Magnox

Chapelcross Site

Strategic Environmental Assessment Site Specific Baseline

September 2014

FOREWORD

This document has been prepared to support the NDA's Strategic Environmental Assessment of its decommissioning strategy for the 10 Magnox Sites. This document contains baseline environmental information and other relevant environmental data.

STRATEGIC ENVIRONMENTAL ASSESSMENT
Site Specific Baseline – September 2014

Chapelcross Site
Annan
Dumfriesshire
DG12 6RF

Chapelcross Site

Chapelcross Site (hereafter referred to as the Site) is a four reactor Magnox station undergoing decommissioning, and is located close to the town of Annan in Dumfries and Galloway, South West Scotland. It is situated in open inland countryside on the site of a former RAF airfield, approximately 6 km from the northern coast of the Solway Firth. The site is close to the River Annan, from which it drew cooling water supplies during its operational phase. Due to its inland location, the site utilised natural draft cooling towers for dispersion of waste heat (one per reactor), and discharges effluent via a surface pipeline to the Solway Firth. The site incorporates the Chapelcross Processing Plant (a tritium production facility) which ceased operations soon after the station shut down, and is now being decommissioned. The licensed site covers an area of 92 hectares[1] and the land holding also incorporates the extensive former airfield. The following describes the key dates for the site:

- Construction of the site commenced in 1955, and electricity was first supplied to the grid in 1959.[1]
- The site ceased electricity generation in 2004 after 45 years of operation.[1]
- Defuelling of the reactors was completed in early 2013.
- The Optimised Care and Maintenance Preparations (OC&MP) phase of the decommissioning process is scheduled to be completed in March 2017, at which point the site will enter into an Interim Care and Maintenance (IC&M) phase.[2]
- From 2017 to 2023 the site will be in IC&M, a semi-quiescent state with a much reduced maintenance schedule.
- From 2023 to 2028 the site will make final preparations for entry into Care & Maintenance (C&M).
- Final Site Clearance (FSC) is scheduled to commence at the end of the C&M phase. All remaining structures on the site cleared by 2095.

[1] *Magnox Ltd (2014) Chapelcross. Available at http://www.magnoxsites.co.uk/site/chapelcross/*
[2] *Nuclear Decommissioning Authority (NDA) Business Plan, 2012-2015*

Site End State Assumption

The planned end state for Chapelcross Site is defined in the NDA Strategy Document 2011. This states: *'Radioactive and non-radioactive contamination will be reduced to meet the requirements of the relevant regulatory regime for the next planned use of the site and the current use of adjacent land. Where the next planned use no longer requires a nuclear site licence, radioactive contamination will be reduced to meet the criteria for delicensing, with any remaining radioactive substances being subject to the relevant environmental permitting regime. The physical state of designated land will be made suitable for the next planned use of the site; structures and infrastructure will be made safe or removed where necessary, having first explored opportunities for their re-use.*

Current Environment Baseline

Table 1: Baseline Data for all SEA Objectives for Chapelcross Site

SEA Objective	Environmental Baseline Data	References
Air Quality & Dust	*Radioactive Discharges* • Aerial discharges of radioactivity have reduced since the cessation of generation. The reactor cores at the site are enclosed within Steel Pressure Vessels (SPVs), which are in turn contained within concrete structures ('bioshields') designed to protect site personnel from radiation originating from within the cores. During operations discharges of aerial activity resulted from ventilation of the bioshield voids, which released gaseous activation products when the reactors were under load. • Periodic venting of reactor coolant gas was carried out during the operational phase. This has significantly reduced since the end of generation. • The Chapelcross Processing Plant (CXPP) discharged waste gaseous tritium throughout its operational lifetime. Discharges of tritium will continue on a reduced scale through the decommissioning process for the plant, and in addition small scale emissions from persistent tritium in the plant will likely continue until Final Site Clearance. • Nuclear operations including waste retrieval which are being undertaken as part of the decommissioning works result in minor but regular aerial discharges of radioactivity. *Conventional Discharges* • Vehicles and diesel generators are employed on the site, which are sources of air quality contaminants including NO_x (oxides of nitrogen), SO_x (oxides of sulphur), and PM_{10} (particulate with a diameter <10µm). These sources run only intermittently, and due to the rural nature of the site average levels of these pollutants are likely to be low. • Discharges from these sources will likely remain steady throughout the C&MP phase. • Dust is currently, and will in future, be generated from construction and demolition activities undertaken on the site as part of C&MP. Mitigation of this dust is undertaken in all instances. • The location of the site is not currently designated an Air Quality Management Area (AQMA).[1]	*1. DEFRA (2014) Air Quality, http://aqma.defra.gov.uk/aqma/list.php*

Global Climate Change and Energy	• Throughout its lifetime the site has drawn power from the National Grid to satisfy domestic power needs (heavy plant items such as the gas circulators and cooling water pumps were driven by power derived directly from the station's output). The use of this energy has resulted in indirect CO_2 emissions, due to the mixed generation used in the UK. • In addition to grid supplies, the site has several essential items of plant for the provision of back-up power, and these are fossil fuel powered. The sites auxiliary equipment consists of diesel generators. These machines are not in constant use; instead they are there for emergencies, but are regularly run for testing purposes. • Areas within the reactor building continue to be heated to protect instrumentation, which results in emissions form the boilers. • A number of vehicles are based at the site, which are either used within the site footprint, or move from the site to further afield (e.g. vehicles used in carrying out the District Survey), and have associated carbon emissions. Indirect carbon emissions originate from the use of hire vehicles by site personnel when travelling on company business in addition. • Magnox Ltd. has registered under the Carbon Reduction Commitment (CRC) and also has a company-wide Energy Efficiency Policy. Both of these schemes are currently being implemented on a site by site basis, with the aim of minimising greenhouse gas emissions across the company. *Climate Change and Flooding* • The inland nature of the site means that it is not vulnerable to increased risk from sea flooding due to climate change-induced sea level rise and more frequent storm surges.[3] • It is possible that changing patterns of rainfall during the C&M phase due to the effects of climate change could affect the site through changes to the local hydrology; however, the potential for flooding at the site due to changes in flow rate and course of River Annan is negligible as the site is 2km from River Annan and elevated 40m higher. The risks posed by this possibility, and the defensive measures that would be necessary to prevent this will be identified through the Periodic Safety Review. Furthermore, any changes in rainfall patterns during the C&M period will be gradual, allowing the advance planning of any necessary mitigation measures.	

[3] *Although the outfall of the effluent discharge pipeline is situated at the coastline and so could be affected by sea level changes, it will not be in regular use at the point that potential sea level changes are likely to manifest themselves.*

Biodiversity, Flora and Fauna	• The site is situated in a predominantly rural setting, and has 7 statutorily designated areas in close proximity.
	• These designated areas are:
	  ○ Upper Solway Flats and Marshes Site of Special Scientific Interest (SSSI)
	  ○ Upper Solway Flats and Marshes Special Protection Area (SPA)
	  ○ Upper Solway Flats and Marshes Ramsar
	  ○ The Solway Firth Special Area of Conservation (SAC)
	  ○ Raeburn Flow SSSI
	  ○ Raeburn Flow SAC
	  ○ Royal Ordnance Powfoot SSSI.[1]
	• The effluent pipeline is located within, and discharges directly to, a location that is within the Solway Firth SAC. Due to the designations on the coastline that effluent from Chapelcross discharges to, it is also classified as the Solway Firth European Marine Site.[24] .
	• The site Biodiversity Action Plan considers how the site manages its impacts on local ecosystems. This document is reviewed and updated on a regular basis.
		1. Chapelcross Environmental Impact Assessment Baseline (EIAB) Report
		2. Natural England (2011) England's European Marine Sites, available at http://www.naturalengland.org.uk/ourwork/marine/protectandmanage/mpa/europeansites.aspx

Landscape and Visual	• The site is located inland, to the north of the Solway Firth coastline.[1] • The surrounding landscape is a broad, gently undulating lowland plain surrounding the Solway Firth.[2] • The surrounding area contains several copses and small areas of woodland that are visually important within the local landscape.[2] • The site contains several prominent structures that are visible at medium – long distances. The 90m tall cooling towers [3] were demolished in 2007[4] which reduced the visual impact of the site significantly. However, the bioshield venting stacks atop the reactor buildings are on the order of 50m high and continue to contribute to the site's visual signature. • As such, the site is a prominent feature in the local landscape, although to a lesser extent than it was prior to 2007.[4]	*1 Ordnance Survey (2011) 1:25000 Sheet 323, Eskdale and Castle O'er Forest* *2. Chapelcross Environmental Impact Assessment Baseline (EIAB) Report* *3. Mobbs P. (1992) Chapelcross B – the case against*

[4] *Where an SPA or SAC is continuously or intermittently covered by tidal waters or includes any part of the sea adjacent to the UK, the site is referred to as a European Marine Site.*

		construction of one, or two, PWRs on the Solway Firth *4. Magnox North (2009) Chapelcross Site IWS*
Archaeology & Cultural Heritage	• The western extremity of the Frontiers of the Roman Empire (Hadrian's Wall) World Heritage Site is situated approximately 8km to the south of the site, across the Solway Firth. • There are no Scheduled Ancient Monuments or Listed Buildings near to the site. • There are 6 entries in the draft Register of Landscapes, Parks and Gardens of Special Historic Interest; Arbigland, Kinmount House, Raehills, Dalswinton, Castlehill and Cowhill Tower, near to the site as listed by Scottish Natural Heritage. • No known sites of archaeological interest are present on the site, and remnants from the WWII era are likely to have been destroyed during station construction (although may be intact in the wider airfield). • There are no known sites of archaeological interest in the vicinity of the route of the effluent pipeline.	*Chapelcross Environmental Impact Assessment Baseline (EIAB) Report*
Groundwater, Geology and Soils	• A layer of made ground is present on approximately a third of the site, and consists of reworked Glacial Till. The natural superficial deposits in the Chapelcross Site locality consist of Glacial Till, and some localised alluvium. The Glacial Till consists of stiff sandy silty clays with gravel and cobble fragments. This is underlain by a layer of glacially reworked bedrock fragments in a clayey sand matrix.[1] • The bedrock strata at the site consists of the Permo-Triassic Sherwood Sandstone Group. The component facies (in order of increasing depth) are the St Bees Sandstone formation, consisting of interbedded fluvial sandstones and mudstones, underlain by the St Bees Shales; siltstone and silty mudstone, and the St Bees Evaporites, consisting of interlaminated siltstone, mudstone and evaporites. The Carboniferous Limestone Series underlies the Permo-Triassic units, and consists of interbedded conglomerates, sand-, silt-, mud- and limestones.[1] • The superficial deposits at the site are considered a Minor aquifer due to their generally low hydraulic conductivity, and act as a confining layer to the underlying aquifer.[1] • The St Bees Sandstone bedrock at the site is considered a Major aquifer of local importance. The underlying shale form an underlying confining aquitard.[1] • Neither the shallow nor deep aquifers are abstracted in the vicinity of the site, however there is one licenced abstraction for agricultural	*1. Chapelcross Environmental Impact Assessment Baseline (EIAB) Report* *2. Scottish Government (2009) The Scottish Soil Framework*

	use (consisting of wells and springs) approximately 2 km from the site.[1] • The soil in the area surrounding the site is classified as lowland brown earth soils of high agricultural value.[2] *Land Quality* • There is radioactive and non-radioactive land contamination at the site, resulting primarily from historical events during generation, and from use of the land prior to construction of the power station). • The radioactive land contamination is associated with several sources. Land and groundwater throughout the site has varying levels of tritium contamination as a result of fall-out from authorised discharges to air from CXPP during generation. There are also low levels of radioactive contamination present in sub-surface soils adjacent to the part of the original concrete effluent pipeline nearest to the Solway Firth. • The non-radiological contamination is primarily associated with contamination of groundwater in the sandstone aquifer by chlorinated hydrocarbons associated with the historical practice of disposal of waste solvents to ground. Contamination has been detected in groundwater outside of the NDA landholding and regulators and affected stakeholders have been informed. A programme of work leading to long-term management of this contamination (including assessment of potential remedial intervention options) is currently under way. In addition to this issue, crushed concrete created by demolition of the four cooling towers was deposited in the below-ground cooling tower basins. The high water table in this area of the site has caused the basins to fill up with water that has attained a high pH as a result of contact with the crushed concrete. The management of this alkaline water presents a challenge to the site, which is currently being dealt with by abstracting the water from the basins, treating it to neutralise the pH and discharging the treated water to surface water drains, thus protecting the water quality of the Gullielands Burn that runs through the site. Other minor non-radiological issues include the disposal of sludge originating from the former cooling tower structures that has resulted in the contamination of surface soils with copper, chromium and arsenic, and spillages from the Waste Oil Storage Compound have resulted in minor hydrocarbon contamination of shallow groundwater. • Monitoring and investigation of ground contamination is on-going at the site. • The site shall continue to manage land quality through the production and maintenance of a Land Quality file, Land Quality Characterisation Plan and Land Quality Strategy.	
Surface Water Resources and Quality	• The nearest water courses to the site are Gullielands Burn (which flows directly through the site and is culverted), Kirtle Water, the River Annan and the Solway Firth at a distance to the south.[1]	*1. Ordnance Survey (2011) 1:25000 Sheet 323, Eskdale and Castle O'er*

	• The flood risk relating to the site due to the River Annan and Gullielands Burn is judged to be low.[2] • The ecological and chemical status of Gullielands Burn is not listed. The status of the Solway Firth was ecologically Moderate, and as a Pass chemically, in 2008.[3] • During the operational phase, waste heat was dispersed to the atmosphere using natural-draft cooling towers, as no large body of water was situated nearby to perform this function. Aqueous effluent discharges have always been made to the Solway Firth via a 6 km surface (with some buried sections, primarily within the town of Annan)[2] pipeline that passes through open countryside and also through the town of Annan. Discharges are made at high tide, when the end of the pipeline is submerged, to ensure the optimal dispersion of activity. • Throughout the operational phase effluent discharges were made without any treatment or abatement, but the site was issued with a revised RSA93 authorisation by the Scottish Environment Protection Agency in 2013, which will necessitate improvements to the abatement of aqueous liquid waste. All aqueous radioactive waste produced during decommissioning will be abated before discharge in accordance with the authorisation, which will still be carried out via the pipeline to the Solway Firth. • The discharge pipeline was initially of concrete construction and leaks were detected early in the operational phase. The concrete pipeline was replaced by a jointed ductile cast iron concrete pipeline and further improvements were achieved by slip-lining a more resilient plastic pipe within the original.	*Forest* *2. Chapelcross Environmental Impact Assessment Baseline (EIAB) Report* *3. Scottish Environmental Protection Agency (2008) RBMP Water body information sheet for water body 200515 in Solway, available at http://www.sepa.org.uk/water/river_basin_planning/waterbody_data_sheets.aspx*
Waste	• Both operational and decommissioning activities at nuclear sites generate radioactive and conventional waste. • Low Level Waste (LLW) is generated at the site from a range of routine operational and decommissioning activities, and comprises a range of different materials. • The baseline for LLW is to package the waste and send it to the Low Level Waste Repository (LLWR) near Drigg in Cumbria for disposal. • Opportunities to characterise or decontaminate to Very Low Level Waste (VLLW, for controlled burial) or exempt (for permitted landfill), size reduce, incinerate or metal melt, in order to reduce LLWR consignments are actively sought. • Intermediate Level Waste (ILW) [5] is generated from decommissioning activities. It has accumulated at several locations at the site, the majority of which will be retrieved during IC&MP when an ILW store becomes available on site. The exception to this are a number of Miscellaneous Activated Components (MAC) stored in vaults in the concrete bioshield which will be retrieved during FSC. • CXPP makes a contribution to the site's ILW legacy and contains a number of orphan and unique waste streams. These wastes are	*1. Magnox (2011) Chapelcross Site IWS*

[5] In HAW '11, anything which is not classified as LLW (which includes ILW) is referred to as 'Higher Activity Waste (HAW)'. The term ILW is generally used in Magnox company documents for Scottish sites however, in order to achieve consistency across the company and is also used in this document. The terms ILW and HAW should be treated as analogous in this document.

	distinguished from the majority of waste streams at the site by high levels of tritiation. A BPEO study has demonstrated the optimal disposal routes for these waste streams. *Site Waste Strategy Baseline* • The Scottish Government published its Higher Activity Radioactive Waste Policy in 2011 (HAW '11), which states that it's intention is '*to support long-term near surface, near site storage facilities so that the Waste is monitorable and retrievable and the need for transporting it over long distances is minimal'* • The waste strategy at the site will conform to this policy. • The use of self-shielding Ductile Cast Iron Containers (DCICs) for interim storage and eventual final disposal of solid and wet ILW (which is dried within the container) is being pursued by Magnox Ltd., and is to be implemented at the site. This is supported by generic and site-specific options studies, but will also be subject to regulatory approval. • An ILW store is to be built at the site in which these DCICs will be stored in accordance with HAW '11. • Magnox Fuel Element Debris (FED) was not generated at Chapelcross, because desplittering of spent fuel elements was not undertaken at the site, so accumulation of this type of waste did not occur.[2]	
Traffic and Transport	• The site connects to the A75 trunk road via the B722 (or other unnamed roads). The A75 links to the national motorway network at Jct. 22, A74(M).[1] • Although an active railway line runs approximately 4 km to the south of the site through Annan, there is currently no railhead near Chapelcross. The nearest passenger rail stations are located at Annan (Glasgow South Western Line) or Lockerbie (West Coast Main Line).[1] • ILW flasks and LLW containers are transported the relatively short distance to Sellafield / LLWR from Chapelcross by road.[2] • There may be scope to make use of a railhead near to the site in future to handle waste packages bound for an off-site disposal or storage facility.	*1. Ordnance Survey (2011) 1:25000 Sheet 323, Eskdale and Castle O'er Forest* *2. Magnox North (2007) Information in Support of Applications by Magnox Electric Ltd. under RSA93 to Dispose and Discharge Radioactive Wastes from Chapelcross Site*

Land Use and Material Assets	• The licenced portion of the site occupies an area of 92 hectares, on an overall NDA estate of 188 hectares.[1] The rest of the NDA land holding incorporates the former RAF airfield ('North Site'). • The site consists of four reactor buildings, turbine hall, workshops, a flask handling building, administrative and office buildings, CXPP, access roads, grassy areas and areas of hardstanding. • The North Site incorporates large grassy areas, areas of degraded hardstanding and multiple hangar slabs and other miscellaneous buildings associated with its former use as a military airfield. • The surrounding area is rural in nature and is used primarily for agricultural and recreational purposes. • Notable uses in proximity to the site include several forestry blocks, and the route of the disused railway that hosts the effluent discharge pipeline. • The site incorporates a significant quantity of material that is potentially eligible for direct reuse or recycling: • This includes a substantial quantity of recyclable metal in the turbine hall, the boilers, the gas ducts, the SPVs, and as rebar incorporated into large concrete structures such as the bioshield.[2] • A proportion of this recyclable metal will be made available for recycling during the C&MP phase, such as the turbine hall deplanting and demolition and other general building dismantling. The 16 boilers (4 per reactor) are planned to be separated from the primary circuit ducting and laid horizontally in cradles during the C&MP period, so may also be available for recycling in the shorter term.[6] • The remainder of the primary circuit, the bioshield and the SPVs will be dismantled at FSC, so a quantity of the recyclable metal on site will be produced at this time in addition. A proportion of this material will be classified as ILW (activated reactor components in particular) so will likely not be suitable for recycling (and will be managed in accordance with HAW '11), but the remainder will be LLW or exempt, and as such eligible for recycling and reuse within or outwith the nuclear industry.[2] • The inert rubble produced from the demolition of the cooling towers was used to infill the subsurface voids resulting from the removal of these structures. • A large volume of inert concrete and masonry rubble will be produced through further demolition activities during C&MP, and during FSC, and will likely be reused on- or off-site as infill material, or similar.[2]	*1. Magnox Ltd (2011) Chapelcross – Facts and Figures. Available at http://www.magnoxsites.co.uk/our-sites/chapelcross/facts-and-figures* *2. Magnox Ltd. (2011) Chapelcross Site IWS*

[6] *A precedent for the disposition, shipping and recycling of boilers has been set at Berkeley Site, so may be feasible for the boilers at Chapelcross in the short-term as well on the basis of the success at Berkeley.*

Noise and Vibration	• Noise and vibration originate from a number of sources at the site.
	• The Baseline Noise Survey Data (L_{Aeq}, dB(A)) (during C&MP) is as follows:
	  ○ Jockstown properties – 48.1
	  ○ Dumbretton properties – 50.1
	  ○ West Bretton properties – 58.3
	  ○ Village of Creca – 53.7
	  ○ South Camp (scrapyard) – 60.4
	  ○ Blackhills – 55.3
	  ○ Outertown cottages – 47.2
	  ○ Auchlewen – 61.6
	  ○ Annfield – 60.1
	  ○ Windyknowe – 50.1.[1]
	• The criteria for the significance of noise are the proximity of noise sources to the receptors, and the presence of any screening / nature of the ground between the source and the receptor.
	• Since the cessation of generation the profile of noise and vibration from the site has changed, but remains significant due to the nature of decommissioning works.
		1. Chapelcross Environmental Impact Assessment Baseline (EIAB) Report

Table 2: Environmental Discharge Data for Baseline Years 2012/13 for Chapelcross Site

In addition to the baseline information, which describes the permanent, semi-permanent and inherent features and impacts of Chapelcross Site and its surrounding area, the following table outlines discharge data for the site for the years 2012 and 2013[7], and how these quantities will likely change in future. This is intended to provide a quantitative 'snapshot' of the features of the site and impact that it has (and is anticipated to have in future), in order to supplement the baseline information.

SEA Objective	Environmental Discharge Data	Future Changes in Environmental Discharges	References
Air Quality & Dust	• Total Tritium discharges to air in 2012 were 6.05E+01TBq and 4.58E+01 TBq in 2013.[1] • Beta Gamma discharges to air were 1.07E-04 in 2013. The total dose from all pathways and sources of radiation is assessed to have been 0.011 mSv in 2012, which was approximately 1 per cent of the dose limit. As in recent years, infants who were high-rate consumers of milk were the most exposed people. The decrease in dose from 0.037 mSv (in 2011) was equally attributed to a decreased value for the maximum carbon-14 concentration in milk and the exclusion of the LoD for americium-241 activity in food in the 2012 assessment. Total doses remained broadly similar from year to year, and were low.	• Discharges of radioactivity to the atmosphere decreased significantly upon the cessation of generation. • As decommissioning progresses through the C&MP phase the trend will be for discharges to continue to remain steady or decrease. • However, certain decommissioning activities such as the retrieval, treatment and passivation of wastes and draining of the ponds may result in short term spikes in aerial discharges of radioactivity. • It is likely that discharges from CXPP will temporarily increase during Post Operational Clear-Out and decommissioning of the facility. • Once the major hazard reduction projects have been completed and the site enters the extended, quiescent C&M phase, aerial discharges of radioactivity will be extremely low. • The degassing of materials in CXPP, desiccant material in storage, bioshield concrete and core graphite may result in very minor discharges of tritium. • Dust from demolition and traffic movement may affect the local	*1.Magnox Ltd Performance Indicator Report 2012 and 2013* *2. CEFAS (Centre for Environment, Fisheries and Aquaculture Science) (2012) Radioactivity in Food and the Environment 18.*

[7] *Data from 2012 and 2013 are presented to provide an indication of variances.*

		area during all 3 decommissioning phases. Civil works will be a source of dust. • FSC will result in a temporary increase in aerial discharges of radioactivity. This is because the radioactive reactor cores and associated equipment and infrastructure will be dismantled at this point. Detailed estimates for the discharges from this process have not been made, but will likely comprise particulate as major remaining structures are demolished. • Retrieval of waste packages from site for disposal (in accordance with HAW '11) will result in traffic movements to the site. This retrieval will likely be phased over an extended period of time, so the impact from this is likely to be limited.	
Global Climate Change and Energy	• In 2012, 24188 MWh of energy was used at the site, increasing to 51254 MWh in 2013. • Direct CO_2 and other greenhouse gas emissions generated in 2012 were 4.5E-03 megatonnes, and 2.55E-03 megatonnes in 2013. The majority of Direct CO2 emissions (99.3%) are from diesel used for steam heating system. The remainder are from diesel loco and standby generators. • Indirect CO_2 and other greenhouse gas emissions generated (including energy consumption and site diesel usage) was 4.1E-03 in 2012 increasing to 2.83E-03 in 2013.	• The site will draw power from the grid and operate plant and vehicles for decommissioning works such as ILW processing and for general domestic needs until the completion of C&MP. • During C&M the site's power usage will be very low, but periodic inspections and maintenance will result in very small spikes in energy usage. • The retrieval of waste packages from the site ILW store will result in intermittent vehicle movements to and from the site. Energy use and the operation of numerous vehicles will resume on a significant scale during FSC. • However, the types of the vehicles in use and the nature of energy mix in use in the UK at these dates cannot be predicted, thus the associated CO_2 emissions relative to the present are unknown.	*1. Magnox Ltd Performance Indicator Reports 2012 and 2013.*

Surface Water Resources and Quality	• In 2012 total Alpha liquid discharges were 7.71E-06TBq and 1.37E-06 TBq in 2013. • Total Beta Gamma (excluding Tritium) liquid discharges were 5.99E-03TBq in 2012 and 1.52E-03 TBq in 2013. • Total Tritium liquid discharges were 3.17E-03 TBq in 2012 and 1.61E-03 TBq in 2013.[1] Radioactive liquid effluents are discharged to the Solway Firth. Samples of seawater and *Fucus vesiculosus*, as environmental indicators, were collected in addition to seafood, sediments and dose rates. Concentrations of most radionuclides and gamma dose rates remained at similar levels to those detected in recent years. Measurements of the contact beta dose rate on stake nets were below the LoD. Between 1992 and 2009, a number of particles were found at the end of the discharge outfall consisting of lime-scale originating from deposits within the pipeline. Magnox Limited continues to monitor this area frequently and no particles were found during 2012 (as for the interim years). The relining of the pipeline and grouting at strategic points, which was undertaken in 2009/2010, has reduced the potential for particles to be released.[2]	• A primary issue for surface water management at Chapelcross Site relates to the cooling tower basins. Concrete rubble from the demolition of the cooling towers was used to infill the subsurface basins of the towers. Water ingress into these basins (due to the high groundwater table in that part of the site) has resulted in the production of alkaline water (due to contact with the concrete infill material), which has overtopped the basins. Active management through treatment of water abstracted from the basins prior to discharge is undertaken in order to protect Gullielands Burn. • Discharges of aqueous radioactivity will begin to decrease significantly now that defuelling of the reactors has been completed • As decommissioning progresses through the C&MP phase the trend will be for discharges to continue to decrease. • However, certain decommissioning activities such as the retrieval, treatment and passivation of wastes, and decontamination and draining of the ponds may result in short term spikes in aqueous discharges of radioactivity. • Once the major hazard reduction projects have been completed and the site enters the extended, quiescent C&M phase, aqueous discharges of radioactivity will be very low, but not zero. • FSC will result in temporary discharges of aqueous radioactivity, primarily from waste treatment as the radioactive reactor cores and associated equipment / infrastructure are dismantled. Detailed estimates for the discharges due to this have not been made, however.	*1.Magnox Ltd Performance Indicator Reports 2012 and 2013* *2. CEFAS (Centre for Environment, Fisheries and Aquaculture Science) (2012) Radioactivity in Food and the Environment 18*

Waste	• The following waste metrics are for 2012 and 2013: • In 2012 the site produced 198.7 m^3 of LLW from routine operational activities which was reused, recycled or disposed of. • Of this total, 99.36 m^3 was treated and 99.36 m^3 was disposed of to the LLWR.[1] • In 2012 the site also produced 637.5 m^3 of LLW from routine decommissioning activities which was reused, recycled or disposed of. Of this total, 130 m^3 of metal was recycled, 188.6 m^3 was treated and 318.8 m^3 was disposed of to the LLWR.[1] • In 2013 the site produced 825.5 m^3 of LLW from routine decommissioning activities. Of this total, 95.4 m^3 of metal was recycled, 183.8 m^3 of the LLW was treated and 546.3 m^3 was disposed as exempt waste.[1] • In 2012 the site produced 47.6 tonnes of inert waste from op activities, of which 100% of this total was reused or recycled.[1] • 347.5 tonnes of non-hazardous waste was produced from operational activities, of which 90% of this total was reused or recycled.[1] • In 2012 the site also produced 6.5 tonnes of inert waste from decommissioning activities, of which 100% of this total was reused or recycled.[1] • 60.2 tonnes of non-hazardous waste was produced from decommissioning activities, of which 100% of this total was	• As decommissioning progresses through the C&MP phase the trends for waste generation will likely remain at current levels or increase. When the site enters C&M in 2028 these levels will fall significantly.	*1.Magnox Ltd Performance Indicator Reports 2012 and 2013.*

	reused or recycled.[1] • In 2013 the site produced 29.5 tonnes of inert waste from operational activities, of which 100% of this total was reused or recycled.[1] • 161.5 tonnes of non-hazardous waste was produced from operational activities, of which 81% of this total was reused or recycled.[1]		

The following table illustrates further parameters that are significant for the site.

Table 3: Additional Data for baseline Year 2012/13 for Chapelcross Site

SEA Objective	Additional Data	Changes in Additional Parameters	References
Surface Water Resources and Quality	• In 2012 the site consumed 29440m^3 of mains water, reducing to 25033m^3 in 2013.	• Water consumption at the site is likely to continue for the duration of the C&MP period at a similar level.	*1. Magnox Ltd Performance Indicator Reports 2012 and 2013.*
Economy, Society and Skills	• The site is located in rural area of Dumfries and Galloway. • The major settlements within 10km of the site are Annan to the southwest, Gretna to the southeast, Ecclefechan to the northwest, as well as a number of smaller settlements including Eaglesfield, and the hamlet of Creca (to the immediate northeast of the site).[1] • The population of Dumfries and Galloway was 150300 during 2013.[2] • Dumfries and Galloway had a working population of 70300 during 2013.[2]	• The number of personnel employed on site will decrease significantly after the completion of C&MP. • Personnel numbers at the site will increase again for the duration of FSC.	*1. Ordnance Survey (2011) 1:25000 Sheet 323, Eskdale and Castle O'er Forest* *2. Office for National Statistics (2014) Official Labour Market Statistics, available at http://www.nomisweb.co.uk/* *3. EU (2014)*

	• The dominant working sectors in Dumfries and Galloway during 2013 were Services (41700, 80.6 %) and Public Admin, Education and Health (18000, 34.7 %). • Employment in the Electricity, Gas and Water Supply industry in Dumfries and Galloway was not listed, but the effect of employment at Chapelcross Site is likely to be low against the total working population of this unitary council. • In 2012 26800, 30.3% of the population were qualified to NVQ4 level or above. • Dumfries and Galloway is not subject to Convergence Funding from the EU, or other external assistance.[3]		*Cohesion Policy 2007 – 13, available at http://ec.europa.eu/regional_policy/atlas2007/index_en.htm*
Traffic and Transport	• In 2012 The Annual Average Daily Traffic (AADT) from all traffic movements on the A75 close to the Gretna junction (22) for the A74 (M) from recent measurements was 9237, of which 1484 were Heavy Goods Vehicle (HGV) movements. • On the A75 immediately adjacent to Annan, which is a possible route to the site from either the east or west the traffic movements from recent measurements was 7593, of which 1334 were HGV movements.[1] More recent data for 2013 was not available. • The proportion of these total movements that are directly attributable to the site is very low, and will continue to be so even during periods of increased work at the site.	• It is anticipated that general traffic and HGV movements will remain steady or increase during the remainder of the C&MP phase at the site. • Movement of materials for potential future major construction or others project e.g. delivery of DCICs to site, construction of the site ILW store will generate extra traffic movements, as will movement of demolition waste and other inert material for reuse or conventional disposal • A similar increase in traffic flows on local roads can be expected during the FSC phase.	*1. Department for Transport (2014) AADF Home, available at: http://www.dft.gov.uk/matrix/search.aspx*

Figure1: Statutorily Designated Areas in the Vicinity of Chapelcross Site