Nuclear Decommissioning Authority

Strategic Environmental Assessment

Site Specific Baseline

Chapelcross

May 2010

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An Environmental and Sustainability Report will be published as part of the Strategic Environmental Assessment (SEA) of the Revised NDA Strategy. It has been produced in compliance with the SEA Directive (2001/42/EC) and transposing regulations (S.I.1633, 2004).

The following pages contain specific baseline information, and maps, for the Chapelcross site. This information is used in the preparation of the Environmental and Sustainability Report. A short introduction is followed by a table containing the current baseline information, organised by sustainability headings. The final section includes information about future developments and environmental issues.

The NDA is committed to openly sharing information and making it accessible to all. In making this non-confidential environmental and sustainability information available we believe that it will provide a useful ongoing resource to the general public.

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Site Specific Baseline for Chapelcross

Chapelcross

Chapelcross nuclear power station is located in Dumfriesshire and covers and area of 96 hectares. It began generating electricity in 1959 and continued to do so for 45 years, until 2004. Following the cessation of energy generation, a four stage decommissioning process commenced in 2005. Chapelcross is currently in the process of defuelling the operational site which is due for completion in 2011. Care and maintenance preparation is due to run for approximately 12 years (although it started in 1998 on the north site) until completion in 2022, and will ensure that the reactors and any remaining facilities on the operational site are in suitable condition for care and maintenance, which is anticipated to run for 85 to 100 years. The final site clearance is planned to commence following this period of care and maintenance lasting for 10 years and will involve the demolition of the reactors and removal of any other infrastructure remaining on site.

Site End State Assumption

The end state for Chapelcross involves the decommissioning and de-licensing of the site. All hazards will be removed and the removal of buildings will be prioritised. All waste arising will be appropriately treated, processed, packaged and sent for permanent off-site disposal once appropriate national repositories exist. The de-licensed site may then be used for industrial re-use.

Current Environmental Baseline

Table 1: Baseline Data across all topics for Chapelcross

SEA Objective	Key Environmental Baseline	Source
Air Quality	In 2004, a first and second stage review of air quality within Dumfries and Galloway Council was undertaken for a number of pollutants including carbon monoxide, lead, sulphur dioxide, nitrogen dioxide and fine particulates (PM_{10}). The results of the second stage review and assessment indicated that all pollutants were unlikely to exceed national air quality objectives for the target years. Chapelcross discharged 68.4 TBq of tritium to the atmosphere, amounting to 1.4% of the annual discharge limit. It also discharged 3.9 10^{-5} TBq of sulphur-35 to the atmosphere, amounting to less than 1% of the annual discharge limits. The discharges were assessed to result in doses to the critical group (a group or representative individual who receive the largest dose from artificially produced radionuclides due to their habits, diet and where they spend their time) of 0.023 mSv/y, or approximately 2% of the public dose limit of 1 mSv/y (from all sources).	BNFL plc (2004) *Chapelcross Nuclear Power Station Environmental Statement*; Environment Agency et al. (2009) *Radioactivity in Food and the Environment*
Climate Change and Energy	Chapelcross used carbon dioxide (CO_2) as a coolant during the operational phase with modest emissions of the order of a few thousand tonnes per year. However, such discharges are now	BNFL plc (2004) *Chapelcross*

	negligible and the sites carbon footprint is dominated by indirect emissions from energy use. In 2004, the estimated amount of fossil fuel derived CO_2 emissions from activities on the operational site was 2,424 tonnes although this is likely to fluctuate depending on the level of activity on the operational site during the decommissioning process.	*Nuclear Power Station Environmental Statement*; NDA (2005) *Chapelcross EAPINS Project Questionnaire*
Biodiversity, Flora and Fauna	While there are no designated sites of nature conservation interest within 2 km of Chapelcross, there are a number of SSSIs, SPAs, SACs and a Ramsar site within a larger radius, particularly within10 km of the site. The Solway Firth SSSI, SPA, SAC and Ramsar site supports one of the largest continuous areas of intertidal habitat in Britain. It is of international importance for a range of coastal habitats and for the wintering and passage waterfowl supported by them. Protected species supported by habitat in the area include natterjack toads and great-crested newts, as well as otters protected under Schedule 5 of the Wildlife and Countryside Act (1981) and Schedule 2 of the Conservation (Natural habitats &c.) Regulations 1994. The Upper Solway Flats and Marshes also It is also noted for supporting Barnacle goose, Golden plover; Bar-tailed godwit and whooper swans (which are Annex 1 species under the Birds Directive). It also supports internationally important numbers of Pink-footed goose; Pintail; Scaup; Oystercatcher; Knot; Curlew; Redshank; and Dunlin over winter, and Ringed plover on passage. Bats are protected by the Wildlife and Countryside Act 1981 (as amended) and under Regulation 39 of the Conservation (Natural Habitats &c.) Regulations 1994. Small numbers of several bat species have been recorded feeding with nearby areas around the power station. Badgers are protected by the Protection of Badgers Act 1992. Evidence of badgers was found at two locations towards the northern end of the effluent pipe. Peregrine (Annex 1 species under the Birds Directive) have been known to regularly breed at Chaplecross. A holistic approach to biodiversity should recognise that biodiversity is more than just the reflection of designated sites. It is an interrelated network of habitats and species, of which designated sites and species are those that are most fragile or rare and require the highest degree of protection. Many non designated species of flora and fauna are found in the area including scrub land containing hawthorn and goat willow. Scottish Natural Heritage highlights that the Natura 2000 network of sites in Scotland is nearly complete, but that additional sites, particularly within the marine environment may be identified in the future. A generic assessment on the impacts of the radioactive discharges on wildlife from the UK's nuclear power stations concluded that the chronic dose rate guideline was not exceeded for any of the assessed marine or terrestrial organisms. Furthermore, the estimated doses to wildlife were below the level at which effects could be observed. The supporting figure highlights the context of the nuclear licensed site and its immediate surroundings. The area shown in the figure does not attempt to identify all potential designated sites that may be affected by activities associated with the UK Nuclear Industry LLW Strategy. Rather, it attempts to strike a balance between highlighting those sites that are in the vicinity of the nuclear licensed site between different topic themes. Hence, more expansive coverage would reduce the visibility of designated Scheduled Ancient Monuments which, by their nature, have significantly smaller coverage than ecological based designated areas.	BNFL plc (2004) *Chapelcross Nuclear Power Station Environmental Statement*; Environment Agency (2002) *Impact Assessment of Ionising Radiation on Wildlife*
Landscape and Visual	Chapelcross Power Station is situated within a broad, gently undulating lowland plain surrounding the Solway Firth. The largest structures on the site are the four reactor buildings, each rising to 37m. Chapelcross power station does not lie within an area of national, regional or local landscape significance. However, the power station is visible from a wide area adding a substantial industrial feature to a largely rural region and affecting a number of sensitive receptors in both Scotland and	BNFL plc (2004) *Chapelcross Nuclear Power Station Environmental*

	England including Hadrian's Wall World Heritage Site and the Lake District National Park. This visual impact has, however, been significantly reduced since the demolition of the site's cooling towers in 2007. The largest remaining structures are the four reactor buildings rising to 37 m. Local views (up to 2 km radius of the site) are typically, although not exclusively, dominated by the power station.	*Statement*
Cultural Heritage	There are no archaeological or historical features identified within the Chapelcross site or are physically affected by activities at the site.	BNFL plc (2004) *Chapelcross Nuclear Power Station Environmental Statement*
Groundwater, Geology and Soils	The Chapelcross site is underlain by a variable thickness of Superficial Deposits, comprising made ground and glacial till. There is anticipated to be 1,000 m^3 of soil contaminated with radionuclides that will need to be treated as Low Level Waste (LLW), which, once packaged, will result in 1,167 m^3 for disposal. This is expected to be generated during final site clearance. The most significant known contaminated issue at Chapelcross is related to the historical disposal of waste solvents to soil. There is also some groundwater contamination of soil under the old waste oil storage compound in the north of the site. Occasional localised patches of radiological contamination are present in the soil below the active effluent discharge pipe. On the "North Site" there is a near surface deposit of cooling tower sludge containing elevated concentrations of heavy metals used for timber treatment. Elsewhere, residues of the burning of hydrocarbons for fire training have resulted in localised elevated concentrations of hydrocarbons in the shallow soil. Groundwater within the Solway bedrock and localised sand and gravel aquifers is considered to be of good qualitative status and good quantitative status in accordance with the Water Framework Directive. The Scottish Soil Framework indicates that Chapelcross is located in an area of predominantly brown earth soils.	BNFL plc (2004) *Chapelcross Nuclear Power Station Environmental Statement*; NDA (2005) *Chapelcross EAPINS Project Questionnaire*; NDA (2007) *Chapelcross 2007/08 IWS* NDA (2007) *Contaminated Land Position Paper for Chapelcross*; SEPA (2009) [http://gis.sepa.org.uk/rbmp/MapViewer.aspx]; Scottish Government (2009) *The Scottish Soil Framework*
Surface Water Resources and Quality	The site is located approximately 6 km to the north of the Solway Estuary, and is located within the River Annan catchment. The River Annan is classified as having moderate water quality status in accordance with the Water Framework Directive. In 2006, SEPA classified the River Annan as Class A under its Estuarine Waters Classification Scheme. Non-radioactive effluent and runoff is, routed via Gullielands Burn whilst radioactive effluent is routed via the active effluent discharge pipe. Chapelcross discharged 2.51 10^{-5} TBq of alpha radioactive liquid, amounting to less than 1% of annual authorised discharge limits. It also discharged 0.00102 TBq of beta and 2.49 10^{-4} TBq of tritium, each amounting to less than 1% of the respective annual authorised discharge limits. The discharges were assessed to result in doses to the critical group (a group or representative	BNFL plc (2004) *Chapelcross Nuclear Power Station Environmental Statement*; Environment Agency et al. (2009) *Radioactivity in Food and the*

	individual who receive the largest dose from artificially produced radionuclides due to their habits, diet and where they spend their time) of 0.022 mSv/y, equivalent to 2.2% of the public dose limit of 1 mSv/y (from all sources).	*Environment*; www.sepa.org.uk; and SEPA (2009) [http://gis.sepa.org.uk/rbmp/MapViewer.aspx]
Waste	In 2004, 70 tonnes of Asbestos and 75 tonnes of miscellaneous waste were disposed of to landfill. In 2004, over 115 tonnes of waste material was released for reuse and recycling, or reused on site. It is anticipated that there will be a total of 42,940 m^3 of LLW generated during decommissioning, the majority of it during final site clearance, which once packaged will result in 51,280 m^3 of packaged waste for disposal. It is anticipated that some 4,983 m^3 of Intermediate level Waste (ILW) will be generated during decommissioning, which will result in 6,066 m^3 of packaged volume ILW for disposal. This will arise primarily during final site clearance.	NDA (2005) *Chapelcross EAPINS Project Questionnaire*; NDA (2007) *Chapelcross 2007/08 IWS*
Economy, Society and Skills	The resident population of the five Wards within which the station staff reside is 15,894, which represents 10.8% of the Dumfries and Galloway population (148,000). In 2004, Dumfries & Galloway has a working population of 107,391. The working population of the five Wards is 11,541 representing 10.7% of the Dumfries & Galloway total. Dumfries & Galloway still has a high dependence on the agricultural and forestry sector, at almost four times the national Scottish level. In 2004, the levels of unemployment in Dumfries & Galloway (4.2%) were slightly higher than the Scottish average (3.9%), whereas in the five Wards, three were lower than the Scottish Average. In 2004, there were 480 people working at the Chapelcross Station, including contract staff. The decommissioning requirements of the power station in terms of the local sourcing of goods and services are likely to impact on the level of indirect employment in the Five Wards. Some 62 of the 132 schools in Dumfries and Galloway are located within the 5 wards where the site's employees live. Dumfries & Galloway have high levels of working age population with no qualifications. In 2004 those attaining qualifications equivalent to NVQ level 3 or 4 were low.	BNFL plc (2004) *Chapelcross Nuclear Power Station Environmental Statement*
Traffic and Transport	Access in the vicinity of the site is via a series of minor roads which connect to the A74(M) to the north of the site, and A75 trunk road and B6357 to the south. These roads connect at junction 44 of the M6 motorway just to the north of Carlisle. There are three bus routes that operate in the area surrounding the site. There are no specific facilities for cyclists at, or leading to the site from Annan or nearby settlements although a section of the National Cycleway runs from Gretna to Annan following the line of the A75. There are no pedestrian footways leading up to the station.	BNFL plc (2004) *Chapelcross Nuclear Power Station Environmental Statement*
Land Use and Material Assets	The nuclear licensed site at Chapelcross covers an area of approximately 96 hectares, and is slightly larger than the immediate area occupied by the main power station. The area is relatively rural and consists of agricultural land. It is recognised that the Land Reform (Scotland) Act (2003) gives everyone statutory access rights to most land and inland water providing they exercise such rights responsibly. In 2004, the estimated annual energy consumption was; 2,239MWh of electricity, and 43m^3 of oil. This is anticipated to gradually decrease during the course of the decommissioning. In 2004, the estimated annual water consumption was 300,000 m^3 of Towns Mains water.	BNFL plc (2004) *Chapelcross Nuclear Power Station Environmental Statement*; and NDA (2007) *End States Reconciliation Process*
Noise and Vibration	Noise monitoring data from Sizewell 'A' station has been used to estimate the noise levels that	BNFL plc (2004) *Chapelcross*

	would have been generated by Chapelcross in 2000. From this monitoring data, it has been estimated that the multiple sources of noise on Chapelcross would have been equivalent to a single point noise source, with a sound power level of 107 dB(A) situated at reactor building roof level in the centre of the site. Previous studies of baseline vibration levels have been undertaken at Bradwell and Hinkley Point nuclear power stations (both are Magnox type reactors). Measurements showed that vibration levels were very low and it was considered that the operation of the power station had no influence on vibration levels in the surrounding area. It can therefore be assumed that activities at Chapelcross also had no significant influence on vibration levels in the area.	*Nuclear Power Station Environmental Statement*
Health and Safety	In 2007, the discharges to the atmosphere were assessed to result in doses to the critical group (a group or representative individual who receive the largest dose from artificially produced radionuclides due to their habits, diet and where they spend their time) of 0.023 mSv/y, which was approximately 2% of the dose limit (from all sources) for members of the public of 1 mSv/y just over 1% of the annual average UK public background radiation exposure. The impact of the liquid discharges to the aquatic environment for the critical group was assessed as 0.022 mSv/y equivalent to 2.2% of the public dose limit (from all sources). The mean worker dose for employees was 0.070 mSv/y in 2007, with the mean dose for contractors slightly lower at 0.064 mSv/y. The maximum individual worker dose for 2007 was 0.970 mSv/y. In 2007, Chapelcross had an Occupational Safety and Health Administration (OSHA) Total Recordable Incident Rate (TRIR) of 0.17 and had no recorded RIDDOR incidents.	Environment Agency et al. (2009) *Radioactivity in Food and the Environment*; NDA (2008) *Annual HSSE Report*

Future Developments

Discharges have declined significantly now the site is no longer operational and are expected to continue to decline during the care and maintenance preparations, although certain decommissioning activities may result in short term increases in discharges for example as legacy wastes are retrieved and processed to make them passively safe.

It is anticipated that there will be negligible discharges from the site during the decommissioning care and maintenance period. Higher discharges especially those to air may be anticipated to occur during final site clearance when the reactors are dismantled but these discharges have not been estimated in detail at this time.

The reduction in the number of employees at Chapelcross is likely to have a noticeable effect on the local economy, which currently has a relatively high proportion of the labour force population with low levels of qualifications.

Significant volumes of radioactive waste will be generated, which will be treated, packaged and, where necessary, stored on site in purpose built temporary structures, until it is removed for permanent disposal. Discharges of radioactivity to the air and water are likely to reduce during care and maintenance, before increasing during final site clearance die to the increase in levels associated with reactor demolition.

Environmental Issues

Chapelcross is a relatively important contributor to the local economy, and long term changes to employment levels as a result of decommissioning may have a significant effect on local communities.