resources • Strategically significant limitations to available water resources in West Cumbria. Local Resource Zones are expected to have a significant deficit of water resources	• Further investigations required • Studies to ensure that capacity of water and wastewater infrastructure in WRZ is sufficient
• Potential impacts of accidental discharges or construction disturbance could cause deterioration in quality and flow of local groundwater bodies	• Further investigations required • Studies to ensure that local groundwater bodies are investigated and suitable design is adopted to mitigate potential impacts • Potential for ongoing monitoring of impact on groundwater bodies
Flood Risk	

Potential Strategic Significant Effects (adverse and beneficial effects)	Suggested Mitigation for Adverse Effects and Recommendations for the draft Nuclear NPS and IPC
Adverse effects: • Main effects are through the continued management and improvement of existing defences which may affect coastal processes. Potential significant impacts on the Duddon Estuary European Marine site from mitigation actions to protect the nominated site against sea level rise	**Mitigation possibilities:** • It may be possible to mitigate these effects by suitable design and selection of appropriate construction methods and also appropriate management of the defences

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_2	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 Organisation of Standardisation
LAQM	Local Air Quality Management
LBAP	Lancashire Biodiversity Action Plan
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_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
Nuclear NPS	The proposed National Policy Statement for new nuclear power stations
NPS	National Policy Statement
NWCCAP	North West Regional Development Agency
NWRDA	North West Regional Development Agency
OSPAR	Oslo and Paris Conventions
PM_{10}	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
TEN	Trans European Network
UKCIP	UK Climate Impacts Programme
UU	United Utilities
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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