

NDA Draft Strategy

Integrated Impact Assessment Report Volume 2: Detailed Options Assessment

January 2016

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1.0 Introduction

This Volume of the Integrated Impact Assessment (IIA) Report (2016) contains detailed assessment tables presenting the results of the assessment of the NDA Strategy (2016). It is split by themes and topic strategies (see Chapter 4 of Volume 1), and by individual credible options (see Chapter 5 of Volume 1).

The following table (Table 1-A) indicates which strategic themes and topics contained in the Strategy have been assessed in detail, and which are not suitable for more detailed assessment at this time.

Table 1-A: Overview of how strategic themes and topics have been assessed

Theme	Topic	Assessed...		Reason
		in detail	through discussion	
Site Decommissioning and Remediation	Decommissioning	x	✓	Decommissioning is undertaken on a case-by-case basis. As such, there is no baseline scenario and options have been assessed / compared through discussion of potential environmental, socio-economic and health effects associated with them.
	Land Quality and Remediation	x	✓	Due to decisions being taken on a case-by-case basis, no single preferred option for implementing this strategy is identified. As such there is no baseline scenario and these options have been assessed / compared through discussion of the potential environmental, socio-economic and health effects associated with them. Any of the credible options might be preferred under specific conditions.
	Site End States	x	✓	As site end states are by their nature a very site-specific consideration, there is no single preferred option. As such there is no baseline scenario. Options have therefore been assessed / compared through discussion of potential environmental, socio-economic and health effects associated with them.
	Land Use	x	✓	As a new topic, Land Use has no baseline scenario and these options have been assessed / compared through discussion of potential environmental, socio-economic and health effects associated with them.
Spent Fuels	Magnox	✓		There are two credible options for managing the remaining inventory of spent Magnox fuel; reprocessing using existing facilities, which was the preferred option in the last Strategy and forms the baseline in this assessment, and an alternative credible option to curtail reprocessing operations and dispose of the spent fuel to a geological disposal facility (GDF).
	Oxides	✓		There are three credible options for

Theme	Topic	Assessed...		Reason
		in detail	through discussion	
				managing the remaining inventory of spent oxide fuel; reprocessing using existing facilities, disposing of any unprocessed inventory to a GDF, which was the preferred option in the previous Strategy and forms the baseline in this assessment, and two alternative credible options; to curtail reprocessing operations and dispose of the entire inventory to a GDF, or to extend reprocessing operations - building major new support plants.
	Exotics	x	x	As part of the inventory (DFR Breeder material) shares similar properties to spent Magnox fuel, it can be managed using the same facilities (i.e. through reprocessing). Since the last Strategy was published, the decision has been made to incorporate these fuels into the Magnox strategy. Work to identify and develop credible options for disposing of exotic spent fuels that cannot be managed using existing facilities is currently ongoing. This means that at this stage there are no options under the Exotics strategy to be assessed.
Nuclear Materials	Plutonium	✓		There are three credible options for managing the NDA inventory of civil plutonium; indefinite storage, which was the preferred option in the previous Strategy and forms the baseline in this assessment, and two alternative credible options; to immobilise the plutonium and dispose of it to a GDF, or to build facilities to reuse plutonium in nuclear fuel.
	Uranics	x	✓	Although no preferred option was identified in the previous Strategy, indefinite storage has been the historic strategic position to-date and is therefore considered the baseline scenario. As no preferred option has been identified in Strategy (2016), the credible options have been assessed / compared through discussion of potential environmental, socio-economic and health effects associated with them.
Integrated Waste Management	Higher Activity Waste	x	✓	Decisions regarding management of HAW are undertaken on a case-by-case basis. As such there is no baseline scenario and options have been assessed / compared through discussion of potential environmental, socio-economic and health effects associated with them.
	Solid Low Level Waste	x	x	The NDA strategy for managing solid Low Level Waste (LLW), which includes Very

Theme	Topic	Assessed...		Reason
		in detail	through discussion	
				Low Level Waste (VLLW), is consistent with the UK Nuclear Industry LLW Strategy (NDA, 2010a). Therefore, from an NDA perspective, there are no strategic decisions to make and no credible options to assess.
	Non-Radioactive Waste	x	x	The UK has a well-established, comprehensive and prescriptive regulatory regime for the management of non-radioactive waste. The NDA adheres to this regime and implements it across its estate. As a result, there are no strategic decisions for the NDA to make and no credible options require assessment.

Where assessment has been undertaken in the form of a discussion of potential environmental, socio-economic and health effects this is presented in Volume 1 of this IIA Report.

2.0 Methodology

For a full description of the methodology applied in the assessment see Chapter 6 of Volume 1.

A summary of the methodology and approach is provided below.

The geographic scope of the assessment covers the UK, as the 17 sites which comprise the NDA estate are spread across these countries.

The temporal scope of the assessment reflects the period of time for which the NDA Strategy applies. It is therefore assumed that the Strategy will be in operation until the final site in the NDA estate achieves its stated site end state. This is anticipated to be Sellafield in the year 2120. However, it is also assumed that it will be reviewed and updated on a 5-year cycle within this period.

Assessment timescales have been considered in relation to the decommissioning programmes of sites across the NDA estate. Impacts have therefore been categorised into those which are expected to occur or be experienced in the:

- **Short-term** (within 10 years of an option being implemented)
- **Medium-term** (10-25 years); and
- **Long-term** (25 years and beyond).

The exact timescales over which impacts will occur is uncertain. Results outlined in the assessment should therefore be viewed as indicative and not absolute from a temporal perspective.

2.1.1 Significance

One of the key challenges involved in assessing the NDA Strategy relates to its high-level nature and the wide range of nuclear decommissioning and operational activities it covers. These activities are taking place over long timescales (some up to 100 years or more) and across 17 different sites. For these reasons, the IIA has moved away from attempting to state significance without consideration of detailed site-level factors and information. Instead, the assessment focuses on determining 'risks' or 'opportunities' for significant effects, with due consideration of the factors which may alter either the risk or the significance.

The first step in the assessment was to identify whether or not a risk or opportunity exists. If a risk or opportunity was found to exist, i.e. the option could have a significant effect upon a receptor, the next stage was to consider the significance of such an effect. This involved determining the potential magnitude of the impact (adopting a worst case scenario) and the sensitivity of the receptor(s) (see Figure 2-A).

		Sensitivity of Receptor / Indicator					
		Low		Medium		High	
Magnitude of Impact	High	Moderate		Major		Major	
		++	--	+++	---	+++	---
	Medium	Minor		Moderate		Major	
		+	-	++	--	+++	---
	Low	Minor		Minor		Moderate	
		+	-	+	-	++	--

Figure 2-A: Impact Significance Matrix

2.1.2 Uncertainty

Uncertainty is accounted for in the assessment through identification of the factors which may influence either the magnitude of a specific impact, or the sensitivity of the receptors (or indicators in the case of some topics). It has been reported according to the following key:

- ?? result is considered highly uncertain and will almost certainly require further detailed assessment at a later stage
- ? result is considered uncertain and may require further detailed assessment at a later stage
- ✓ result is considered fairly certain and is unlikely to vary enough to require further assessment

Such ratings have been used to account for the uncertainty that exists in how the NDA Strategy may be applied at a site level or at a future time. The intention is that the results of the assessment, including these ratings, will be used to inform future assessment work.

2.1.3 IIA Topic Descriptions

For descriptions of the individual environmental, socio-economic and health topics covered by this IIA, and an overview of the way in which they interact with the Strategy, see Chapter 7 of Volume 1.

3.0 Spent Fuels

3.1 Magnox

3.1.1 Dispose – Description of Option

Option	Curtail reprocessing operations, condition the fuel, interim store and dispose of it in a geological disposal facility (GDF) (Dispose)	
Site	Sellafield	
Description	<p>Defueling of a reactor core, a relatively routine but lengthy process, takes place over a period of years. Spent fuel formerly irradiated in nuclear reactors contains around 99% of a reactor site's radioactive inventory. Historically the UK's approach has been to reprocess Magnox spent fuel, but the facilities for this are ageing and may close before reprocessing of the irradiated inventory has been completed.</p> <p>In the disposal option, the remaining Magnox inventory would be interim stored in a combination of existing and new facilities (dry storage in reactors or wet storage in ponds), immobilised/ conditioned (using new facilities at Sellafield) and then disposed of to a GDF. The timing and nature of the 'conditioning' step has yet to be detailed. In theory, it could occur relatively soon after the removal of fuel from the reactor (within a 1-20 year timeframe) or at the point where the fuel is about to be transported to the disposal facility (assumed to be 2075). A decision on the optimal time for 'conditioning' and what 'conditioning' entails is dependent upon the effectiveness of the storage regime applied, the stability of the fuel under various scenarios, future transport regulations and the design requirements/ availability of the GDF.</p> <p>For the purpose of the assessment it has been assumed that conditioning would involve encapsulating the Magnox spent fuel into purpose-built steel or concrete drums, infilling with cementitious grout, and placing these packages into 3-5 cubic metre stainless steel, iron or concrete containers.</p>	
Details/ Activities	<p>Construction of new facilities To condition the spent Magnox fuel construction of one or more encapsulation plants and one or more interim stores would be required to hold the encapsulated products until a GDF becomes available.</p> <p>Operation of new facilities Although encapsulation is a relatively simple and well-established process, some development work would be required to treat whole fuel elements. Depending on the nature of the fuel, there may be a requirement to infill the waste containers with cementitious grout. Container size is assumed to be 3-5 cubic metres, to comply with GDF design standards.</p>	<p>Closure of existing and future facilities As the Magnox reprocessing plant is scheduled to be closed around the year 2020, implementation of this option would bring the closure programme forward by several years, but would not lead to closure of existing facilities directly. There would however be an eventual requirement to close the new encapsulation plant and storage facilities once the inventory had been fully disposed of to a GDF.</p> <p>Avoid need to maintain existing facilities Scheduled closure of the Magnox reprocessing plant around 2020 means that implementation of this option would not affect the need to maintain or replace existing facilities.</p>

3.1.2 Dispose – Assessment

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
ENVIRONMENT				
Air Quality				
(Potential receptors: Residents neighbouring the site, nearby ecological features (incl. flora and fauna), non-motorised users of the local transport network, e.g. pedestrians, equestrians and cyclists).				
(Indicators: Local air quality (concentrations of relevant pollutants: NO _x , PM ₁₀ and SO ₂)).				
ST - MT	Construction of new facilities <ul style="list-style-type: none"> • Generation of dust • Emissions of pollutants such as NO_x, SO₂ and PM. Can be directly through use of plant or indirectly through transport.	–	Vehicle movements required for construction would likely be spread out over a sufficient period of time for the effect upon local air quality to be insignificant. Standard construction good practice and additional mitigation measures can reduce dust generation (which usually has a short range) and ensure that any impacts upon air quality are of low magnitude. Existing air quality at the site is well within national Air Quality Objectives so indicator sensitivity is low.	✓ No. of facilities requiring construction, the timing of construction (including seasonal works which may influence the dispersal of pollutant emissions).
ST - MT	Operation of new facilities <ul style="list-style-type: none"> • Emissions of pollutants through use of equipment and plant. 	–	Given the nature of the encapsulation technology and controls in place to manage pollutant emissions, magnitude can be considered low. Existing air quality is well within Air Quality Objectives so indicator sensitivity is low.	✓ Duration of operation, whether packages require infilling.
ST	Closure of existing facilities <ul style="list-style-type: none"> • Pollutant-emitting activities such as demolition and transport movements. 	0	As the Magnox reprocessing plant is scheduled for closure around 2020, implementation of disposal would bring forward impacts on air quality but would not significantly affect their magnitude.	✓
LT	Closure of future facilities <ul style="list-style-type: none"> • During decommissioning there may be effects on air quality associated with activities such as demolition and the transport of plant, equipment and waste. 	–	Although multiple facilities would be closed, air quality impacts from transport are unlikely to be significant as movements would be spread out over time. Impacts from generation of dust and other air pollutants would be mitigated through standard construction good practice, so residual impacts on local air quality would be of low magnitude. Air quality at the site is not anticipated to significantly worsen in the long-term, so indicator sensitivity would remain low.	✓ See construction of new facilities (above).

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
Biodiversity, Flora and Fauna (Potential Receptors: SSSIs, SACs, Ramsar, Ancient Woodland, National and Local Nature Reserves, Local Wildlife Sites).				
ST - LT	Construction of new facilities <ul style="list-style-type: none"> Possible land-take from designated or non-designated sites of value for nature conservation. There could be direct impacts through severance from or destruction to habitats, and/ or declines in populations of species. Effects on ecological receptors from disturbance or pollution-generating activities (air, noise, water etc.) 	- The significance of potential impacts on biodiversity, flora and fauna is difficult to determine based on the information currently available. If assumptions are made that: a) an assessment of receptor sensitivity is undertaken prior to any works commencing, b) construction best practice would be followed, c) any sensitive or designated species relocated if appropriate and d) there would be no land take from adjacent or nearby designated or non-designated sites, the magnitude of impacts would likely be low even if the receptor was of medium sensitivity.	??	No. and scale of facilities requiring construction, characteristics of nearby sites of value for nature conservation (both designated and non-designated) and other ecological receptors, no. of transport movements involved and the time over which they occur.
ST - MT	Operation of new facilities <ul style="list-style-type: none"> Pollution from noise, air, water and landscape and visual impacts can affect nearby ecological receptors. 	0 Given the nature of the encapsulation process and the fact that effects on biodiversity, flora and fauna during operation would likely be similar to those under the baseline scenario, the impact can be considered neutral.	✓	
ST	Closure of existing facilities <ul style="list-style-type: none"> Pollutant-emitting activities such as demolition and transport movements which could affect ecological receptors. 	0 As the Magnox reprocessing plant is scheduled for closure around 2020 under the baseline, implementation of disposal would bring forward impacts on biodiversity, flora and fauna but would not significantly affect their magnitude.	✓	
LT	Closure of future facilities <ul style="list-style-type: none"> Possible effects on ecological receptors from disturbance, pollutant-generating activities such as demolition and transport. 	- The significance of potential impacts on biodiversity, flora and fauna is difficult to determine based on information currently available, as the sensitivity of receptors varies from case to case. If the assumptions outlined above are made the magnitude of impacts would likely be low even if the receptor was of medium sensitivity.	??	See construction of new facilities (above).

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty	
Climate Change and Energy					
(Potential Receptors: The atmosphere, the oceans, flora and fauna, soils, people).					
(Indicators: Industrial process sector greenhouse gas emissions and sector contribution to total UK emissions).					
ST – MT	<p>Construction of new facilities</p> <ul style="list-style-type: none"> • Generation of CO₂ emissions • Use of energy and materials, which could have further implications in terms of embodied carbon. <p>The impact of increased CO₂ emissions may continue beyond the end of construction.</p>	--	<p>Taking into account the extent of construction likely to be required and material volumes involved in building an encapsulation plant and potentially one or more interim stores, the magnitude of impact in terms of CO₂ emissions may be high in the short-term.</p> <p>Decommissioning and the management of radioactive waste fall under the 'industrial processes' sector for the purpose of UK greenhouse gas emissions reporting, defined as 'emissions from industry except for those associated with fuel combustion (for example, emissions from cement manufacture)'.¹</p> <p>Given the overall steady decline in CO₂ emissions in the industrial process sector between 1990 and 2014, and the relatively modest contribution of the sector to UK emissions, indicator sensitivity is considered low.</p>	?	Embodied carbon of materials used, complexity/ no. of facilities (may affect construction programmes)
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> • Impacts on climate change and energy use from use of plant and equipment. 	+	<p>Although the facilities would use substantial energy over a period of years, the extent of energy use and carbon emissions generated would be reduced compared to the baseline of reprocessing, giving a positive impact of low magnitude. As the impact would be small in the context of industrial process sector emissions as a whole, sensitivity of the indicator is considered low.</p>	?	Contribution of facilities to industrial process sector CO ₂ emissions, changes in sector targets, if packages need to be infilled.
ST	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> • CO₂ emission-generating activities such as demolition and transport of plant, equipment and waste. 	0	<p>As the Magnox reprocessing plant is scheduled for closure around 2020, implementation of disposal would bring forward impacts on climate change and energy use but would not significantly affect their magnitude.</p>	✓	
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> • CO₂ emission-generating activities such as demolition. 	--	<p>Closing the encapsulation plant and interim stores could have a medium magnitude impact in terms of CO₂ emissions and energy use, particularly if wastes are transported off-site for disposal.</p>	??	Changes in CO ₂ targets / legislation and technology (including

¹ National Statistics. Provisional UK greenhouse gas emissions national statistics 2014

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
	<ul style="list-style-type: none"> Would require energy use. 	In the future, international and national carbon emission targets are likely to be stricter. Indicator sensitivity may therefore increase to medium.		vehicle and industrial carbon capture), volume of waste generated and whether this can be reused or recycled.
Coastal Change and Flood Risk (Potential Receptors: Local population and infrastructure in coastal areas and areas at risk of flooding). (Indicators: Environmental Agency Flood Risk Map).				
ST	Construction of new facilities <ul style="list-style-type: none"> Potential to affect surface water runoff and filtration rates through soil. This can lead to increased flood risk. Construction in coastal regions can affect coastal defences (natural and man-made) and may provide opportunities to further protect coastlines from erosion. 	- Construction works could affect hydrology at the site by increasing the presence of hard surfaces. This can increase surface water runoff and restrict drainage. As these risks would be designed-out in line with standard practice, the magnitude of the residual impact on flood risk can be considered low. Sellafield is located in Flood Zone 1, defined as having less than a 1 in 1000 chance of flooding occurring each year. The site has an elevation of 5-50m above sea level and is protected from coastal flooding by cliffs, a shingle spit and a railway embankment. Given the very small risk of flooding and existing defences which protect the site from coastal erosion, sensitivity in the short to medium-term is low.	?	The extent of any coastal erosion / sea level rise, any changes to existing coastal defences.
ST - MT	Operation of new facilities	0 Unlikely to be significant effects in terms of coastal change and flood risk from operation of the encapsulation plant and interim stores.	✓	
ST	Closure of existing facilities	0 Given the industrial nature of the site, including the presence of numerous other structures and facilities, it is unlikely that bringing forward the closure programme for the Magnox facilities will have a significant impact on flood risk. There is unlikely to be significant coastal change over this timeframe.	✓	
LT	Closure of future facilities <ul style="list-style-type: none"> Opportunities to reduce flood risk. 	0 Given that the site is located in Flood Zone 1, the category least at risk of flooding, sensitivity to minor improvements in drainage would be low and the overall impact negligible.	?	See construction of new facilities (above).

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
Cultural Heritage (Potential Receptors: Listed buildings, Scheduled Ancient Monuments, Registered Parks and Gardens, Conservation Areas).				
ST	Construction of new facilities <ul style="list-style-type: none"> Potential to affect cultural and built heritage receptors directly through changes to their setting or indirectly through other environmental effects. 	<p>–</p> <p>Construction works likely to be confined within the site boundary. Direct impacts through damage or degradation of buildings/ structures would therefore be unlikely. This could change if land beyond the existing boundary was required. Construction activities may also generate vibration and noise, which may have an impact on nearby heritage features. Assuming appropriate mitigation is put in place, any residual impacts would be of low magnitude.</p> <p>Although the sensitivity of receptors cannot be determined based on the information currently available, there are several heritage features within a few hundred meters of the site. Even if these receptors were determined to be of medium sensitivity, assuming appropriate mitigation is in place the overall impact would likely be of minor significance.</p>	??	This is a very site-specific consideration which would depend on the proximity of receptors to the site and activities, and the sensitivity of the receptors themselves, including whether they are statutorily designated.
ST - MT	Operation of new facilities <ul style="list-style-type: none"> Could affect cultural heritage features through changes in noise and other environmental effects. 	<p>0</p> <p>Aside from potential movements associated with transporting the encapsulated waste products to a GDF (which will be covered in elsewhere), activities involved in operation would be intra-site, meaning it is unlikely there would be direct impacts upon cultural heritage features. Assuming monitoring is undertaken if required and appropriate mitigation is used to manage impacts from noise etc., residual impacts are unlikely to be significant.</p>	✓	
ST	Closure of existing facilities <ul style="list-style-type: none"> Demolition, transport and other activities involved in closing facilities can affect the setting of cultural heritage features. Removal of facilities from the landscape could improve the setting of heritage features. 	<p>0</p> <p>As the Magnox reprocessing plant is scheduled for closure around 2020, disposal would bring forward potential impacts on cultural heritage but would not significantly affect the magnitude of such impacts.</p>	✓	
LT	Closure of future facilities	<p>–</p> <p>Decommissioning works would likely be confined within the site boundary, making direct impacts through damage or degradation of buildings/ structures</p>	??	See construction of new facilities (above).

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
	See closure of existing facilities (above).	<p>unlikely. Activities such as demolition generate vibration and noise, which can have an impact on nearby heritage features. Assuming appropriate mitigation is put in place, any residual impacts would be of low magnitude.</p> <p>Although the sensitivity of receptors cannot be determined based on information currently available, there are several heritage features within a few hundred meters of the site. Even if these receptors were determined to be of medium sensitivity, assuming appropriate mitigation is in place the overall impact would likely be of minor significance</p> <p>In the long-term, the setting of heritage features could be improved through the removal of features that act as detractors in the environment. However, given the presence of many other industrial facilities at the site, such impacts are unlikely to be significant.</p>		
<p>Geology and Soils (Potential Receptors: Geodiversity, designated geological sites, high quality land such as that used for agriculture).</p>				
ST - MT	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Possible adverse effects upon soil quality at the site Potential for non-radioactive releases to the ground, leading to land contamination within site boundary. 	<p>Impacts of construction on geology and soils would likely be confined within the site boundary. The use of ALARA and, BAT principles and other institutional controls would minimise releases. Given the extent of construction works that may be required, the magnitude of impacts could be medium.</p> <p>Taking into account the industrial nature of the site, which already experiences land contamination in a number of locations, changes to soil and ground quality are likely to be minor and within statutory limits. Receptor sensitivity is therefore considered low. Cumulative effects need to be considered.</p>	✓	The extent of construction activities and proximity to areas of existing contamination.
	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Soil resources would likely be used up during construction and/ or excavation activities. 	<p>Given the potential construction activities required, the magnitude of impacts on soil use can be considered medium. Some material may be sourced locally or reused from other parts of the site, in which case the magnitude of the impact could be reduced.</p> <p>Construction is unlikely to extend beyond existing site boundary and would</p>	✓	

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
ST - MT	Operation of new facilities	0	most likely take place on brownfield land that is of low sensitivity to impacts.	✓
ST	Closure of existing facilities • Activities such as demolition have the potential to result in ground contamination.	0	Provided that appropriate monitoring and established practices such as the use of ALARA and BAT principles are maintained, there are unlikely to be any releases to ground which could lead to significant effects on geology and soil at the site during operation. As the Magnox reprocessing plant is scheduled for closure around 2020, implementation of disposal would bring forward impacts on geology and soils but would not significantly affect the magnitude of such impacts.	✓
LT	Closure of future facilities • Decommissioning the encapsulation plant and interim storage facilities could impact soil quality and land contamination at the site.	–	During decommissioning there may be potential for adverse effects on geology and soils at the site and at the sites where waste arisings are managed. The use of ALARA and BAT principles and other institutional controls would help minimise releases and the spread of contamination. Given the potential extent of works required, impact magnitude could be medium. In the future, as the site moves through its decommissioning programme, there may either be worsening or improvement in ground and soil conditions at the site. This could alter the sensitivity of the receptor to effects.	?? Extent of decommissioning activity required (including transport of wastes off-site), potential use of remediation techniques to clean-up land at the site.
Landscape and Visual (Potential Receptors: The local population, cyclists, pedestrians and equestrians using local routes, fauna, tourists and other visitors to the area). (Indicators: The local landscape).				
ST	Construction of new facilities • Potential adverse effect on the local landscape from construction of multiple industrial facilities.	–	During the short-term there would be adverse impacts associated with the movement of construction plant and vehicles, and possibly additional transport movements to remove waste from the site. Such activities could have a medium magnitude effect upon the landscape and may adversely affect views from nearby locations. Given the industrial nature of the site and its prominence in the local landscape, sensitivity of the surrounding landscape to further adverse	✓ Potential reuse of waste materials would reduce requirement for transport movements. If construction of facilities/stores were to extend beyond the existing site

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
			changes can be considered low. Cumulative effects need to be considered		boundary this could have increased visual impacts.
ST - LT	Operation of new facilities <ul style="list-style-type: none"> Once operational, the facilities would be a constant feature of the landscape for many years. Ongoing transport movements from transporting the encapsulated products to a disposal facility. 	-	<p>Following construction and extending into the long-term there may be adverse landscape and visual effects associated with the presence of the facilities themselves and the ongoing transport of spent fuel to a GDF (covered in assessments elsewhere). As multiple facilities may be required, the magnitude of impacts could be medium.</p> <p>Given the industrial nature of the site and its existing prominence in the local landscape, sensitivity is considered low.</p>	?	Decommissioning of other facilities at the site could increase the prominence of the encapsulation plant and interim stores. Location of facilities/ stores.
ST	Closure of existing facilities <ul style="list-style-type: none"> Could create some landscape and visual opportunities. 	0	As the Magnox reprocessing plant is scheduled for closure around 2020 under the baseline, disposal would bring forward positive landscape and visual impacts, but given the relatively short timeframes involved, the effect of this is unlikely to be significant.	✓	
LT	Closure of future facilities <ul style="list-style-type: none"> May create landscape and visual impact opportunities. Could lead to improved views. 	0	Given the number of other facilities on the site and its prominence in the local landscape, the sensitivity of the indicator is considered low and any improvements would be unlikely to be significant.	?	The number and scale of other facilities on the site.
Materials and Waste (Potential Receptors: Local, regional and national waste management facilities, local landfills, the Low Level Waste Repository).					
ST	Construction of new facilities <ul style="list-style-type: none"> Would likely require substantial volumes of material. Some of this may be sourced from reusable material already on-site and some may be imported from primary sources. 	--	<p>Material requirements may differ depending on the extent to which the waste packages need to be infilled with cementitious grout, but would involve substantial volumes of construction materials such as concrete and steel. As the encapsulation process is a relatively simple technology, material impacts of disposal would have medium magnitude compared to the baseline of using existing facilities.</p> <p>Although there may be some opportunities to reuse existing material on the site, it is likely given the volumes of material required that some would need to be imported. The greater the distances involved in transporting material,</p>	✓	Complexity/ design of facilities (likely to alter material requirements). Distances over which material need to be imported, and whether material on-site can be reused.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
		<p>the greater the secondary environmental impacts such as changes in air quality are likely to be.</p>		
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Disposing of the inventory of Magnox spent fuel carries environmental risks. Implementation of the disposal option would avoid generation of HAL (Highly Active Liquor), a highly radioactive liquid waste stream which requires careful management, thereby offering an opportunity. 	<p>--</p> <p>Compared to the baseline of reprocessing the Magnox inventory through existing facilities (i.e. the Magnox reprocessing plant), disposal would require classifying all the material (approximately 2,500 tonnes) as waste (note that this amount is currently reducing by approximately 500 tonnes per year). This option therefore generates a substantial volume of packaged waste during operation, constituting a negative impact of medium magnitude.</p> <p>In the baseline, HAL is produced as a liquid waste stream as a result of reprocessing activities. So whilst disposal would generate waste requiring disposal, which would increase in volume following encapsulation, the nature of the waste could make it easier to manage. As there is an established management route in place to manage HAL, i.e. treatment via vitrification, sensitivity to positive impacts of avoiding HAL production is considered low.</p>	✓	
ST	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> Activities such as demolition and excavation have the potential to generate considerable volumes of waste material. 	<p>-</p> <p>As the Magnox reprocessing plant is scheduled for closure around 2020 under the baseline scenario, implementation of disposal would bring forward impacts on materials and wastes. This could slightly increase the pressure on waste facilities to manage these waste arisings.</p> <p>Given the considerable volumes of waste already stored on the site (in 2012 it was estimated to be over 1,700, 75,000 and 4,000 cubic metres of HLW, ILW and LLW respectively), the generation of waste in the volumes that might be expected from closing existing facilities is relatively small. Sensitivity could therefore be considered low. Cumulative impacts need to be considered, as does the capacity of facilities to receive any LLW or VLLW arisings.</p>	✓	

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> Potential to generate substantial volumes of Intermediate Level Waste (ILW), Low Level Waste (LLW), and non-radioactive waste. 	<p>---</p> <p>In the long-term, closure of the new facilities would generate waste. Given the scale of facilities to be constructed and the risk material will become contaminated with radiation, the magnitude of impacts could be high.</p> <p>Taking into account the success of the UK Strategy for the management of solid Low Level Waste, considerable progress has been made in diverting LLW and VLLW from disposal at the LLWR and similar facilities through reuse, recycling and decontamination. This means that any LLW or VLLW generated from the closure of future facilities is likely to have a suitable waste management route available. Sensitivity is therefore considered low.</p>	?	Capacity of the LLWR and availability of other Low Level Waste disposal facilities, the nature of the waste (i.e. radioactive or non-radioactive), the programme, availability and capacity of a GDF to manage ILW arisings.
<p>Noise (Potential Receptors: Local population, residential properties, schools, hospitals and other community facilities).</p>				
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Potential for increased noise and vibration, particularly from activities such as excavation and piling, and through the transport of plant and construction materials. 	<p>-</p> <p>Impacts would be confined within the site boundary or along site access roads, provided that no piling activities are required. Given existing noise levels at the site, the magnitude of noise impacts would likely be low.</p> <p>Where piling activities are required, noise impacts could extend beyond the site boundary and might be considered medium to high magnitude on a short-term basis.</p> <p>Construction management procedures and design measures could be used to minimise noise and vibration levels, in which case residual impacts would be of low magnitude.</p> <p>Given that a number of residential properties are located within a few hundred metres of the site and site access road, receptor sensitivity can be considered medium. It is likely that this would need to be verified through further assessment.</p>	??	Location and extent of construction works, no. of transport movements and the timescale over which they occur.
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Potential noise and vibration impacts associated with the processes used to encapsulate the Magnox spent fuel. 	<p>0</p> <p>Any noise and vibration impacts associated with operation of the new facilities would likely be confined within the site boundary. The design of the new facilities may also include measures to minimise noise and vibration impacts.</p> <p>Given the timescale over which transport movements are likely to occur and</p>	✓	

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
	<ul style="list-style-type: none"> Noise from intra-site transport from existing stores to the facilities, and potential off-site transport to a GDF. 		that they will be mostly intra-site (movements associated with transporting conditioned wastes to a GDF will be covered in assessments elsewhere) there are unlikely to be any significant noise and vibration impacts during operation.		
ST	Closure of existing facilities <ul style="list-style-type: none"> May include noise-generating activities such as demolition and transport movements associated with plant, equipment and waste. 	0	As the Magnox reprocessing plant is scheduled for closure around 2020 under the baseline scenario, disposal would bring forward noise and vibration impacts but would not significantly affect their magnitude.	✓	
LT	Closure of future facilities <ul style="list-style-type: none"> Decommissioning activities such as demolition, excavation and transport of plant, equipment and waste may be noise and vibration-generating. 	–	<p>Noise and vibration impacts from decommissioning activities can be mitigated through standard construction/ demolition good practice. Any residual impacts would therefore be of low magnitude.</p> <p>Potential receptors, including residents within a few hundred metres of the site and access roads may have medium sensitivity to noise and vibration impacts from transport movements. This would need to be verified through further assessment.</p>	??	The no. of transport movements required. This could be reduced if waste material can be reused on site.
Radiological Discharges (Potential Receptors: The environment, people, flora and fauna). (Indicators: Discharge rates at the site, extent of controls and existing mitigation in place).					
MT - LT	Operation of new facilities <ul style="list-style-type: none"> Avoiding the production of HAL, a high risk by-product of spent fuel reprocessing, may present opportunities. 	+	<p>Under the baseline scenario, spent fuel is reprocessed, leading to production of three outputs; plutonium, uranium and HAL. HAL is a radioactive liquid waste stream requiring careful management. In comparison, encapsulation with potential infilling using cementitious grout is a relatively low risk process as it does not produce any hazardous by-products. The disposal option could therefore have a low magnitude positive impact from a radiological perspective compared to the baseline.</p> <p>Due to existing mitigation and controls in place to manage the risk of radiological effects, including the use of ALARA and BAT principles and the fact that there is an established management route in place to manage HAL</p>	?	Delays to the programme of the encapsulation plant could mean the Magnox inventory continues to be stored in existing facilities which may be susceptible to degradation. This could create a radiological risk.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
			(i.e. treatment via vitrification), and suitable facilities available to store the plutonium and uranium products, sensitivity is considered low.		
ST and LT	Closure of existing and future facilities <ul style="list-style-type: none"> Decommissioning activities such as demolition of facilities have the potential to result in discharges of radioactivity. 	0	Due to the extensive procedures and controls in place to minimise or avoid discharges of radioactivity during decommissioning, including adherence to ALARA and BAT principles, any impacts associated with closure of existing or future facilities are unlikely to be significant.	✓	
Water Resources and Quality (Potential Receptors: Flora and fauna, people, waterbodies, water abstraction points). (Indicators: Local water quality (EU Water Directive Rating), water abstraction volumes).					
ST	Construction of new facilities <ul style="list-style-type: none"> Could potentially impact water quality at the site through run-off from roads used by construction plant and vehicles. May require an increase in water consumption which could put strain on water resources. 	--	Construction would likely take place within the existing site boundary, with appropriate management procedures in place to keep pollutant discharges to a minimum. Impacts would therefore be of low magnitude. Because existing water quality at the site is defined as good (in accordance with the Water Framework Directive), sensitivity to contamination is considered medium. The very large volumes of water currently abstracted by the site (in 2012 this was reported as some 6 million cubic metres) suggest that sensitivity to further water consumption (likely during construction) may be high.	?	The extent of construction activities would affect the volume of water that needs to be abstracted.
ST - MT	Operation of new facilities <ul style="list-style-type: none"> Potential requirement for water abstraction. 	--	During operation, there may be a requirement for water abstraction associated with infilling waste packages with cementitious grout. This could create a low magnitude negative impact. Given the high levels of water abstraction currently taking place to support the site, sensitivity to additional water consumption may be high.	?	Extent of indirect water abstraction and consumption needed to support workers etc. If infilling is required.
		+	Compared to the baseline where a number of aqueous processes used during reprocessing produce liquid waste streams, the disposal option may have an overall low magnitude positive effect from avoiding these processes. As there are extensive existing controls in place to monitor and minimise	✓	

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
ST	Closure of existing facilities <ul style="list-style-type: none"> • Could increase water abstraction. • May increase the risk of pollutant discharges to water receptors. 	0 As the Magnox reprocessing plant is scheduled for closure around 2020 under the baseline scenario, disposal would bring forward impacts on water resources and quality but would not significantly affect the magnitude of such impacts.	✓	
LT	Closure of future facilities <ul style="list-style-type: none"> • There may be substantial requirements for water abstraction and an increased risk of discharges to nearby waterbodies from decommissioning activities. 	-- Taking into account the potential extent of decommissioning activities required, impact magnitude in terms of contamination and water abstraction may be medium. Because water quality at the site is good, its sensitivity is considered medium. This is not anticipated to decline in the medium to long-term, and may improve once operations such as spent fuel reprocessing are complete. Water abstraction involved in closing future facilities may place an additional burden on water resources at the site. Water consumption is currently very high and this may continue into the long-term. Sensitivity to increased water abstraction may therefore be considered medium.	??	Changes in water abstraction and consumption at the site, (linked to timescales for decommissioning activities e.g. completion of spent fuel reprocessing operations). Changes in WFD classifications.
SOCIO-ECONOMICS				
Employment				
(Potential Receptors: Regional and national employment).				
(Indicators: Employment created / sustained, contribution to employment markets).				
ST	Construction of new facilities <ul style="list-style-type: none"> • Construction of the encapsulation plant and interim stores would create a full range of employment, from construction 	+++ Estimates for jobs associated with encapsulation can range up to around 1,000 FTE per year for a construction period of 5 years. ² Construction is assumed to occur at Sellafield, which is within the Copeland district. Currently 5.5% (1,819 people) of the local population works in	?	Technology used, potential employment requirements for other national nuclear projects.

² based on estimates from "Macro-economic study of Nuclear Materials" (ERM on behalf of the NDA, 2008) and estimates provided for analogous facilities.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
	to highly-skilled and managerial jobs.			
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Would create a range of employment opportunities. 	<p>++</p> <p>Estimates suggest that conditioning via encapsulation could generate in the region of 700 jobs per year.²</p> <p>The current contribution of the “manufacturing” sector (which includes most decommissioning and fuel reprocessing work) to the local employment market in terms of jobs is roughly 10,000. Sensitivity is therefore considered high based on the importance of manufacturing jobs to the local labour market.</p> <p>The increase in employment in this sector would be around 6%, which would constitute a low magnitude impact.</p>	?	Proportion of jobs created as new jobs, and the number transferred from other activities in the industry. For example, those involved in reprocessing of Magnox fuel.
ST	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> Disposal of the Magnox inventory would lead to closure of the existing reprocessing plant and stores, which could result in job losses. Decommissioning has the potential to create employment opportunities. 	<p>--</p> <p>The Magnox reprocessing facility currently employees over 400 people.</p> <p>As outlined above, based on the contribution of the “manufacturing” sector to the local labour market, receptor sensitivity is considered high.</p> <p>The potential decrease in employment in this sector due to this option would be around 4%, which is considered a low magnitude impact.</p> <p>As the Magnox reprocessing facilities are scheduled for closure around 2020 in the baseline, this would be a short-term impact.</p> <p>To decommission the facilities, nuclear civil, construction, engineering and waste management experience may be required. This could create some employment opportunities but it is unlikely to be a significant impact.</p>	✓	Complexity involved in decommissioning the facilities, availability of relevant expertise, no. of jobs supported by existing stores, the transferability of existing jobs to new facilities.
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> Decommissioning of future facilities could result in job losses. 	<p>-</p> <p>Eventual closure of the new treatment and storage facilities will likely have a low magnitude negative impact on local employment. As there may be additional need for workers to undertake other activities on the site, some of these jobs may be retained. Sensitivity is therefore considered low.</p>	?	Potential for facilities to be modified to manage other waste streams, likelihood of additional arisings which need to be managed.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
<p>Knowledge and Skills (Potential Receptors: National skill base). (Indicators: Existence and degree of maintenance of skills, anticipated demand for nuclear skills, national nuclear knowledge and capabilities).</p>				
ST - MT	<p>Development of new facilities</p> <ul style="list-style-type: none"> Will likely draw heavily on the local and regional supply of construction, engineering and civils workers. 	<p style="text-align: center;">-</p> <p>Under the disposal option there would be a full range of employment generated, from construction to highly-skilled and managerial jobs. The greater proportion of these jobs would likely be of a relatively lower skill requirement.</p> <p>Given the anticipated demand for nuclear engineering, civil and construction workers between 2017 and 2027 to work on the UK's new nuclear build projects, disposal of the Magnox inventory could have a negative impact through increasing pressure on the national skill base. This impact might be at least partially mitigated by the transfer of workers from the national workforce to nuclear roles. Sensitivity is therefore considered low.</p>	?	<p>Specific skills required and the availability of such skills in the local or regional area.</p>
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Could create opportunities to develop or enhance knowledge and skills. 	<p style="text-align: center;">+</p> <p>As disposal via encapsulation is a well-established technology, this option would likely maintain existing skills, which would be utilised during operation of the plant and stores, but do little to facilitate the development of new skills or improve knowledge.</p> <p>Overall, due to the importance of this field (radioactive waste management) to the region and nationally, the impact of maintaining knowledge and skills is considered to be low magnitude positive.</p>	?	<p>Skill development may be time limited, skills/ knowledge opportunities may be transferable to other waste management technologies/ waste types.</p>
ST	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> May lead to loss of existing knowledge and skills. Could create opportunities to enhance or maintain decommissioning skills and expertise. 	<p style="text-align: center;">0</p> <p>Employment supported by the Magnox reprocessing plant and stores may be lost, leading to early degradation of knowledge and skills. As the facilities are scheduled for closure around 2020, the impact of this early loss of skills and knowledge would be short-term and minor.</p> <p>Requirements for decommissioning associated with this option are not anticipated to lead to development of new knowledge and skills, as such skills already exist. It may help maintain these skills which would be minor positive.</p> <p>The early loss of reprocessing skills and maintenance of decommissioning skills are likely to balance each other out, in which case the overall impact is</p>	✓	

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
			likely to be neutral.		
LT	Closure of future facilities <ul style="list-style-type: none"> Once disposal operations are completed and the Magnox fuel inventory has been fully managed, knowledge and skills would be lost. 	+	Given the potential transferability of disposal and storage skills to management of other types of waste, and the importance of such skills nationally, the long-term impact on the national skill base may be minor positive.	?	Potential transferability to other forms of waste.
Education and Training (Potential Receptors: National Skill Base). (Indicators: Likely future skill requirements and contribution to improving the UK skill base).					
ST - MT	Development and operation of new facilities <ul style="list-style-type: none"> To ensure the correct skills are available to develop and implement disposal, some education and training may be required. This could create opportunities at regional and national spatial scales. 	+	If disposal via encapsulation is implemented there may be some limited education and training opportunities created compared to the baseline of reprocessing, which is a well-established process. This impact on education and training would likely occur in the short to medium-term during construction and operation, with benefits reducing following this period.	✓	
ST	Closure of existing facilities	0	It is unlikely that closure of existing facilities used to reprocess the Magnox inventory would have significant impacts in terms of education and training. The skills and knowledge to carry out such decommissioning activities already exist.	?	Extent to which facilities may be contaminated/ require a specialist approach to decommissioning.
LT	Closure of future facilities	0	Following completion of disposal, there will likely be a requirement for additional decommissioning expertise to close the treatment and storage facilities. Given the existence of such knowledge and skills, it is unlikely there would be any significant requirement for or impact on education and training.	?	The retention and availability of decommissioning skills over time.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
Economy (Potential Receptors: Local and Regional economy). (Indicators: £ Gross Value Added).				
ST	Construction of new facilities <ul style="list-style-type: none"> Expenditure on Magnox disposal could have knock-on impacts on local, regional and national economic development. The nature and extent of potential benefits is dependent on local supply linkages and the demographics of the area in which money is invested.	++ <p>Average Gross Value Added (GVA) per employee data for UK regions³ can be multiplied by employment estimates for encapsulation in order to estimate total GVA contributions for the disposal option.</p> <p>The value for West Cumbria is £19,032 per employee. Assuming the majority of employment is either sourced or based locally, this results in a 5 year total of construction GVA of up to £95 million, or a construction sector increase of approximately 6% a year. This would constitute a medium magnitude impact.</p> <p>The construction GVA of West Cumbria in 2013 was £333 million, which equated to approximately 5 – 10% of total GVA for West Cumbria. This suggests the sector is of medium sensitivity based on its importance to the regional economy, giving an overall moderate positive impact.</p>	?	Change in the importance of construction to the regional economy, whether employment is sourced/ transferred from existing jobs.
		N / A <p>At the national level, economic impacts are tied to the capital spend required to achieve the objectives. As cost has not been considered in this IIA and will be assessed in an independent assessment elsewhere, national economic impacts have not been assessed.</p>	N/A	
ST - MT	Operation of new facilities <ul style="list-style-type: none"> Could lead to ongoing economic contributions to the local and regional economy. 	++ <p>GVA per employee data can be multiplied by the expected FTE (jobs supported) per year of operation.</p> <p>The value for West Cumbria is £19,032 per employee. Assuming the majority of employment is either sourced or based locally, the result for operational GVA is around £67 million per year for the duration of the operation period, equating to a manufacturing sector increase of approximately 4%. This would constitute a low magnitude impact.</p> <p>The manufacturing GVA of West Cumbria in 2013 was £1,666 million (approximately 35 - 40% of total GVA for West Cumbria), suggesting the</p>	✓	

³ Office for National Statistics (2012)

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
ST	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> • Could lead to changes in the supply chain involved in reprocessing Magnox spent fuel. • Decommissioning may require nuclear civils, construction and engineering experience, which could lead to economic investment. 	<p>--</p> <p>The GVA for West Cumbria is £19,032 per employee. Assuming the majority of employment is either sourced or based locally, the result for operational GVA lost due to facility closure is around £7.6 million per year, equating to a manufacturing sector decrease of approximately 0.5%. This would constitute a low magnitude impact. As the facilities are scheduled for closure around 2020 under the baseline, this would be a total loss in GVA of approximately £38 million.</p> <p>Taking into account the manufacturing GVA of West Cumbria in 2013 the sector is considered to have high sensitivity based on its importance to the regional economy.</p>	?	Whether these jobs can be retained or transferred.
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> • Could reduce economic contributions to the local and regional economy due to loss of employment. 	<p>-</p> <p>Eventual closure of the disposal facilities could reduce spending and investment into the local economy. Given the size of the Sellafield site and the number of other operations that take place (and are assumed will continue to take place in the long-term), the magnitude of such impacts on the local economy are likely to be low.</p>	??	Potential for encapsulation plant and interim stores to be used for alternative waste streams.
<p>Local and National Assets (Potential Receptors: local, regional and national community). (Indicators: Indices of Multiple Deprivation (IMD) ranking for barriers to housing and services, the existence of alternative facilities)</p>				
ST - MT	<p>Construction and operation of new facilities</p> <ul style="list-style-type: none"> • New transport infrastructure may be developed, or existing infrastructure enhanced to improve access during construction and operation. This could have benefits at a local level. • An increase in employment could 	<p>0</p> <p>Future transport of staff, materials and waste would likely be assessed in more detail at a site level, with negative impacts potentially mitigated through improvements in infrastructure. Transport movements are also likely to be spread out over a long period of time, in which case the overall impact of disposal on local assets can be considered neutral.</p> <p>The area around the Sellafield site (Copeland) is ranked within the 10% most deprived areas in relation to "Barriers to housing and services".⁴ The receptor could therefore have medium sensitivity to changes.</p>	??	Potential changes to site access routes would be highly dependent on the location of any potential treatment/ storage facility(ies) and the estimated no. of vehicle movements involved.

⁴ This Index includes the indicators of: road distance to a GP surgery, road distance to a general store or supermarket, road distance to a primary school and road distance to a Post Office or sub post office

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
	change local travel patterns and may reduce access to community facilities and services.				
ST - LT	Development of new facilities <ul style="list-style-type: none"> At a national scale, development of conditioning and storage facilities may provide opportunities for the management of other waste streams. 	+	<p>Encapsulation is a fairly common method for immobilising radioactive waste pending transfer to a suitable disposal facility. Opportunities may therefore exist as part of the Magnox disposal route to develop and maintain a national asset(s), which would constitute a short to long-term positive impact of medium magnitude.</p> <p>As alternative treatment facilities already exist and are likely to be developed over time to manage other waste streams regardless of whether or not a disposal option is implemented, indicator sensitivity can be considered low, making the overall impact of minor significance.</p>	✓	The suitability of any developed facilities to manage other forms of waste, future waste arisings, changes in government policy.
ST	Closure of existing facilities	0	Loss of the Magnox reprocessing facility would reduce the capability of the UK to deal with this kind of waste in the future. However, as this facility is scheduled to close around 2020 and no new Magnox power stations are proposed, this impact is not considered significant	✓	
LT	Closure of future facilities	0	No significant impact on existing local and national assets is expected as a result of the closure of future facilities.	?	
HEALTH					
<p>Respiratory and cardiovascular effects associated with changes in air quality</p> <p>Cardiovascular health effects, respiratory illnesses and levels of chronic disease can be influenced by poor air quality. Studies have shown that there is a direct association between proximity to busy roads (including those travelled by a large number of heavy vehicles) and respiratory illness. Air quality can also influence levels of physical activity, which in turn can impact cardiovascular conditions and lead to stress.</p> <p>(Potential Receptors: The local population and non-motorised users in the local area, in particular infants, young children, the elderly and people with existing respiratory or cardiovascular conditions such as asthma).</p> <p>(Indicators: hospital admissions and mortality rates linked to cardiovascular illness, national health survey results).</p>					
ST	Construction of new facilities	-	Effects of construction likely to be confined within the site boundary, so the	✓	No. of vehicle

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
	<ul style="list-style-type: none"> Construction works can negatively affect health through changes in air quality from emissions of pollutants such as NO_x, SO₂ and Particulate Matter. 	<p>magnitude of health impacts on the community can be considered low. Use of dust suppression techniques and other construction management practices can mitigate the risk of impacts on health through changes in air quality. Any new facilities would be designed to comply with air emission standards.</p> <p>Activities beyond the site boundary such as the movement of vehicles would need to be carefully monitored and managed to avoid effects upon recreation and amenity areas, and levels of physical activity.</p> <p>Copeland, the district Sellafield is located in, has a high level of under 75 year-old mortality associated with cardiovascular illness (100.6 deaths per 100,000 compared to 81.1 for England (2010-2012)). Indicator sensitivity to impacts which affect the risk of respiratory and cardiovascular illnesses and conditions may therefore be considered medium.</p>		<p>movements and the timescales over which they occur, no. of facilities constructed, capacity of local medical facilities, proximity of residents and other receptors to activities.</p>
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> May result in dust and some pollutant emissions through the ongoing use of plant and equipment and transport, which can affect health. 	<p>Air quality changes during operations would likely be of low magnitude and continually monitored and mitigated. The magnitude of health impacts to the public would therefore also be low.</p> <p>– Based on the health profile of Copeland, which suggests that the local population may be sensitive to health effects associated with changes in air quality, sensitivity can be considered medium. Cumulative effects on air quality at the site in the medium to long-term need to be considered.</p>	?	<p>Length of the operation phase, potential requirement for infilling of the waste packages with cementitious grout.</p>
ST and LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> Potential to negatively impact health through dust and pollutant emissions from demolition, plant and vehicles. Changes in air quality could also negatively impact the use of recreation and amenity areas and levels of physical activity. 	<p>As with construction, effects of closure and demolition are likely to be confined within the site boundary and may be mitigated through the use of good construction and demolition practice. The magnitude of potential health impacts would therefore likely be low.</p> <p>– Based on the health profile of Copeland, which has higher than average levels of cardiovascular illness and scored poorly on the most recent national health survey, sensitivity can be considered medium.</p>	?	<p>Extent to which recreation and amenity areas would be impacted and how the local population would respond to these changes, availability of other amenity and recreation areas in the local area.</p>
<p>Annoyance, sleep disturbance, cardiovascular effects, potential hearing damage and other health effects associated with changes in noise levels</p>				

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
<p>Health effects from changes in noise levels can relate to communication, school performance, sleep, aggression and annoyance in addition to cardiovascular effects and potential hearing damage. (Potential Receptors: The local population and non-motorised users of the local area including the road network, in particular infants, young children and the elderly). (Indicator: hospital admissions and mortality rates linked to cardiovascular illness, national health survey results).</p>				
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> • Would likely cause increased noise and vibration, particularly from activities such as excavation and piling, and through the transport of plant and construction materials. 	<p>–</p> <p>It is likely that the impacts of construction and transport on noise and vibration would occur only in the short-term and be confined to a local scale (within or near the site boundary). Good construction practice can be used to ensure the magnitude of noise and vibration impacts is low.</p> <p>Noise and vibration impacts which affect the use of recreation and amenity areas and levels of physical activity may have a further negative impact on the health of the local population.</p> <p>Sensitivity of receptors to noise and vibration from traffic movements during construction, particularly those near to the site access road, may be medium.</p>	??	<p>Extent of construction works required, location of new facilities, types of equipment and plant used, no. of transport movements and timescale over which they occur.</p>
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> • Potential for increased noise and vibration from operation of plant and stores. 	<p>0</p> <p>As noise and vibration impacts during operation would be confined within the site boundary there are unlikely to be any significant health effects upon the local population.</p>	✓	
ST and LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> • Noise and vibration levels can increase as a result of demolition, and have the potential to lead to negative impacts on health. 	<p>–</p> <p>Impacts of demolition noise and vibration would likely occur over a relatively short period of time but could extend beyond the site boundary. Good construction and demolition practice can reduce the magnitude of noise and vibration impacts, in which case the magnitude of residual impacts would be low.</p> <p>Taking into account the proximity of residential properties and local cycle routes, receptor sensitivity may be medium.</p>	?	<p>Extent of demolition required, types of equipment and plant used, no. of transport movements.</p>
<p>Effects on physical activity and obesity</p> <p>The UK government recommends that adults, children and young people should aim to be active daily. In addition to formal recreation facilities (e.g. playing fields and leisure centres), high quality walking and cycling infrastructure are increasingly recognised as important for promoting health. The use of recreation areas, local</p>				

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
<p>amenities and levels of physical activity undertaken can be impacted through environmental changes in air quality, noise, visual disturbance and traffic. (Potential Receptors: The local population, in particular groups who regularly use recreation and amenity areas, including children and users of national cycle routes). (Indicators: Levels of physical activity and obesity, availability of recreational facilities).</p>				
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Can potentially reduce the attractiveness and usage of recreation and amenity areas through visual disturbance from plant and vehicles, and through changes in traffic volumes and patterns on the local road network. <p>This can lead to changes in levels of physical activity undertaken by the local population.</p>	<p>As the majority of environmental effects which could influence use of recreational areas and local amenities would be confined within or close to the site boundary, the magnitude of impacts from a health perspective is likely to be low.</p> <p>Copeland has a higher percentage of adults classed as obese (28.3%) and overweight or obese (75.9%) than the England average (23%) and (63.8%) respectively (Active People Survey 2012).</p> <p>Based on the health profile of Copeland and the proximity of recreational receptors (there is both a national and a local cycle route close to the site), sensitivity to impacts from construction may be medium.</p>	??	Extent of construction required, location of the new facilities, types of equipment and plant required.
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> A number of environmental effects (e.g. noise, air quality and landscape and visual) could impact the attractiveness of local recreational and amenity areas. 	<p>0</p> <p>Due to the relatively minor environmental effects anticipated to arise from operation of the new encapsulation plant and interim stores, impacts on local recreational and amenity areas (and subsequently levels of physical activity) are unlikely to be significant.</p>	✓	
ST and LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> Changes in air quality, noise and visual disturbance associated with demolition and closure works (including transport of waste materials off-site) could reduce the use of recreation and amenity areas and levels of physical activity. 	<p>–</p> <p>Decommissioning activities are likely to be confined mainly within the site boundary, but will require careful management through construction/ demolition good practice to ensure that the magnitude of impacts is low.</p> <p>Based on the health profile of Copeland and the proximity of receptors to the site, sensitivity to impacts from works to close existing facilities can be considered medium.</p>	?	Proximity of facilities to recreational and amenity areas, no. of transport movements required (linked to amount of generated waste material that can be reused on-site).
<p>Health and Safety Effects from Road Traffic Changes</p> <p>Studies have shown that people modify their behaviours in response to increased road traffic. As traffic increases, social networks tend to decrease. This affects people's sense of community and healthy social interaction. Increased traffic can also reduce levels of physical activity by discouraging non-motorised forms of</p>				

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
<p>transport such as walking and cycling. Potential health effects relating to road traffic changes include potential increases in the risk of road accidents, stress levels experienced whilst travelling and reduced levels of social contact. (Potential Receptors: The local population, in particular road users, non-motorised road users and groups who regularly use recreation and amenity areas e.g. children). (Indicators: Accident statistics).</p>				
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Can result in increased traffic due to movement of plant and vehicles. This could increase driver stress, the risk of road accidents and exacerbate physical and mental health conditions. 	<p style="text-align: center;">-</p> <p>Impacts on the local road network from transport in the short-term until the facilities are constructed. Vehicle movements would likely be spread out over a considerable length of time, making the magnitude of impact low. Given existing and historic accident figures for the A595, the main road which links to the site access road, sensitivity to traffic changes may be considered medium.</p>	?	<p>No. / timing of transport movements (linked to no. of facilities constructed), cumulative developments, changes in local transport network and travel patterns.</p>
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> There may be a requirement for ongoing transport movements. 	<p style="text-align: center;">0</p> <p>During operation it is anticipated that the majority of transport movements would be intra-site (movements associated with transporting the conditioned wastes to a GDF will be covered in assessments elsewhere). Given the relatively short distances involved and the secure nature of the site (i.e. no public access) it is not anticipated that there would be significant impacts on users of the local transport network.</p>	✓	
ST and LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> An increase in transport movements during decommissioning could affect the local road network and has the potential to lead to increased stress, anxiety and risk of road accidents. 	<p style="text-align: center;">-</p> <p>As transport movements during decommissioning would be spread out over a considerable period of time, any residual impacts upon the local road network would be of low magnitude. Given existing and historic accident figures for the A595, the main road which links to the site access road, sensitivity to traffic changes may be considered medium.</p>	?	<p>See construction of new facilities (above).</p>
<p>Health effects relating to changes in the water environment</p> <p>Changes to the water environment can affect drinking water and food supplies such as fish stocks. They can also affect agriculture, direct recreation facilities (e.g. recreational angling, kayaking) and wider recreational resources (e.g. views of water along countryside walks). Loss of such recreational water resources can reduce</p>				

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
<p>levels of physical activity, leading to a number of potential health effects. In some cases, water and food contamination can result in short and long-term illnesses. (Potential Receptors: The local population, groups who abstract water from local sources (e.g. for irrigation) and users of recreational water bodies). (Indicators: Water quality, hospital admissions, physical activity rates).</p>				
ST - MT	<p>Construction of new facilities</p> <ul style="list-style-type: none"> • Could potentially impact water quality at the site through run-off from roads used by plant and vehicles. • Likely to require an increase in water consumption which may put strain on water resources. 	<p>-</p> <p>Short-term changes to the water environment from construction activities could have health implications if they affect drinking supplies or recreational resources. If a contaminant is long lasting, it could stay within water bodies or water systems for a prolonged period of time.</p> <p>Monitoring and the use of good construction practice would minimise impacts upon the water environment and ensure that any residual health impacts were of low magnitude. Requirements for water abstraction are unlikely to affect recreational use of water resources.</p>	?	<p>Dewatering required as part of construction, piling requirements and depths of excavations (could impact groundwater), type of contaminants and how long lasting they are.</p>
ST - LT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> • Possible requirement for water abstraction and discharges to water bodies. This can lead to health effects associated with water contamination. • Possible opportunities from avoiding risks associated with aqueous processes in the baseline. 	<p>+</p> <p>Although there may be a requirement for water abstraction and a small risk of effects on water quality during operation, compared to the baseline where a number of aqueous processes are used during reprocessing operations which produce liquid waste streams, disposal may have an overall low magnitude positive effect.</p> <p>As there are extensive existing controls in place to monitor and minimise discharges to waterbodies, including the use of ALARA and BAT, and given the absence of water-based recreational activities downstream of the site, sensitivity is considered low.</p>	?	<p>The use of any aqueous processes.</p>
MT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> • Decommissioning has the potential to result in contamination of local water bodies. This could lead to health effects upon the local population and any recreational users of these features. 	<p>-</p> <p>As demolition activities would be confined within the site boundary and controlled through construction good practice and monitoring, any residual impacts are likely to be of low magnitude.</p> <p>Given existing good water quality at the site and the non-use of nearby fresh water bodies for recreational purposes, sensitivity to minor contamination which could lead to health effects is low.</p>	?	<p>Changes in water quality at the site over time</p>
<p>Radiological safety related health effects</p> <p>Effects relating to potential radiological exposure could include fear of exposure and the mental health and wellbeing impacts associated with this, as well as direct</p>				

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
exposure due to discharges. (Potential Receptors: Local population and in particular children and pregnant women). (Indicators: Discharge rates at the site, RIFE total reported dosages to the public).				
ST - MT - LT	Operation of new facilities and closure of existing facilities <ul style="list-style-type: none"> Disposal of the Magnox inventory could offer radiological opportunities in terms of avoiding the production of Highly Active Liquor (HAL), a high risk by-product of spent fuel reprocessing. 	+ Encapsulation with potential infilling using cementitious grout is a relatively low risk process from a radiological perspective. The disposal option could therefore be considered to have a medium magnitude positive impact compared to the baseline. Due to the use of extensive controls (including adherence to the principles of ALARA and BAT), the actual radiological health risk of reprocessing the Magnox inventory under the baseline scenario is considered low. Sensitivity to changes is therefore also considered to be low, giving an overall minor positive impact from disposal.	✓	
Mental health and Wellbeing effects Changes in employment and income can influence people's mental health, as can changes in the environment through disturbance and pollution. Further health effects relating to mental health and wellbeing can include depression, anxiety, stress, changes in community cohesion and changes in levels of physical activity. (Potential Receptors: Mental health statistics for local population, visitors, regional population).				
ST	Construction of new facilities <ul style="list-style-type: none"> Likely to create employment opportunities, which studies have shown can positively influence mental health and wellbeing. 	+ Under the disposal option employment would be generated during construction. This may have a positive impact on the health and wellbeing of the local population. There may also be added benefits to the local economy which again might positively influence wellbeing and mental health.	??	No. of jobs created, duration of the construction works, where employment is sourced from.
ST	Construction of new facilities <ul style="list-style-type: none"> May lead to negative impacts on mental health and wellbeing due to the range and extent of environmental effects experienced by the local population. Such health effects might include annoyance, anxiety or stress. 	- Construction can result in a number of adverse environmental effects, including increases in noise and vibration, reduced air quality and landscape and visual impacts. These impacts have the potential to adversely affect the mental health and wellbeing of the local population. It is likely that negative effects upon mental health and wellbeing would be limited to those living in close proximity to the site, and would be of low magnitude once mitigation measures were applied.	??	Extent of environmental impacts, duration of the construction works.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> • Has the potential to offer socio-economic opportunities which may have positive effects for the mental health of those employed. • Possible risk of adverse environmental effects which can influence health through increased stress and anxiety. 	<p style="text-align: center;">+</p> <p>Effects on the environment (including through changes in air and water quality, and the local landscape etc.) are likely to be less pronounced during operation than during construction. Transport movements will likely be fewer and emissions from activities and processes are likely to be reduced. Overall, the net effect upon the mental health and wellbeing of the local population during operation may therefore be minor positive because of the employment opportunities created.</p>	??	Socio-economic opportunities available, whether these are made available to local population, environmental impacts and whether they can be mitigated.
ST and LT	<p>Closure of existing and future facilities</p> <ul style="list-style-type: none"> • Can lead to negative environmental effects which might affect mental health and wellbeing, as well as negative socio-economic effects from possible job losses. • Could have positive mental health and wellbeing effects such as reduced anxiety, stress and improved social cohesion from employment generated to carry out decommissioning and removal of facilities from the landscape. 	<p style="text-align: center;">-</p> <p>Loss of jobs could lead to stress, anxiety and other negative effects on the mental health and wellbeing of the local population. If skills/jobs can be transferred, then these impacts may be mitigated. Employment opportunities created to carry out the decommissioning activities would be short-term and unlikely to fully offset these potential job losses.</p> <p>Closure of facilities would offer some landscape and visual opportunities, which might positively affect mental health and wellbeing, but given the industrial nature of the site and the presence of numerous other facilities the impact of this is likely to be minor.</p> <p>Demolition and transporting waste materials off-site can lead to adverse environmental effects which create annoyance, disturbance and stress.</p> <p>Overall, there is likely to be a minor negative effect on mental health and wellbeing associated with closing facilities.</p>	??	No. of jobs created, how many jobs lost/transferred, timescales for closures. Nature and extent of environmental impacts.

3.2 Oxides

3.2.1 Dispose – Description of Option

Option	Curtail reprocessing operations, condition the fuel, interim store and dispose of it in a geological disposal facility (Dispose)	
Site	Sellafield	
Description	<p>Oxide fuel is used in Advanced Gas-Cooled Reactors (AGR) operated by EDF Energy in the UK, and in Light Water Reactors (LWR) operated by numerous utilities throughout the world. Spent oxide fuel that has been irradiated in UK reactors is currently reprocessed in Thermal Oxide Reprocessing Plant (THORP) at Sellafield which started operation in 1994.</p> <p>Reprocessing of spent fuel in THORP provides uranium and plutonium products that can be reused in new nuclear fuel. THORP was expected to complete existing reprocessing contracts by 2010. However, due to operational difficulties both in THORP and in downstream support plant this has not been possible. THORP is now expected to complete reprocessing operations in 2018.</p> <p>In this option, reprocessing operations at THORP would be curtailed, with the remaining inventory conditioned and disposed of to a GDF at the earliest opportunity. For the purpose of the assessment, it has been assumed that conditioning would involve encapsulating the spent oxide fuel in steel or concrete drums and placing these packages into 3-5 cubic metre stainless steel, iron or concrete boxes (containers). The containers would then be interim stored for a period of years pending transfer to a GDF.</p> <p>It should be noted that under the baseline scenario, part of the oxides inventory that is not contracted for reprocessing in THORP would be managed via disposal. This means that under this curtail and dispose option, the main differences to the baseline relate to the amount of inventory to be managed and the scale of disposal facilities, which might be slightly larger.</p>	
Details/ Activities	<p>Expansion of new facilities This option would involve building additional storage capacity for AGR spent fuel, managing fuels more susceptible to corrosion during storage, and potentially expanding the encapsulation plant and storage facilities that would be constructed under the baseline.</p> <p>Operation of new facilities Encapsulation is a relatively simple and well established process. Container size is assumed to be 3-5 cubic metres, to comply with GDF</p>	<p>Closure of existing and future facilities As THORP is scheduled to be closed in 2018, implementation of this option would bring forward the closure programme by a few years, but not lead to closure of existing facilities directly. There would however be an eventual requirement to close the new encapsulation plant and storage facilities once the inventory had been fully disposed of. As such activities would also be required under the baseline, any additional effects are likely to be minor.</p> <p>Avoid need to maintain existing facilities</p>

Option	Curtail reprocessing operations, condition the fuel, interim store and dispose of it in a geological disposal facility (Dispose)	
	design standards. Under this option, the entire inventory of oxides would be disposed of; meaning the operation phase of the plant would likely be extended compared to the baseline.	Scheduled closure of THORP in 2018 means that implementation of the disposal option would not affect need to maintain or replace existing facilities.

3.2.2 Dispose – Assessment

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
ENVIRONMENT				
Air Quality				
(Potential receptors: Residents neighbouring the site, nearby ecological features (incl. flora and fauna), non-motorised users of the local transport network, e.g. pedestrians, equestrians and cyclists).				
(Indicators: Local air quality (concentrations of relevant pollutants: NO _x , PM ₁₀ and SO ₂)).				
ST - MT	Expansion of new facilities <ul style="list-style-type: none"> • Generation of dust • Emissions of pollutants such as NO_x, SO₂ and PM. This can be directly through the use of plant or indirectly through the transport of materials and waste.	–		No. of facilities requiring construction, the timing of construction (including seasonal works which may influence the dispersal of pollutant emissions).
ST - MT	Operation of new facilities <ul style="list-style-type: none"> • Emissions of pollutants through use of equipment and plant. 	–		Duration of the operational phase.

Time-scale	Risk / Opportunity for Impact	Significance of Impact		Un-certainty	Factors affecting uncertainty
ST	Closure of existing facilities <ul style="list-style-type: none"> Pollutant-emitting activities such as demolition and transport movements. 	0	As THORP is scheduled for closure in 2018 under the baseline scenario, implementation of disposal would bring forward impacts on air quality but would not significantly affect their magnitude.	✓	
LT	Closure of future facilities <ul style="list-style-type: none"> During decommissioning there may be effects on air quality associated with activities such as demolition and the transport of plant, equipment and waste. 	–	As activities to decommission the facilities would be required under the baseline (albeit potentially to a slightly lesser extent), the disposal option would have only a minor additional impact on air quality. Air quality at the site is not anticipated to significantly worsen in the long-term, so indicator sensitivity would remain low.	?	No. of facilities requiring decommissioning, the timing of demolition (including seasonal works)
Biodiversity, Flora and Fauna (Potential Receptors: SSSIs, SACs, Ramsar, Ancient Woodland, National and Local Nature Reserves, Local Wildlife Sites).					
ST - LT	Expansion of new facilities <ul style="list-style-type: none"> Possible land-take from designated or non-designated sites of value for nature conservation. There could be direct impacts through severance from or destruction to habitats, and/ or declines in populations of species. Effects on ecological receptors from disturbance or pollution-generating activities (air, noise, water etc.) 	–	The significance of potential impacts on biodiversity, flora and fauna is difficult to determine based on the information currently available. If assumptions are made that: a) an assessment of receptor sensitivity is undertaken prior to any works commencing, b) construction best practice would be followed, c) any sensitive or designated species relocated if appropriate and d) there would be no land take from adjacent or nearby designated or non-designated sites, the magnitude of impacts would likely be low even if the receptor was of medium sensitivity.	??	No. and scale of facilities requiring construction, characteristics of nearby sites of value for nature conservation (both designation and non-designated) and other ecological receptors, no. of transport movements involved and the time over which they occur.
ST - MT	Operation of new facilities <ul style="list-style-type: none"> Pollution in the form of noise and vibration, air quality, water and landscape and visual impacts has the potential to impact nearby ecological receptors. 	0	Given the nature of the encapsulation process and the fact that effects on biodiversity, flora and fauna during operation would likely be similar to those under the baseline scenario, the impact can be considered neutral.	✓	
ST	Closure of existing facilities <ul style="list-style-type: none"> Pollutant-emitting activities such as 	0	As THORP is scheduled for closure in 2018 under the baseline scenario, disposal would bring forward impacts on biodiversity, flora and fauna but	✓	

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	demolition and transport movements could affect ecological receptors.		would not significantly affect their magnitude.	
LT	Closure of future facilities <ul style="list-style-type: none"> Possible effects on ecological receptors from disturbance, pollutant-generating activities such as demolition and transport. 	–	<p>The significance of potential impacts on biodiversity, flora and fauna is difficult to determine based on the information currently available, as the sensitivity of receptors will vary from case to case.</p> <p>If the assumptions outlined above are made the magnitude of impacts would likely be low even if the receptor was of medium sensitivity.</p>	?? See expansion of new facilities (above).
Climate Change and Energy (Potential Receptors: The atmosphere, the oceans, flora and fauna, soils, people). (Indicators: Industrial process sector greenhouse gas emissions and sector contribution to total UK emissions).				
ST – MT	Expansion of new facilities <ul style="list-style-type: none"> Generation of CO₂ emissions Use of energy and materials, which could have further implications in terms of embodied carbon. <p>The impact of increased CO₂ emissions may continue beyond the end of construction.</p>	–	<p>Taking into account the relatively minor expansion to facilities constructed under the baseline that would be required, the magnitude of impact in terms of CO₂ emissions generated may be medium in the short-term.</p> <p>Decommissioning and the management of radioactive waste fall under the 'industrial processes' sector for the purpose of UK greenhouse gas emissions reporting, defined as 'emissions from industry except for those associated with fuel combustion (for example, emissions from cement manufacture)'.⁵</p> <p>Given the overall steady decline in CO₂ emissions in the industrial process sector between 1990 and 2014, and the relatively modest contribution of the sector to UK emissions, indicator sensitivity is considered low.</p>	? Embodied carbon of materials used, complexity/ no. of facilities (may affect construction programmes)
ST - MT	Operation of new facilities <ul style="list-style-type: none"> Impacts on climate change and energy use from use of plant and equipment. 	–	<p>As disposal may require extending the operation phase of the encapsulation plant and interim storage facilities, there may be a low magnitude impact in terms of energy and CO₂ emissions. As the impact would likely be small in the context of industrial process sector emissions as a whole, sensitivity of the indicator is considered low.</p>	? Contribution of the facility(ies) to industrial process sector CO ₂ emissions, changes in sector targets.
ST	Closure of existing facilities <ul style="list-style-type: none"> CO₂ generating activities such as 	0	<p>As THORP is scheduled for closure in 2018 under the baseline scenario, disposal would bring forward impacts on climate change and energy use but</p>	✓

⁵ <https://www.gov.uk/government/statistics/provisional-uk-greenhouse-gas-emissions-national-statistics-2014>

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
	demolition and transport of plant, equipment and waste.		would not significantly affect their magnitude.		
LT	Closure of future facilities <ul style="list-style-type: none"> • CO₂ emission-generating activities such as demolition. • Would require energy use. 	–	<p>Closure of the encapsulation plant and interim stores would be required under the baseline, so any additional effects associated with the disposal option in terms of CO₂ emissions and energy use would likely be minor.</p> <p>In the future, international and national carbon emission targets are likely to be stricter. Indicator sensitivity may therefore increase to medium.</p>	??	Changes in CO ₂ targets / legislation and technology (including vehicle and industrial carbon capture), volume of waste generated and whether this can be reused or recycled.
Coastal Change and Flood Risk (Potential Receptors: Local population and infrastructure in coastal areas and areas at risk of flooding). (Indicators: Environmental Agency Flood Risk Map).					
ST	Expansion of new facilities <ul style="list-style-type: none"> • Potential to affect surface water runoff and filtration rates through soil. This can lead to increased flood risk. • Construction in coastal regions can affect existing coastal defences (natural and man-made) and may provide opportunities to further protect coastlines from erosion. 	–	<p>Construction works could affect hydrology at the site by increasing the presence of hard surfaces. This can increase surface water runoff and restrict drainage. As these risks would be designed-out in line with standard practice, the magnitude of the residual impact on flood risk can be considered low.</p> <p>Sellafield is located in Flood Zone 1, defined as having less than a 1 in 1000 chance of flooding occurring each year. The site has an elevation of 5-50m above sea level and is generally protected from coastal flooding by cliffs, a shingle spit and a railway embankment. Given the very small risk of flooding and existing defences which protect the site from coastal erosion, sensitivity in the short to medium-term is low.</p>	?	The extent of any coastal erosion / sea level rise, any changes to existing coastal defences.
ST - MT	Operation of new facilities	0	Unlikely to be any significant effects in terms of coastal change and flood risk from extended operation of the encapsulation plant and interim stores.	✓	
ST	Closure of existing facilities	0	Given the industrial nature of the site, including the presence of numerous other structures and facilities, it is unlikely that bringing forward the closure programme for THORP and other facilities will have a significant impact in	✓	

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
		terms of reducing flood risk. There is unlikely to be any significant coastal change over this timeframe.			
LT	Closure of future facilities <ul style="list-style-type: none"> Decommissioning may create opportunities to reduce flood risk. 	0	Given that the site is located in Flood Zone 1, the category least at risk of flooding, sensitivity to minor improvements in drainage would be low and the overall impact negligible.	?	See expansion of new facilities (above).
Cultural Heritage (Potential Receptors: Listed buildings, Scheduled Ancient Monuments, Registered Parks and Gardens, Conservation Areas).					
ST	Expansion of new facilities <ul style="list-style-type: none"> Potential to affect cultural and built heritage receptors directly through changes to their setting or indirectly through other environmental effects. 	0	Given the relatively minor additional construction requirements compared to the baseline and the likelihood that construction works would be confined within the site boundary, there are unlikely to be any significant effects upon cultural heritage.	✓	.
ST - MT	Operation of new facilities <ul style="list-style-type: none"> Could affect cultural heritage features through changes in noise and other environmental effects. 	0	Aside from potential movements associated with transporting the encapsulated waste products to a GDF (which will be covered in assessments elsewhere), activities involved in operation would be intra-site, meaning it is unlikely there would be direct impacts upon cultural heritage features. Assuming monitoring is undertaken if required and appropriate mitigation is used to manage impacts from noise etc., residual impacts are unlikely to be significant.	✓	
ST	Closure of existing facilities <ul style="list-style-type: none"> Demolition, transport and other activities can affect the setting of cultural heritage features. Removal of facilities from the landscape could improve the setting of heritage features. 	0	As THORP is scheduled for closure in 2018 under the baseline scenario, the disposal option would bring forward potential impacts on cultural heritage but would not significantly affect their magnitude.	✓	
LT	Closure of future facilities See closure of existing facilities (above).	0	As this option would require only a minor expansion to the encapsulation plant and interim stores which form part of the baseline, and most	✓	

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
		decommissioning works would likely be confined within the site boundary, there are unlikely to be any significant effects upon cultural heritage features.			
Geology and Soils (Potential Receptors: Geodiversity, designated geological sites, high quality land such as that used for agriculture).					
ST - MT	Expansion of new facilities <ul style="list-style-type: none"> Possible adverse effects upon soil quality at the site. Potential for non-radioactive releases to the ground, leading to land contamination within the site boundary. 	–	Impacts of construction on geology and soils would likely be confined within the site boundary. The use of ALARA and BAT principles and other institutional controls would minimise releases. Given the minor extent of construction works required to expand the facilities, impact magnitude would likely be low. Taking into account the industrial nature of the site, which already experiences land contamination in a number of locations, changes to soil and ground quality are likely to be minor and within statutory limits. Receptor sensitivity is therefore considered low.	✓	The extent of construction activities and proximity to areas of existing contamination.
	Expansion of new facilities <ul style="list-style-type: none"> Soil resources would likely be used up during construction and/ or excavation activities. 	–	Given the relatively minor extent of construction activities required to expand the encapsulation plant and interim stores, the magnitude of construction on soil use can be considered low. Some material may be sourced locally or reused from other parts of the site, in which case the impact magnitude could be further reduced. Construction is unlikely to extend beyond the existing site boundary and would most likely take place on brownfield land that is of low sensitivity to impacts.	✓	
ST - MT	Operation of new facilities	0	Provided that appropriate monitoring and established practices such as the use of ALARA and BAT principles are maintained, there are unlikely to be any releases to ground which could lead to significant effects on geology and soil at the site during operation.	✓	
ST	Closure of existing facilities <ul style="list-style-type: none"> Activities such as demolition have the potential to result in ground contamination. 	0	As THORP is scheduled for closure in 2018 under the baseline, disposal would bring forward impacts on geology and soils but would not significantly affect their magnitude.	✓	

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> Decommissioning the encapsulation plant and interim storage facilities could impact soil quality and land contamination at the site. 	<p>–</p> <p>Implementation of this option could increase the scale of facilities requiring decommissioning, however the effect of this in terms of geology and soils both at the site and at the sites where waste arisings are managed would likely be minor. The use of ALARA and BAT principles and other institutional controls would help minimise releases and the spread of contamination.</p> <p>In the future, as the site moves through its decommissioning programme, there may either be worsening or improvement in ground and soil conditions. This could alter the sensitivity of the receptor to effects.</p>	??	Extent of decommissioning activity required (including transport of wastes off-site), potential use of remediation techniques to clean-up land at the site.
<p>Landscape and Visual (Potential Receptors: The local population, cyclists, pedestrians and equestrians using local routes, fauna, tourists and other visitors to the area). (Indicators: The local landscape).</p>				
ST	<p>Expansion of new facilities</p> <ul style="list-style-type: none"> Potential adverse effect on the local landscape from construction of multiple industrial facilities. 	<p>–</p> <p>During the short-term there would be adverse impacts associated with the movement of construction plant and vehicles, and possibly additional transport movements to remove waste from the site. Such activities could have a medium magnitude effect upon the landscape and may adversely affect views from nearby locations.</p> <p>Given the industrial nature of the site and its prominence in the local landscape, sensitivity of the surrounding landscape to further adverse changes can be considered low. Cumulative effects need to be considered</p>	✓	Potential reuse of waste materials would reduce requirement for transport movements. If construction of facilities/ stores were to extend beyond the existing site boundary this could have increased visual impacts.
ST - LT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Once operational, the facilities would be a constant feature of the landscape for many years. Ongoing transport movements associated with transporting the encapsulated products to a disposal facility. 	<p>–</p> <p>Following construction and extending into the long-term there may be adverse landscape and visual effects associated with the presence of the facilities themselves and the ongoing transport of spent fuel to a GDF (covered in assessments elsewhere). Although the facilities would only be slightly larger under this option, disposing of the entire oxides inventory would extend the operation phase, potentially by several years. This could have a medium magnitude landscape and visual impact.</p> <p>Given the industrial nature of the site and its prominence in the local landscape, sensitivity to further adverse changes can be considered low.</p>	?	Decommissioning of other facilities at the site could increase the prominence of the encapsulation plant and interim stores. Location of facilities/ stores.

Time-scale	Risk / Opportunity for Impact	Significance of Impact		Un-certainty	Factors affecting uncertainty
ST	Closure of existing facilities <ul style="list-style-type: none"> • Could create some landscape and visual opportunities. 	0	As THORP is scheduled for closure in 2018 under the baseline, implementation of disposal would bring forward positive landscape and visual impacts. However, given the relatively short timeframes involved, the effect of this is unlikely to be significant.	✓	
LT	Closure of future facilities <ul style="list-style-type: none"> • May create landscape and visual impact opportunities. • Could lead to improved views from nearby locations. 	0	Given the number of other facilities on the site and its prominence in the local landscape, the sensitivity of the indicator is considered low and any improvements would be unlikely to be significant.	?	The extent of expansion required.
Materials and Waste (Potential Receptors: Local, regional and national waste management facilities, local landfills, the Low Level Waste Repository).					
ST	Expansion of new facilities <ul style="list-style-type: none"> • Would require additional volumes of material. Some of this may be sourced from reusable material already on-site and some may be imported from primary sources. 	--	Construction works to expand the encapsulation plant and stores would involve materials such as concrete and steel, which could have an additional low magnitude compared to the baseline scenario. Although there may be some opportunities to reuse existing material on the site, it is likely given the volumes of material which may be required that some would need to be imported. The greater the distances involved in transporting material, the greater the secondary environmental impacts such as changes in air quality are likely to be.	✓	Extent of expansion required. Distances over which material need to be imported, and whether material on-site can be reused.
ST - MT	Operation of new facilities <ul style="list-style-type: none"> • In the baseline, HAL (Highly Active Liquor) a highly radioactive liquid waste stream is generated during spent fuel reprocessing. Implementation of the disposal option would avoid generation of this waste, thereby offering an opportunity. • Some spent oxide fuels that are not suitable or intended for reprocessing will 	---	Compared to the baseline of reprocessing part of the Oxides inventory through existing facilities (i.e. THORP) and disposing of the rest, disposal would require classifying all the material (approximately 7,500 tonnes) as waste. This option therefore generates a substantial volume of packaged waste during operation, constituting a high magnitude negative impact. In the baseline scenario HAL is produced as a liquid waste stream. Whilst the disposal option would generate a greater volume of waste, by avoiding production of HAL, the nature of the waste would make it easier to manage. As there is an established management route in place to manage HAL, i.e. treatment via vitrification, sensitivity to positive impacts of avoiding its	✓	

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	be disposed of as waste under the baseline. The disposal option would increase this amount.			
ST	Closure of existing facilities <ul style="list-style-type: none"> Activities such as demolition and excavation have the potential to generate considerable volumes of waste material. 	<p>As THORP is scheduled for closure in 2018 under the baseline, disposal would bring forward impacts on materials and wastes. This could slightly increase the pressure on waste facilities to manage these waste arisings.</p> <p>Given the considerable volumes of waste material already stored on the site (in 2012 there was estimated to be over 1,700, 75,000 and 4,000 cubic metres of HLW, ILW and LLW respectively), the generation of waste in the volumes that might be expected from closing existing facilities is relatively small. Sensitivity could therefore be considered low. Cumulative impacts need to be considered, as does the capacity of facilities to receive any LLW or VLLW arisings.</p>	✓	
LT	Closure of future facilities <ul style="list-style-type: none"> Potential for generating substantial volumes of ILW, LLW, and non-radioactive waste. 	<p>As disposal would only involve expanding the encapsulation plant and interim stores this may generate some additional waste arisings, resulting in a low magnitude negative impact.</p> <p>Taking into account the success of the UK Strategy for the management of solid Low Level Waste, considerable progress has been made in diverting LLW and VLLW from disposal at the LLWR and similar facilities through reuse, recycling and decontamination. This means that any LLW or VLLW generated from the closure of future facilities is likely to have a suitable waste management route available. Sensitivity is therefore considered low.</p>	?	Capacity of the LLWR and availability of other low level waste disposal facilities, the nature of the waste (i.e. radioactive or non-radioactive), the programme, availability and capacity of a GDF to manage ILW arisings.
Noise				
(Potential Receptors: Local population, residential properties, schools, hospitals and other community facilities).				
ST	Expansion of new facilities <ul style="list-style-type: none"> Potential for increased noise and vibration, particularly from activities such as excavation and piling, and through the transport of plant and 	<p>Impacts would be confined within the site boundary or along site access roads, provided that no piling activities are required. Given existing noise levels at the site, the magnitude of noise impacts would likely be low.</p> <p>Where piling activities are required, noise impacts could extend beyond the site boundary and might be considered medium to high magnitude on a short-</p>	??	The location and extent of construction works, no. of transport movements and the timescale over which

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	construction materials.	<p>term basis.</p> <p>Construction management procedures and design measures could be used to minimise noise and vibration levels, in which case residual impacts would be of low magnitude.</p> <p>As a number of residential properties are located within a few hundred metres of the site and site access road, receptor sensitivity can be considered medium. It is likely this would need to be verified through further assessment.</p>		they occur.
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Potential noise and vibration impacts associated with the processes used to encapsulate the spent oxides fuel, in addition to the intra-site transport from existing stores to the facilities, and potential off-site transport to a GDF. 	<p>0</p> <p>Any noise and vibration impacts associated with extended operation of the new facilities would likely be confined to within the site boundary. The design of the new facilities may also include measures to minimise noise and vibration impacts.</p> <p>Given the timescale over which transport movements are likely to occur and that they will be mostly intra-site (movements associated with transporting wastes to a GDF will be covered in assessments elsewhere) there are unlikely to be any significant noise and vibration impacts during operation.</p>	✓	
ST	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> May include noise-generating activities such as demolition and transport movements associated with plant, equipment and waste. 	<p>0</p> <p>As THORP is scheduled for closure in 2018 under the baseline, implementation of disposal would bring forward noise and vibration impacts but would not significantly affect their magnitude.</p>	✓	
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> Decommissioning activities such as demolition, excavation and transport of plant, equipment and waste may be noise and vibration-generating. 	<p>–</p> <p>Noise and vibration impacts from decommissioning activities can be mitigated through standard construction/ demolition good practice. Any residual impacts would be of low magnitude.</p> <p>Potential receptors, including residents within a few hundred metres of the site and access roads, may have medium sensitivity to noise and vibration impacts from transport movements. This would need to be verified through further assessment</p>	??	The no. of transport movements required. This could be reduced if waste material can be reused on site.
<p>Radiological Discharges (Potential Receptors: The environment, people, flora and fauna).</p>				

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
(Indicators: Discharge rates at the site, extent of controls and existing mitigation in place).				
MT - LT	Operation of new facilities <ul style="list-style-type: none"> Avoiding production of HAL, a high risk by-product of spent fuel reprocessing, may present an opportunity to reduce radiological risk. 	<p style="text-align: center;">+</p> <p>Under the baseline scenario, spent fuel is reprocessed, leading to production of three outputs; plutonium, uranium and HAL. HAL is a radioactive liquid waste stream requiring careful management. In comparison, encapsulation is a relatively low risk process as it does not produce any hazardous by-products. The disposal option could therefore have a low magnitude positive impact compared to the baseline.</p> <p>Due to existing mitigation and controls in place to manage the risk of radiological effects, including the use of ALARA and BAT principles and the fact that there is an established management route in place to manage HAL (i.e. treatment via vitrification) and suitable facilities available to store the plutonium and uranium products, sensitivity is considered low.</p>	?	Delays to the programme of the encapsulation plant could mean the oxides inventory continues to be stored in existing facilities which may be susceptible to degradation. This could create a radiological risk.
ST and LT	Closure of existing and future facilities <ul style="list-style-type: none"> Decommissioning activities such as demolition of facilities have the potential to result in discharges of radioactivity. 	<p style="text-align: center;">0</p> <p>Due to the extensive procedures and controls in place to minimise or avoid discharges of radioactivity during decommissioning, including adherence to ALARA and BAT principles, any impacts associated with closure of existing or future facilities are unlikely to be significant.</p>	✓	
Water Resources and Quality (Potential Receptors: Flora and fauna, people, waterbodies, water abstraction points). (Indicators: Local water quality (EU Water Directive Rating), water abstraction volumes).				
ST	Expansion of new facilities <ul style="list-style-type: none"> Could potentially impact water quality at the site through run-off from roads used by construction plant and vehicles. May require an increase in water consumption which could put strain on water resources. 	<p style="text-align: center;">--</p> <p>Construction would likely take place within the existing site boundary, with appropriate management procedures in place to keep pollutant discharges to a minimum. Given the relatively minor extent of construction works required to expand the encapsulation plant and interim stores, impacts upon water resources and quality would be of low magnitude.</p> <p>Because existing water quality at the site is defined as good (in accordance with the Water Framework Directive), sensitivity to contamination is considered to be medium.</p> <p>The very large volumes of water currently abstracted by the site (in 2012 this was reported as some 6 million cubic metres) suggest that sensitivity to</p>	?	The extent of construction activities would affect the volume of water that needs to be abstracted.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
		<p>further water consumption (likely during construction) may be high.</p>		
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Potential requirement for water abstraction. 	<p>0</p> <p>During operation, there are likely to be minimal requirements for water abstraction. Significant effects on water resources and quality from extending the operation period would therefore be unlikely.</p>	?	Indirect water abstraction and consumption needed to support workers etc.
		<p>+</p> <p>Compared to the baseline, where aqueous processes used in reprocessing operations produce liquid waste streams, the disposal option may have an overall low magnitude positive effect from avoiding these processes.</p> <p>As there are extensive existing controls in place to monitor and minimise discharges to waterbodies during reprocessing, and given the existing status of water quality and resources at the site, sensitivity to impacts is low.</p>	✓	
ST	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> Could increase water abstraction. May increase the risk of pollutant discharges to water receptors. 	<p>0</p> <p>As THORP is scheduled for closure in 2018 under the baseline, disposal would bring forward impacts on water resources and quality but would not significantly affect their magnitude.</p>	✓	
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> There may be substantial requirements for water abstraction and an increased risk of discharges to nearby waterbodies. 	<p>---</p> <p>Taking into account the relatively minor increase in decommissioning activities required compared to the baseline, the magnitude of impacts in terms of contamination and water abstraction would likely be low.</p> <p>Because water quality at the site is good, its sensitivity is considered medium. Provided appropriate measures are put in place during closure activities, this is not anticipated to decline in the medium to long-term, and may improve once operations such as spent fuel reprocessing are complete.</p> <p>Water abstraction involved in closing the future facilities may place further burden on water resources at the site. Water consumption is currently very high and this may continue into the long-term. Sensitivity to increased water abstraction may therefore be considered medium.</p>	??	Changes in water abstraction and consumption at the site, (linked to timescales for decommissioning activities e.g. completion of spent fuel reprocessing operations). Changes in Water Framework Directive classifications.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
SOCIO-ECONOMICS				
Employment (Potential Receptors: Regional and national employment). (Indicators: Employment created / sustained, contribution to employment markets).				
ST	Expansion of new facilities <ul style="list-style-type: none"> Construction of the encapsulation plant and interim stores would create a full range of employment, from construction to highly-skilled and managerial jobs. 	<p style="text-align: center;">+</p> <p>Estimates for jobs associated with encapsulation may range up to around 1,000-1,500 FTE per year for a construction period of 5 years.⁶ Construction is assumed to occur at Sellafield, which is within the Copeland district. Currently 5.5% (1,819 people) of the local population works in construction, suggesting it is an important contributor to local employment markets. Sensitivity is therefore considered medium.</p> <p>The potential increase in construction capacity of between 55 and 82% would constitute a high magnitude impact. However, given that the majority of these jobs would be created under the baseline scenario, the additional employment associated with disposal would constitute a low magnitude impact, making the overall significance minor.</p>	?	No. of facilities to be constructed, potential employment requirements for other national nuclear projects.
ST - MT	Operation of new facilities <ul style="list-style-type: none"> Would create a range of employment opportunities. 	<p style="text-align: center;">+ +</p> <p>Estimates suggest that conditioning via encapsulation could generate in the region of 700 jobs per year.⁶ The current contribution of the “manufacturing” sector (which includes most decommissioning and fuel reprocessing work) to the local employment market in terms of jobs is roughly 10,000. Sensitivity is therefore considered high based on the importance of manufacturing jobs to the local labour market.</p> <p>The increase in employment in this sector would be around 6%, which would constitute a low magnitude impact. Extension of the operational phase, required under this option, would help to maintain these jobs over a longer period, resulting in a moderate positive impact.</p>	?	Proportion of jobs created as new jobs, and the number transferred from other activities in the industry. For example, those involved in reprocessing of Oxide fuel. Duration of the operation phase.

⁶ based on estimates from “Macro-economic study of Nuclear Materials” (ERM on behalf of the NDA, 2008) and estimates provided for analogous facilities.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
ST	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> Disposal of the Oxides inventory would lead to closure of the existing reprocessing plant and stores. Decommissioning has the potential to create employment opportunities. 	<p>THORP currently employees around 800 people.</p> <p>As outlined above, based on the contribution of the “manufacturing” sector to the local labour market, receptor sensitivity is considered high.</p> <p>The potential decrease in employment in this sector due to this option would be around 8%, which is considered a medium magnitude impact.</p> <p>As the Oxide reprocessing facilities are scheduled for closure by 2018 in the baseline, this would be a short-term impact.</p> <p>To decommission the facilities, nuclear civil, construction, engineering and waste management experience may be required. This could create some employment opportunities but it is unlikely to be a significant impact.</p>	<p>✓</p>	<p>The complexity involved in decommissioning the facilities, availability of relevant expertise, no. of jobs supported by existing stores, the transferability of existing jobs to new facilities.</p>
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> Decommissioning of future facilities could result in job losses. 	<p>Eventual closure of the new treatment and storage facilities will likely have a low magnitude negative impact on local employment. As there may be additional need for workers to undertake other activities on the site, some of these jobs may be retained. Sensitivity is therefore considered low.</p>	<p>??</p>	<p>Potential for facilities to be modified to manage other waste streams, additional arisings which need to be managed.</p>
<p>Knowledge and Skills (Potential Receptors: National skill base). (Indicators: Existence and degree of maintenance of skills, anticipated demand for nuclear skills, national nuclear knowledge and capabilities).</p>				
ST - MT	<p>Development of new facilities</p> <ul style="list-style-type: none"> Will likely draw heavily on the local and regional supply of construction, engineering and civils workers. 	<p>Under the disposal option there would be some additional employment generated, including construction and highly-skilled and managerial jobs. It is anticipated a greater proportion of these jobs would be of a relatively lower skill requirement.</p> <p>Given the anticipated demand for nuclear engineering, civil and construction workers between 2017 and 2027 to work on the UK’s new nuclear build projects, disposal of the Oxides inventory could have a negative impact through increasing pressure on the national skill base. This impact might be at least partially mitigated by the transfer of workers from the national workforce to nuclear roles. Sensitivity is therefore considered low.</p>	<p>?</p>	<p>Specific skills required and the availability of such skills in the local or regional area.</p>

Time-scale	Risk / Opportunity for Impact	Significance of Impact		Un-certainty	Factors affecting uncertainty
ST - MT	Operation of new facilities <ul style="list-style-type: none"> • Could create opportunities to develop or enhance knowledge and skills. 	0	<p>As disposal via encapsulation is a well-established technology, this option would maintain existing skills, which would be utilised during operation of the encapsulation plant and stores, but do little to facilitate the development of new skills and improve knowledge.</p> <p>As such skills would be maintained under the baseline, there are unlikely to be any significant effects associated with the disposal option.</p>	✓	Skill development may be time limited. Skills/ knowledge opportunities may be transferable to other waste management technologies/ wastes.
ST	Closure of existing facilities <ul style="list-style-type: none"> • May lead to loss of existing knowledge and skills. • Could create opportunities to enhance decommissioning skills and expertise. 	0	<p>Employment supported by THORP and stores may be lost, leading to an early degradation of knowledge and skills. As the facilities are scheduled for closure in 2018, the impact of this early loss of skills and knowledge would be short-term and minor.</p> <p>Requirements for decommissioning expertise associated with this option are not anticipated to lead to development of new knowledge and skills, as such skills already exist. It may lead to maintenance of such skills which would be a minor positive.</p> <p>The early loss of reprocessing skills and maintenance of decommissioning skills are likely to balance each other out, in which case the overall impact is likely to be neutral.</p>	✓	
LT	Closure of future facilities <ul style="list-style-type: none"> • Once disposal operations are completed and the Oxide fuel inventory has been fully managed, knowledge and skills would be lost. 	+	<p>Given the potential transferability of disposal and storage skills to management of other types of waste, and the importance of such skills nationally, the long-term impact on the national skill base may be minor positive.</p>	?	Potential transferability to other forms of waste.
Education and Training (Potential Receptors: National Skill Base). (Indicators: Likely future skill requirements and contribution to improving the UK skill base).					
ST - MT	Development and operation of new facilities <ul style="list-style-type: none"> • To ensure the correct skills are available to develop and implement disposal, 	0	<p>As the minor education and training benefits that could be achieved from pursuing encapsulation instead of reprocessing (an already well-established process) would be achieved under the baseline, the disposal option is unlikely to have any significant additional effects.</p>	✓	

Time-scale	Risk / Opportunity for Impact	Significance of Impact		Un-certainty	Factors affecting uncertainty
	some education and training may be required. This could create opportunities at regional and national spatial scales.				
ST	Closure of existing facilities	0	It is unlikely that closure of existing facilities used to reprocess the oxides inventory would have any significant impacts in terms of education and training. The skills and knowledge to carry out such decommissioning activities already exist.	?	Extent to which facilities may be contaminated/ require a specialist approach.
LT	Closure of future facilities	0	Following completion of disposal, there will likely be a requirement for additional decommissioning expertise to close the treatment and storage facilities. Given the existence of such knowledge and skills, it is unlikely that there would be any significant requirement for or impact on education and training.	?	The retention and availability of decommissioning skills over time.
Economy (Potential Receptors: Local and Regional economy). (Indicators: £ Gross Value Added).					
ST	Expansion of new facilities <ul style="list-style-type: none"> Expenditure on Oxides disposal could have knock-on impacts on local, regional and national economic development. The nature and extent of benefits it provides is dependent on local supply linkages and the demographics of the area in which money is invested. 	+	Average Gross Value Added (GVA) per employee data for UK regions ⁷ can be multiplied by employment estimates for encapsulation in order to estimate total GVA contributions for the disposal option. The value for West Cumbria is £19,032 per employee. Assuming the majority of employment is either sourced or based locally, this results in a 5 year total of construction GVA of between £95 million and £143 million, or a construction sector increase of 6% - 9% a year. This would constitute a medium magnitude impact. The construction GVA of West Cumbria in 2013 was £333 million, which equated to approximately 5 – 10% of total GVA for West Cumbria. This suggests the sector is of medium sensitivity based on its importance to the regional economy, giving an overall moderate positive impact. However, as disposal would only involve expansion of the encapsulation plant and interim stores which would be constructed under the baseline, the actual	?	Number and extent of facilities requiring construction. Number of workers required and construction timescales.

⁷ Office for National Statistics (2012)

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
		<p>contribution of this option to the local and regional economy is likely to be lower than these figures indicate, making the impact minor.</p> <p>N / A</p> <p>At the national level, economic impacts are tied to the capital spend required to achieve the objectives. As cost has not been considered in this IIA, and will be assessed in an independent assessment elsewhere, national economic impacts have not been assessed.</p>		
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> • Could lead to ongoing economic contributions to the local and regional economy. 	<p>++</p> <p>GVA per employee data can be multiplied by the expected FTE (jobs supported) per year of operation.</p> <p>The value for West Cumbria is £19,032 per employee. Assuming the majority of employment is either sourced or based locally, the result for operational GVA is around £13 million per year for the duration of the operation period, equating to a manufacturing sector increase of approximately 0.8%. This would constitute a low magnitude impact.</p> <p>The manufacturing GVA of West Cumbria in 2013 was £1,666 million (approximately 35 - 40% of total GVA for West Cumbria), suggesting the sector is of high sensitivity based on its importance to the regional economy. Disposing of the entire Oxides inventory would extend the operation phase compared to the baseline.</p>	✓	Duration of the operation phase.
ST	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> • Could be changes to the supply chain involved in reprocessing Oxide spent fuel. • Decommissioning may require nuclear civils, construction and engineering experience, which could lead to economic investment. 	<p>--</p> <p>The Gross Value Added for West Cumbria is £19,032 per employee. Assuming the majority of employment is either sourced or based locally, the result for operational GVA lost due to facility closure is £15.2 million per year, equating to a manufacturing sector decrease of 0.9%. This would constitute a low magnitude impact. As the facilities are scheduled for closure by 2018 this would be a total loss in GVA of approximately £30.5 million.</p> <p>Taking into account the manufacturing GVA of West Cumbria in 2013 the sector is considered to have high sensitivity based on its importance to the regional economy.</p>	?	
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> • Could reduce economic contributions to 	<p>-</p> <p>Eventual closure of the disposal facilities could reduce spending and investment into the local economy. Given the size of the Sellafield site and</p>	??	Potential for encapsulation plant and

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
	the local and regional economy due to loss of employment.		the number of other operations that take place (and are assumed will continue to take place in the long-term), the magnitude of such impacts on the local economy are likely to be low.	interim stores to be used for alternative waste streams.	
Local and National Assets (Potential Receptors: local, regional and national community). (Indicators: Indices of Multiple Deprivation (IMD) ranking for barriers to housing and services, the existence of alternative facilities)					
ST - MT	Expansion and operation of new facilities <ul style="list-style-type: none"> New transport infrastructure may be developed or existing transport infrastructure enhanced to improve access during construction. This could have benefits at a local level. An increase in employment could change local travel patterns and may lead to a reduction in access to community facilities and services. 	0	Future transport of staff, materials and waste would likely be assessed in more detail at a site level, with negative impacts potentially mitigated through improvements in infrastructure. Transport movements are also likely to be spread out over a long period of time, in which case the overall impact of disposal on local assets can be considered neutral. The area around the Sellafield site (Copeland) is ranked within the 10% most deprived areas in relation to "Barriers to housing and services". The receptor could therefore have medium sensitivity to changes. ⁸	??	Potential changes to site access routes would be highly dependent on the location of any potential treatment/ storage facility(ies) and the estimated no. of vehicle movements involved.
ST - LT	Development of new facilities <ul style="list-style-type: none"> At a national scale, development of conditioning and storage facilities may provide opportunities for the management of other waste streams. 	0	Encapsulation is a fairly common method for immobilising radioactive waste pending transfer to a disposal facility. Opportunities may therefore exist as part of the Oxides disposal route to develop and maintain a national asset(s). This would constitute a positive impact of medium magnitude. As an encapsulation plant and interim stores would be developed under the baseline scenario, there are unlikely to be any additional significant effects in terms of national assets from disposal.	✓	
ST	Closure of existing facilities	0	Loss of the oxides reprocessing facility would reduce the capability of the UK to deal with this kind of waste in the future. However, as this facility is scheduled to close by 2018 under the baseline, this impact is not considered	✓	

⁸ This Index includes the indicators of: road distance to a GP surgery, road distance to a general store or supermarket, road distance to a primary school and road distance to a Post Office or sub post office

Time-scale	Risk / Opportunity for Impact	Significance of Impact		Un-certainty	Factors affecting uncertainty
			significant.		
LT	Closure of future facilities	0	No significant impact on existing local and national assets is expected as a result of the closure of future facilities.	?	
HEALTH					
Respiratory and cardiovascular effects associated with changes in air quality					
Cardiovascular health effects, respiratory illnesses and levels of chronic disease can be influenced by poor air quality. Studies have shown that there is a direct association between proximity to busy roads (including those travelled by a large number of heavy vehicles) and respiratory illness. Air quality can also influence levels of physical activity, which in turn can impact cardiovascular conditions and lead to stress. (Potential Receptors: The local population and non-motorised users in the local area, in particular infants, young children, the elderly and people with existing respiratory or cardiovascular conditions such as asthma). (Indicators: hospital admissions and mortality rates linked to cardiovascular illness, national health survey results).					
ST	Expansion of new facilities • Construction works can negatively affect health through changes in air quality from emissions of pollutants such as NO _x , SO ₂ and Particulate Matter.	0	As this option would only require a relatively minor expansion to facilities that would be constructed under the baseline, health impacts from changes in air quality specific to disposal are unlikely to be significant.	?	Extent of facilities to be constructed, capacity of local medical facilities, proximity of residents and other receptors to activities.
ST - MT	Operation of new facilities • May result in dust and some pollutant emissions through the ongoing use of plant and equipment and transport, which can affect health.	0	Although the disposal option would result in the operation phase of the facilities being extended compared to the baseline, pollutant emissions from operational activities are anticipated to be small and continually monitored and mitigated, so any difference is unlikely to result in a significant impact	?	Length of the operation phase, processes used.
ST and LT	Closure of future facilities • Potential to negatively impact health through dust and pollutant emissions from demolition plant and vehicles. • Changes in air quality could also	-	As with construction, effects of closure and demolition are likely to be confined within the site boundary and may be mitigated through the use of good construction and demolition practice. The magnitude of potential health impacts would therefore likely be low. Based on the health profile of Copeland, which has higher than average levels of cardiovascular illness and scored poorly on the most recent national	?	Extent to which recreation and amenity areas would be impacted and how the local population would respond, and the

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
	negatively impact the use of recreation and amenity areas and levels of physical activity.		health survey, sensitivity can be considered medium.	availability of other amenity and recreation areas in the local area.	
<p>Annoyance, sleep disturbance, cardiovascular effects, potential hearing damage and other health effects associated with changes in noise levels</p> <p>Health effects from changes in noise levels can relate to communication, school performance, sleep, aggression and annoyance in addition to cardiovascular effects and potential hearing damage.</p> <p>(Potential Receptors: The local population and non-motorised users of the local area including the road network, in particular infants, young children and the elderly).</p> <p>(Indicators: hospital admissions and mortality rates linked to cardiovascular illness, national health survey results)</p>					
ST	<p>Expansion of new facilities</p> <ul style="list-style-type: none"> • Could cause increased noise and vibration, particularly from activities such as excavation and piling, and through the transport of plant and construction materials. 	–	<p>It is likely that the impacts of construction and transport on noise and vibration would occur only in the short-term and be confined to a local scale (within or near the site boundary). Good construction practice can be used to ensure the magnitude of noise and vibration impacts is low.</p> <p>Noise and vibration impacts which affect the use of recreation and amenity areas and levels of physical activity may have a further negative impact on the health of the local population.</p> <p>Sensitivity of receptors to noise and vibration from traffic movements during construction, particularly those near to the site access road, may be medium.</p>	??	Extent of the construction works required, location of the new facilities, types of equipment and plant used, no. of transport movements and timescale over which they occur.
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> • Increased noise and vibration from operation of plant and stores. 	0	As this option would extend the duration of noise impacts during operation but not significantly increase them, with any impacts confined mainly within the site boundary, no significant effects are anticipated compared to the baseline.	✓	
ST and LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> • Noise and vibration levels can increase as a result of demolition, and have negative impacts on health. 	0	As the new facilities would need to be decommissioned under the baseline, any additional impacts on noise and vibration associated with disposal are unlikely to be significant.	?	Extent of demolition required, equipment and plant used, no. of transport movements.
<p>Effects on physical activity and obesity</p> <p>The UK government recommends that adults, children and young people should aim to be active daily. In addition to formal recreation facilities (e.g. playing fields and leisure centres), high quality walking and cycling infrastructure are increasingly recognised as important for promoting health. The use of recreation areas, local amenities and levels of physical activity undertaken by the local population can be impacted through environmental changes in air quality, noise, visual disturbance and</p>					

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
traffic. (Potential Receptors: The local population, in particular groups who regularly use recreation and amenity areas, including children and users of national cycle routes). (Indicators: Levels of physical activity and obesity, availability of recreational facilities).				
ST	Expansion of new facilities <ul style="list-style-type: none"> Can potentially reduce the attractiveness and usage of recreation and amenity areas through visual disturbance from plant and vehicles, and through changes in traffic volumes and patterns on the local road network. This can lead to changes in levels of physical activity undertaken by the local population.	- As the majority of environmental effects which could influence use of recreational areas and local amenities would be confined within or close to the site boundary, the magnitude of impacts from a health perspective is likely to be low. Copeland has a higher percentage of adults classed as obese (28.3%) and overweight or obese (75.9%) than the England average (23%) and (63.8%) respectively (Active People Survey 2012). Based on the health profile of Copeland and the proximity of recreational receptors (there is both a national and a local cycle route close to the site), sensitivity to impacts from construction may be medium.	??	Extent of the construction required, location of the new facilities, types of equipment and plant required
ST - MT	Operation of new facilities <ul style="list-style-type: none"> A number of environmental effects (e.g. noise, air quality and landscape and visual) could impact the attractiveness of local recreational and amenity areas. 	0 Due to the relatively minor environmental effects anticipated to arise from extended operation of the new encapsulation plant and interim stores, impacts upon local recreational and amenity areas (and subsequently levels of physical activity) are unlikely to be significant.	✓	
ST and LT	Closure of future facilities <ul style="list-style-type: none"> Changes in air quality, noise and visual disturbance associated with demolition and closure works, and transport could reduce use of recreation and amenity areas and levels of physical activity. 	- Decommissioning activities are likely to be confined mainly within the site boundary, but will require careful management through construction/ demolition good practice to ensure that the magnitude of impacts is low. Based on the health profile of Copeland and the proximity of receptors to the site, sensitivity to impacts from works to close existing facilities can be considered medium.	?	Proximity of existing and future facilities to recreational and amenity areas, no. of transport movements required (linked to amount of generated waste).
Health and Safety Effects from Road Traffic Changes Studies have shown that people modify their behaviours in response to increased road traffic. As traffic increases, social networks tend to decrease. This affects people's sense of community and healthy social interaction. Increased traffic can also reduce levels of physical activity by discouraging non-motorised forms of transport such as walking and cycling.				

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
<p>Potential health effects relating to road traffic changes include potential increases in the risk of road accidents, stress levels experienced whilst travelling and reduced levels of social contact. (Potential Receptors: The local population, in particular road users, non-motorised road users and groups who regularly use recreation and amenity areas e.g. children). (Indicators: Accident statistics).</p>				
ST	<p>Expansion of new facilities</p> <ul style="list-style-type: none"> Can result in increased traffic levels due to the movement of plant and vehicles. This has the potential to increase driver stress, the risk of road accidents and exacerbate physical and mental health conditions. 	<p style="text-align: center;">-</p> <p>Impacts on the local road network from transport in the short-term until the facilities are constructed. Vehicle movements would likely be spread out over a considerable length of time, making the magnitude of impact low. Given existing and historic accident figures for the A595, the main road which links to the site access road, sensitivity to traffic changes may be considered medium.</p>	?	<p>No. / timing of transport movements (linked to no. of facilities constructed), cumulative developments, changes in local transport network and travel patterns.</p>
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> There may be a requirement for ongoing transport movements. 	<p style="text-align: center;">0</p> <p>During operation it is anticipated that the majority of transport movements would be intra-site (movements associated with transporting the conditioned wastes to a GDF will be covered in assessments elsewhere). Given the relatively short distances involved and the secure nature of the site (i.e. no public access) it is not anticipated that there would be significant impacts on users of the local transport network.</p>	✓	<p>No. and timing of transport movements.</p>
ST and LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> An increase in transport movements during decommissioning could affect the local road network and has the potential to lead to increased stress, anxiety and risk of road accidents. 	<p style="text-align: center;">0</p> <p>As the majority of transport movements would occur under the baseline, the disposal option is unlikely to significantly alter the magnitude of impacts.</p>	✓	
<p>Health effects relating to changes in the water environment</p> <p>Changes to the water environment can affect drinking water and food supplies such as fish stocks. They can also affect agriculture, direct recreation facilities (e.g. recreational angling, kayaking) and wider recreational resources (e.g. views of water along countryside walks). Loss of such recreational water resources can reduce levels of physical activity, leading to a number of potential health effects. In some cases, water and food contamination can result in short and long-term illnesses. (Potential Receptors: The local population, groups who abstract water from local sources (e.g. for irrigation) and users of recreational water bodies).</p>				

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
(Indicators: Water quality, hospital admissions, physical activity rates).				
ST - MT	<p>Expansion of new facilities</p> <ul style="list-style-type: none"> • Could potentially impact water quality at the site through run-off from roads used by plant and vehicles. • Likely to require an increase in water consumption which may put strain on water resources. 	<p>–</p> <p>Short-term changes to the water environment from construction activities could have health implications if they affect drinking supplies or recreational resources. If a contaminant is long lasting, it could stay within water bodies or water systems for a prolonged period of time.</p> <p>Monitoring and the use of good construction practice would minimise impacts upon the water environment and ensure that any residual health impacts were of low magnitude. Requirements for water abstraction are unlikely to affect recreational use of water resources.</p>	?	Dewatering required as part of construction, piling requirements and depths of excavations (could impact groundwater), type of contaminants and how long lasting they are.
ST - LT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> • Possible requirement for water abstraction and discharges to water bodies. This can lead to health effects associated with water contamination. • Possible opportunities from avoiding risks associated with aqueous processes in the baseline. 	<p>+</p> <p>Although there may be a requirement for water abstraction and a small risk of effects on water quality during operation, compared to the baseline where a number of aqueous processes are used during reprocessing operations which produce liquid waste streams, disposal may have an overall low magnitude positive effect.</p> <p>As there are extensive existing controls in place to monitor and minimise discharges to waterbodies, including the use of ALARA and BAT, and given the absence of water-based recreational activities downstream of the site, sensitivity is considered low.</p>	?	The use of any aqueous processes.
MT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> • Decommissioning has the potential to result in contamination of local water bodies. This could lead to health effects upon the local population and any recreational users of these features. 	<p>–</p> <p>As demolition activities would be confined within the site boundary and such activities would be controlled through construction good practice and monitoring, any residual impacts are likely to be of low magnitude.</p> <p>Given existing good water quality at the site and the non-use of nearby fresh water bodies for recreational purposes, sensitivity to minor contamination which could lead to health effects is low.</p>	?	Changes in water quality at the site over time
<p>Radiological safety related health effects</p> <p>Effects relating to potential radiological exposure could include fear of exposure and the mental health and wellbeing impacts associated with this, as well as direct exposure due to discharges.</p> <p>(Potential Receptors: Local population and in particular children and pregnant women).</p>				

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
(Indicators: Discharge rates at the site, RIFE total reported dosages to the public).					
ST - MT - LT	Operation of new facilities and closure of existing facilities <ul style="list-style-type: none"> Disposal of the Oxides inventory could offer potential radiological opportunities in terms of avoiding the production of Highly Active Liquor (HAL), a high risk by-product of spent fuel reprocessing. 	+	<p>Encapsulation is a relatively low risk process from a radiological perspective. The disposal option could therefore be considered to have a medium magnitude positive impact compared to the baseline.</p> <p>Due to the use of extensive controls (including adherence to the principles of ALARA and BAT), the actual radiological health risk of reprocessing the oxides inventory under the baseline scenario is considered low. Sensitivity to changes is therefore also considered to be low, giving an overall minor positive impact from disposal</p>	✓	
Mental health and Wellbeing effects Changes in employment and income can influence people’s mental health, as can changes in the environment through disturbance and pollution. Further health effects relating to mental health and wellbeing can include depression, anxiety, stress, changes in community cohesion and changes in levels of physical activity. (Potential Receptors: Mental health statistics for local population, visitors, regional population).					
ST	Expansion of new facilities <ul style="list-style-type: none"> Likely to create employment opportunities, which studies have shown can positively influence mental health and wellbeing. 	+	Under the disposal option there would be some additional employment generated during construction. This may have a positive impact on the health and wellbeing of the local population. There may also be added benefits to the local economy which again might positively influence wellbeing and mental health.	??	No. of jobs created, duration of the construction works.
ST	Expansion of new facilities <ul style="list-style-type: none"> May lead to negative impacts on mental health and wellbeing due to the range and extent of environmental effects experienced by the local population. Such health effects might include annoyance, anxiety or stress 	-	Construction can result in a number of adverse environmental effects such as increases in noise and vibration, reduced air quality and landscape and visual impacts. These impacts have the potential to adversely affect the mental health and wellbeing of the local population. It is likely that negative effects upon mental health and wellbeing would be limited to those living in close proximity to the site, and would be of low magnitude once mitigation measures were applied.	??	Extent of environmental impacts, duration of the construction works.

Time-scale	Risk / Opportunity for Impact	Significance of Impact		Un-certainty	Factors affecting uncertainty
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Has the potential to offer socio-economic opportunities which may have positive effects for the mental health of those employed. Possible risk of adverse environmental effects which can influence health through increased stress and anxiety. 	+	Effects on the environment (including through changes in air and water quality, and the local landscape etc.) are likely to be less pronounced during operation than during construction. Transport movements will likely be fewer and emissions from activities and processes are likely to be reduced. Overall, the net effect upon the mental health and wellbeing of the local population during operation may therefore be minor positive because of the employment opportunities created.	??	Socio-economic opportunities available, whether these are made available to local population, environmental impacts and whether they can be mitigated.
ST and LT	<p>Closure of existing and future facilities</p> <ul style="list-style-type: none"> Can lead to negative environmental effects which might affect mental health and wellbeing, as well as negative socio-economic effects from possible job losses. Could have positive mental health and wellbeing effects such as reduced anxiety, stress and improved social cohesion from employment generated to carry out decommissioning and removal of facilities from the landscape. 	-	<p>Loss of jobs could lead to stress, anxiety and other negative effects on the mental health and wellbeing of the local population. If skills/jobs can be transferred, then these impacts may be mitigated. Employment opportunities created to carry out the decommissioning activities would be short-term and unlikely to fully offset these potential job losses.</p> <p>Closure of facilities would offer some landscape and visual opportunities, which might positively affect mental health and wellbeing, but given the industrial nature of the site and the presence of numerous other facilities the impact of this is likely to be minor.</p> <p>Demolition and transporting waste materials off-site can lead to adverse environmental effects which create annoyance, disturbance and stress.</p> <p>Overall, there is likely to be a minor negative effect on mental health and wellbeing associated with closing facilities.</p>	??	No. of jobs created, how many jobs lost/transferred, timescales for closures. Nature and extent of environmental impacts.

3.2.3 Extend Reprocessing – Description of Option

Option	Extend reprocessing capability, building major new support plants (Extend Reprocessing)
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Option	Extend reprocessing capability, building major new support plants (Extend Reprocessing)	
Site	Sellafield	
Description	<p>Oxide fuel is used in Advanced Gas-Cooled Reactors (AGR) operated by EDF Energy in the UK, and in Light Water Reactors (LWR) operated by numerous utilities throughout the world. Spent oxide fuel that has been irradiated in reactors is currently reprocessed in Thermal Oxide Reprocessing Plant (THORP) at Sellafield which started operation in 1994.</p> <p>Reprocessing of spent fuel in THORP provides uranium and plutonium products that can be reused in new nuclear fuel. THORP was expected to complete existing reprocessing contracts by 2010. However, due to operational difficulties both in THORP and in downstream support plant this has not been possible. THORP is now expected to complete reprocessing operations in 2018.</p> <p>In this option, reprocessing operations at THORP would continue in line with existing contractual arrangements. Any fuel currently in storage outside of this contracted amount, along with any future arisings from the AGR reactor fleet, would be reprocessed using a new plant. Interim storage would be required until the new reprocessing plant became available.</p>	
Details/ Activities	<p>Construction of new facilities This option would involve building additional storage capacity for oxide spent fuel, managing fuels more susceptible to corrosion during storage and construction of a new reprocessing plant and supporting infrastructure. This supporting infrastructure could include stores to manage the uranium and plutonium products of reprocessing, as well as a potential vitrification plant to treat HAL (Highly Active Liquor).</p> <p>Operation of new facilities THORP would continue to be operated until closure in 2018. The new reprocessing plant would likely be operational for a number of decades, depending on the rate at which the spent fuel can be reprocessed. It is broadly assumed that the technology would be the same as that currently used in THORP, although there may be some opportunities to refine the technology/ plant design.</p>	<p>Closure of existing and future facilities As THORP is scheduled to be closed in 2018, implementation of this option would not change the closure programme or result in any effects from closure of existing facilities. There would however be an eventual requirement to close the new reprocessing plant and supporting facilities once the inventory had been fully reprocessed.</p> <p>Maintenance of existing facilities Under this option THORP would still be closed as planned in 2018. There would be a requirement to maintain existing storage facilities until a new reprocessing plant became available, however such a requirement would also form part of the baseline. There are therefore unlikely to be any significant effects from maintaining existing facilities associated with this option.</p>

3.2.4 Extend Reprocessing – Assessment

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
ENVIRONMENT				
Air Quality				
(Potential receptors: Residents neighbouring the site, nearby ecological features (incl. flora and fauna), non-motorised users of the local transport network, e.g. pedestrians, equestrians and cyclists).				
(Indicators: Local air quality (concentrations of relevant pollutants: NO _x , PM ₁₀ and SO ₂)).				
ST - MT	Construction of new facilities <ul style="list-style-type: none"> • Generation of dust • Emissions of pollutants such as NO_x, SO₂ and PM. This can be directly through the use of plant or indirectly through the transport of materials and waste.	-	Vehicle movements required for construction would likely be spread out over a sufficient period of time for the effect upon local air quality to be insignificant. Standard construction good practice and additional mitigation measures can reduce dust generation (which usually has a short range) and ensure that any impacts upon air quality are of low magnitude. Existing air quality at the site is well within national Air Quality Objectives so indicator sensitivity is low.	✓ No. of facilities requiring construction, the timing of construction (including seasonal works which may influence the dispersal of pollutant emissions).
ST - MT	Operation of new facilities <ul style="list-style-type: none"> • Emissions of pollutants through use of equipment and plant. 	-	Given the nature of the reprocessing technology and controls in place to manage pollutant emissions, magnitude can be considered to be low. Existing air quality at the site is well within Air Quality Objectives so indicator sensitivity is low.	✓ Duration of the operational phase.
LT	Closure of future facilities <ul style="list-style-type: none"> • During decommissioning there may be effects on air quality associated with activities such as demolition and the transport of plant, equipment and waste. 	-	Although multiple facilities would be closed, air quality impacts from transport are unlikely to be significant as movements would be spread out over a sufficient period of time. Impacts from generation of dust and other air pollutants would be mitigated through standard construction good practice, so residual impacts upon local air quality would be of low magnitude. Air quality at the site is not anticipated to significantly worsen in the long-term, so indicator sensitivity would remain low.	? See construction of new facilities (above).

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
Biodiversity, Flora and Fauna (Potential Receptors: SSSIs, SACs, Ramsar, Ancient Woodland, National and Local Nature Reserves, Local Wildlife Sites).					
ST - LT	Construction of new facilities <ul style="list-style-type: none"> Possible land-take from designated or non-designated sites of value for nature conservation. There could be direct impacts through severance from or destruction to habitats, and/ or declines in populations of species. Effects on ecological receptors from disturbance or pollution-generating activities (air, noise, water etc.) 	–	<p>The significance of potential impacts on biodiversity, flora and fauna is difficult to determine based on the information currently available.</p> <p>If assumptions are made that: a) an assessment of receptor sensitivity is undertaken prior to any works commencing, b) construction best practice would be followed, c) any sensitive or designated species relocated if appropriate and d) there would be no land take from adjacent or nearby designated or non-designated sites, the magnitude of impacts would likely be low even if the receptor was of medium sensitivity.</p>	??	No. and scale of facilities requiring construction, characteristics of nearby sites of value for nature conservation (both designation and non-designated) and other ecological receptors, no. of transport movements involved and the time over which they occur.
ST - MT	Operation of new facilities <ul style="list-style-type: none"> Pollution in the form of noise and vibration, air quality, water and landscape and visual impacts has the potential to impact ecological receptors. 	0	Given the distances from the site to the nearest receptors it is unlikely that there would be any significant effects upon biodiversity, flora and fauna during operation. This would need to be verified through further assessment.	✓	
LT	Closure of future facilities <ul style="list-style-type: none"> Possible effects on ecological receptors from disturbance, pollutant-generating activities such as demolition and transport. 	–	<p>The significance of potential impacts on biodiversity, flora and fauna is difficult to determine based on the information currently available, as the sensitivity of receptors will vary from case to case.</p> <p>If assumptions outlined above are made the magnitude of impacts would likely be low even if the receptor was of medium sensitivity.</p>	??	See construction of new facilities (above).
Climate Change and Energy (Potential Receptors: The atmosphere, the oceans, flora and fauna, soils, people). (Indicators: Industrial process sector greenhouse gas emissions and sector contribution to total UK emissions).					
ST – MT	Construction of new facilities <ul style="list-style-type: none"> Generation of CO₂ emissions 	--	Taking into account the extent of construction that is likely to be required and the volumes of material involved in building a reprocessing plant and supporting infrastructure, the magnitude of impact in terms of CO ₂ emissions	?	Embodied carbon of materials used, complexity/ no. of

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	<ul style="list-style-type: none"> Use of energy and materials, which could have further implications in terms of embodied carbon. <p>The impact of increased CO₂ emissions may continue beyond the end of construction.</p>	<p>generated may be high in the short-term.</p> <p>Decommissioning and the management of radioactive waste fall under the 'industrial processes' sector for the purpose of UK greenhouse gas emissions reporting. This is defined as 'emissions from industry except for those associated with fuel combustion (for example, emissions from cement manufacture)'.⁹</p> <p>Given the overall steady decline in CO₂ emissions in the industrial process sector between 1990 and 2014, and the relatively modest contribution of the sector to UK emissions, indicator sensitivity is considered low.</p>		facilities (may affect construction programmes)
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Impacts on climate change and energy use from use of plant and equipment. 	<p>--</p> <p>The facilities may use substantial amounts of energy and generate CO₂ emissions over a period of many years, making the potential impact of high magnitude. As the impact would likely be small in the context of industrial process sector emissions as a whole, indicator sensitivity is low.</p>	??	Contribution of the facilities to industrial process sector CO ₂ emissions, changes in sector targets.
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> CO₂ emission-generating activities such as demolition and transport of plant, equipment and waste. Would require energy use. 	<p>---</p> <p>Closing the reprocessing plant and supporting infrastructure could have a high magnitude impact in terms of CO₂ emissions and energy use, particularly if wastes produced are transported off-site for disposal.</p> <p>In the future, international and national carbon emission targets are likely to be stricter. Indicator sensitivity may therefore increase to medium.</p>	??	Changes in CO ₂ targets / legislation and technology, volume of waste generated and whether this can be reused or recycled.
<p>Coastal Change and Flood Risk (Potential Receptors: Local population and infrastructure in coastal areas and areas at risk of flooding). (Indicators: Environmental Agency Flood Risk Map).</p>				
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Potential to affect surface water runoff and filtration rates through soil. This can lead to increased flood risk. Construction in coastal regions can 	<p>-</p> <p>Construction works could affect hydrology at the site by increasing the presence of hard surfaces. This can increase surface water runoff and restrict drainage. As these risks would be designed-out in line with standard practice, the magnitude of the residual impact on flood risk can be considered low.</p> <p>Sellafield is located in Flood Zone 1, defined as having less than a 1 in 1000</p>	?	The extent of any coastal erosion / sea level rise, any changes to existing coastal defences.

⁹ <https://www.gov.uk/government/statistics/provisional-uk-greenhouse-gas-emissions-national-statistics-2014>

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
	affect existing coastal defences (natural and man-made) and may provide opportunities to further protect coastlines from erosion.		chance of flooding occurring each year. The site has an elevation of 5-50m above sea level and is generally protected from coastal flooding by cliffs, a shingle spit and a railway embankment. Given the very small risk of flooding and existing defences which protect the site from coastal erosion, sensitivity in the short to medium-term is low.		
ST - MT	Operation of new facilities	0	Unlikely to be any significant effects in terms of coastal change and flood risk from operation of the reprocessing plant and supporting infrastructure.	✓	
LT	Closure of future facilities • Decommissioning may create opportunities to reduce flood risk.	0	Given that the site is located in Flood Zone 1, the category least at risk of flooding, sensitivity to minor improvements in drainage would be low and the overall impact negligible.	?	See construction of new facilities (above).
Cultural Heritage (Potential Receptors: Listed buildings, Scheduled Ancient Monuments, Registered Parks and Gardens, Conservation Areas).					
ST	Construction of new facilities • Potential to affect cultural and built heritage receptors directly through changes to their setting or indirectly through other environmental effects.	-	Construction works likely to be confined within the site boundary. Direct impacts through damage or degradation of buildings/ structures would therefore be unlikely. This could change if land beyond the existing boundary was required. Construction activities may also generate vibration and noise, which may have an impact on nearby heritage features. Assuming appropriate mitigation is put in place, any residual impacts would be of low magnitude. Although the sensitivity of receptors cannot be determined based on the information currently available, there are several heritage features within a few hundred meters of the site. Even if these receptors were determined to be of medium sensitivity, assuming appropriate mitigation is in place the overall impact would likely be of minor significance.	??	This is a very site-specific consideration which would depend on the proximity of receptors to the site and activities, and the sensitivity of the receptors themselves, including whether they are statutorily designated.
ST - MT	Operation of new facilities • Could affect cultural heritage features through changes in noise and other environmental effects.	0	Aside from potential movements associated with transporting vitrified HAL waste products to a GDF (which will be covered in assessments elsewhere), activities involved in operation would be intra-site, meaning it is unlikely there would be direct impacts upon cultural heritage features. Assuming monitoring is undertaken if required and appropriate mitigation is used to manage	✓	

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
		impacts from noise etc., residual impacts are unlikely to be significant.		
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> Demolition, transport and other activities involved in closing facilities can affect the setting of cultural heritage features. Removal of facilities from the landscape could improve the setting of heritage features. 	<p>–</p> <p>Decommissioning works would likely be confined within the site boundary, making direct impacts through damage or degradation of buildings/ structures unlikely. Activities such as demolition generate vibration and noise, which may have an impact on nearby heritage features. Assuming appropriate mitigation is put in place, any residual impacts would be of low magnitude.</p> <p>Although the sensitivity of receptors cannot be determined based on the information currently available, there are several heritage features within a few hundred meters of the site. Even if these receptors were determined to be of medium sensitivity, assuming appropriate mitigation is in place, the overall impact would likely be of minor significance</p> <p>In the long-term, the setting of heritage features could be beneficially affected through the removal of features that act as detractors in the environment. However, given the presence of many other industrial facilities at the site, such impacts are unlikely to be significant.</p>	??	See construction of new facilities (above).
<p>Geology and Soils (Potential Receptors: Geodiversity, designated geological sites, high quality land such as that used for agriculture).</p>				
ST - MT	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Possible adverse effects upon soil quality at the site Potential for non-radioactive releases to the ground, leading to land contamination within the site boundary. 	<p>--</p> <p>Impacts of construction on geology and soils would likely be confined within the site boundary. The use of ALARA and BAT principles and other institutional controls would minimise releases. Given the extent of construction works that may be required, the magnitude of impacts could be high.</p> <p>Taking into account the industrial nature of the site, which already experiences land contamination in multiple locations, any changes to soil and ground quality would be minor and within statutory limits. Receptor sensitivity is therefore considered low. Cumulative effects should be considered.</p>	✓	The extent of construction activities and proximity to areas of existing contamination.
	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Soil resources would likely be used up during construction and/ or excavation 	<p>--</p> <p>Given the potential construction activities required, the magnitude of impacts on soil use can be considered high. Some material may be sourced locally or reused from other parts of the site, in which case the magnitude of the impact</p>	✓	

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	activities.	could be reduced. Construction is unlikely to extend beyond the existing site boundary and would most likely take place on brownfield land that is of low sensitivity to impacts.		
ST - MT	Operation of new facilities	0 Provided that appropriate monitoring and established practices such as the use of ALARA and BAT principles are maintained, there are unlikely to be any releases to ground which could lead to significant effects on geology and soil at the site during operation.	✓	
LT	Closure of future facilities • Decommissioning the new reprocessing plant and supporting facilities could impact soil quality and land contamination at the site.	-- During decommissioning there may be potential for adverse effects upon geology and soils at the site and at the sites where waste arisings are managed. The use of ALARA and BAT principles and other institutional controls would help to minimise releases and the spread of contamination. Given the potential extent of decommissioning works required, impact magnitude could be medium. In the future, as the site moves through its decommissioning programme, there may either be worsening or improvement in ground and soil conditions at the site. This could alter the sensitivity of the receptor to effects.	??	Extent of decommissioning activity required (including transport of wastes off-site), potential use of remediation techniques to clean-up land at the site.
Landscape and Visual (Potential Receptors: The local population, cyclists, pedestrians and equestrians using local routes, fauna, tourists and other visitors to the area). (Indicators: The local landscape).				
ST	Construction of new facilities • Potential adverse effect on the local landscape from construction of multiple industrial facilities.	- During the short-term there would be adverse impacts associated with the movement of construction plant and vehicles, and possibly additional transport movements to remove waste from the site. Such activities could have a medium magnitude effect upon the landscape and may adversely affect views from nearby locations. Given the industrial nature of the site and its prominence in the local landscape, sensitivity of the surrounding landscape to further adverse changes can be considered low. Cumulative effects need to be considered	✓	Potential reuse of waste materials would reduce requirement for transport movements. If construction of facilities/stores were to extend beyond the existing site boundary this could have increased visual impacts.

Time-scale	Risk / Opportunity for Impact	Significance of Impact		Un-certainty	Factors affecting uncertainty
ST - LT	Operation of new facilities <ul style="list-style-type: none"> Once operational, the facilities would be a constant feature of the landscape for many years. 	--	<p>Following construction and extending into the long-term there may be adverse landscape and visual effects associated with the presence of the facilities themselves. As multiple facilities may be required, the magnitude of impacts could be high.</p> <p>Given the industrial nature of the site and its existing prominence in the local landscape, sensitivity is considered low.</p>	?	Decommissioning of other facilities could increase the prominence of the reprocessing plant and supporting infrastructure. Location of facilities/ stores.
LT	Closure of future facilities <ul style="list-style-type: none"> May create landscape and visual impact opportunities Could lead to improved views from nearby locations. 	0	Given the number of other facilities on the site and its prominence in the local landscape, the sensitivity of the indicator is considered low and any improvements would be unlikely to be significant.	?	The number and scale of other facilities on the site.
Materials and Waste (Potential Receptors: Local, regional and national waste management facilities, local landfills, the Low Level Waste Repository).					
ST	Construction of new facilities <ul style="list-style-type: none"> Would likely require substantial volumes of material. Some of this may be sourced from reusable material already on-site and some may be imported from primary sources. 	---	<p>Although reprocessing is a relatively well-established technology, given the potential scale of the facilities to be constructed, which would require substantial volumes of materials such as concrete and steel, material impacts of this option may have a high magnitude.</p> <p>Although there may be some opportunities to reuse existing material on the site, it is likely given the volumes of material required that some would need to be imported. The greater the distances involved in transporting material, the greater the secondary environmental impacts such as changes in air quality are likely to be.</p>	✓	Complexity/ design of facilities (likely to alter material requirements). Distances over which material need to be imported, and whether material on-site can be reused.
ST - MT	Operation of new facilities <ul style="list-style-type: none"> Reprocessing may offer some opportunities to avoid the generation of waste compared to the baseline. Reprocessing would produce plutonium, uranium and Highly Active Liquor (HAL). 	--	Compared to the baseline, in which part of the Oxides inventory would be reprocessed through existing facilities (i.e. THORP) and part would be disposed of as waste, under this option none of the inventory would be classified as waste. This would avoid generation of some 3 to 4,000 tonnes. However, HAL would be produced in considerable volumes. On balance, given the high risk nature of HAL, this option may result in a high magnitude	✓	

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	Whilst plutonium and uranium are not currently considered wastes, the HAL would require careful treatment and management.	negative impact from a materials and waste perspective. Due to the fact that there is an established management route in place to manage HAL, i.e. treatment via vitrification, sensitivity to impacts from generating additional HAL is considered low.		
LT	Closure of future facilities <ul style="list-style-type: none"> Potential to generate substantial volumes of Intermediate Level Waste (ILW), Low Level Waste (LLW), and non-radioactive waste. 	-- In the long-term, closure of the new facilities would generate waste. Given the scale of facilities to be constructed and the risk material will become contaminated with radiation, the magnitude of impacts could be high. Taking into account the success of the UK Strategy for the management of solid Low Level Waste, considerable progress has been made in diverting LLW and VLLW from disposal at the LLWR and similar facilities through reuse, recycling and decontamination. This means that any LLW or VLLW generated from the closure of future facilities is likely to have a suitable waste management route available. Sensitivity is therefore considered low.	?	Capacity of the LLWR and availability of other Low Level Waste disposal facilities, the nature of the waste (i.e. radioactive or non-radioactive), the programme, availability and capacity of a GDF to manage ILW arisings.
Noise				
(Potential Receptors: Local population, residential properties, schools, hospitals and other community facilities).				
ST	Construction of new facilities <ul style="list-style-type: none"> Potential for increased noise and vibration, particularly from activities such as excavation and piling, and through the transport of plant and construction materials. 	- Impacts would be confined within the site boundary or along site access roads, provided that no piling activities are required. Given existing noise levels at the site, the magnitude of noise impacts would likely be low. Where piling activities are required, noise impacts could extend beyond the site boundary and might be considered medium to high magnitude on a short-term basis. Construction management procedures and design measures could be used to minimise noise and vibration levels, in which case residual impacts would be of low magnitude. Given that a number of residential properties are located within a few hundred metres of the site and site access road, receptor sensitivity can be considered medium. It is likely that this would need to be verified through further assessment.	??	The location and extent of construction works, no. of transport movements and the timescale over which they occur.

Time-scale	Risk / Opportunity for Impact	Significance of Impact		Un-certainty	Factors affecting uncertainty
ST - MT	Operation of new facilities <ul style="list-style-type: none"> Potential noise and vibration impacts associated with reprocessing. Noise from intra-site transport of the material from existing stores to the facilities. 	0	<p>Any noise and vibration impacts associated with operation of the new facilities would likely be confined within the site boundary. The design of the new facilities may also include measures to minimise noise and vibration impacts.</p> <p>Given the timescale over which transport movements are likely to occur and the fact that they will be mostly intra-site there are unlikely to be any significant noise and vibration impacts during operation.</p>	✓	
LT	Closure of future facilities <ul style="list-style-type: none"> Activities such as demolition, excavation and transport of plant, equipment and waste may be noise and vibration-generating. 	-	<p>Although considerable decommissioning activities may be required, noise and vibration impacts from such activities can be mitigated through standard construction/ demolition good practice. Any residual impacts would be of low magnitude.</p> <p>Potential receptors, including residents within a few hundred metres of the site and access roads, may have medium sensitivity to noise and vibration impacts from transport movements. This would need to be verified through further assessment.</p>	??	The no. of transport movements required. This could be reduced if waste material can be reused on site.
Radiological Discharges (Potential Receptors: The environment, people, flora and fauna). (Indicators: Discharge rates at the site, extent of controls and existing mitigation in place).					
MT - LT	Operation of new facilities <ul style="list-style-type: none"> Reprocessing converts spent oxide fuels into a more secure form, thereby avoiding risks associated with ongoing storage. It also results in production of uranium, plutonium and Highly Active Liquor (HAL), a high risk by-product of spent fuel reprocessing. 	--	<p>Under this option the entire inventory of spent oxides fuel would be reprocessed, leading to production of three outputs; plutonium, uranium and HAL. HAL is a high risk radioactive liquid waste stream requiring careful management. This option to extend reprocessing operations may therefore have a high magnitude negative impact in terms of radiological discharges.</p> <p>Due to existing mitigation and controls in place to manage the risk of radiological effects, including the use of ALARA and BAT principles and the fact that there is an established management route in place to manage HAL (i.e. treatment via vitrification), as well as suitable facilities available to store the plutonium and uranium products, sensitivity is considered low.</p>	?	Delays to the programme of the reprocessing plant could mean the oxides inventory continues to be stored in existing facilities which may be susceptible to degradation. This could create a radiological risk.
ST and	Closure of future facilities <ul style="list-style-type: none"> Decommissioning activities such as 	0	Due to the extensive procedures and controls in place to minimise or avoid discharges of radioactivity during decommissioning, including adherence to	✓	

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
LT	demolition of facilities have the potential to result in discharges of radioactivity.	ALARA and BAT principles, any impacts associated with closure of future facilities are unlikely to be significant.		
Water Resources and Quality (Potential Receptors: Flora and fauna, people, waterbodies, water abstraction points). (Indicators: Local water quality (EU Water Directive Rating), water abstraction volumes).				
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> • Could potentially impact water quality at the site through run-off from roads used by construction plant and vehicles. • May require an increase in water consumption which could put strain on water resources. 	<p>Construction would likely take place within the existing site boundary, with appropriate management procedures in place to keep pollutant discharges to a minimum. Water abstraction may be required, which could result in a medium magnitude adverse impact on water resources.</p> <p>Because existing water quality at the site is defined as good (in accordance with the Water Framework Directive), sensitivity to contamination is considered to be medium.</p> <p>The very large volumes of water currently abstracted by the site (in 2012 this was reported as some 6 million cubic metres) suggest that sensitivity to further water consumption (likely during construction) may be high.</p>	?	The extent of construction activities would affect the volume of water that needs to be abstracted.
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> • Potential requirement for water abstraction. 	<p>During operation there may be a requirement for water abstraction associated with reprocessing, as well as risks of discharges to water bodies from the use of aqueous processes. Assuming existing controls in place to monitor and minimise discharges to waterbodies during reprocessing operations are maintained, residual impacts would likely be of low magnitude.</p> <p>Given the existing status of water quality at the site, sensitivity to impacts on water quality is considered medium. Due to current high volumes of water abstraction, sensitivity to impacts on water resources may be high.</p>	?	Extent of direct water abstraction needed for reprocessing and indirect water abstraction needed to support workers etc.
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> • There may be substantial requirements for water abstraction and an increased risk of discharges to nearby waterbodies from decommissioning activities. 	<p>Taking into account the potential extent of decommissioning activities required, impact magnitude in terms of contamination and water abstraction may be high.</p> <p>Because water quality at the site is considered to be good, its sensitivity to effects is considered medium. This is not anticipated to decline in the medium to long-term, and may improve once operations such as spent fuel</p>	??	Changes in water abstraction and consumption at the site, (linked to timescales for decommissioning activities e.g. completion of spent fuel

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
		reprocessing are complete. Water abstraction involved in closing future facilities may place an additional burden on water resources at the site. Water consumption is currently very high and this may continue into the long-term. Sensitivity to increased water abstraction may therefore be considered medium.		reprocessing operations). Changes in Water Framework Directive classifications.	
SOCIO-ECONOMICS					
Employment (Potential Receptors: Regional and national employment). (Indicators: Employment created / sustained, contribution to employment markets).					
ST	Construction of new facilities <ul style="list-style-type: none"> Construction of the reprocessing plant and supporting infrastructure would create a full range of employment generated, from construction to highly-skilled and managerial jobs. 	+++	Estimates for jobs associated with reprocessing may range up to around 1,000-2,000 FTE per year for a construction period of 5 years. ¹⁰ Construction is assumed to occur at Sellafield, which is within the Copeland district. Currently 5.5% (1,819 people) of the local population works in construction, suggesting it is an important contributor to local employment markets. Sensitivity is therefore considered medium. The potential increase in construction capacity of approximately 55% - 110% per year would constitute a high magnitude impact. This does not include the additional jobs that would be created to construct supporting infrastructure such as a potential vitrification plant to manage HAL, a by-product of spent fuel reprocessing.	?	Number of facilities to be constructed, potential employment requirements for other national nuclear projects.
ST - MT	Operation of new facilities <ul style="list-style-type: none"> Would create a range of employment opportunities. 	++	Estimates suggest that reprocessing could generate in the region of 200-1000 jobs per year. ¹⁰ The existing contribution of the "manufacturing" sector (which includes most decommissioning and fuel reprocessing work) to the local employment market in terms of jobs is roughly 10,000. Sensitivity is therefore considered high based on the importance of manufacturing jobs to the local labour market. The increase in employment in this sector would be around 2 - 10%, which	?	Proportion of jobs created as new jobs, and the number transferred from other activities in the industry. For example, those involved in existing reprocessing of Oxide fuel.

¹⁰ based on estimates from "Macro-economic study of Nuclear Materials" (ERM on behalf of the NDA, 2008) and estimates provided for analogous facilities.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
LT	Closure of future facilities <ul style="list-style-type: none"> Decommissioning of future facilities could result in job losses. 	<p>–</p> <p>Eventual closure of the new reprocessing plant and supporting facilities will likely have a low magnitude negative impact on local employment. As there may be additional need for workers on the site, some jobs may be retained. Sensitivity is therefore considered low.</p>	?	Potential for facilities to be modified to manage other waste streams.
Knowledge and Skills (Potential Receptors: National skill base). (Indicators: Existence and degree of maintenance of skills, anticipated demand for nuclear skills, national nuclear knowledge and capabilities).				
ST - MT	Development of new facilities <ul style="list-style-type: none"> Will likely draw heavily on the local and regional supply of construction, engineering and civils workers. 	<p>+</p> <p>Under the extended reprocessing option there would be a full range of employment generated, from construction to highly-skilled and managerial jobs. The greater proportion of these jobs would likely be of a relatively lower skill requirement. Opportunities may exist to improve on previous designs for the reprocessing plant, which could have a positive impact in terms of knowledge and skills.</p> <p>Given the anticipated demand for nuclear engineering, civil and construction workers between 2017 and 2027 to work on the UK's new nuclear build projects, reprocessing the oxides inventory could have a negative impact through increasing pressure on the national skill base. This impact might be at least partially mitigated by the transfer of workers from the national workforce to nuclear roles. Sensitivity is therefore considered low.</p>	?	Specific skills required and the availability of such skills in the local or regional area.
ST - MT	Operation of new facilities <ul style="list-style-type: none"> Although reprocessing is relatively well-established there may be opportunities to refine the technology. Could help to advance knowledge and skills in the management of reprocessing products such as HAL, 	<p>+</p> <p>Extended reprocessing would help maintain existing skills, which would be utilised during operation of the new plant and supporting infrastructure, and may facilitate some development of new skills and improved knowledge. This would constitute a low magnitude positive impact.</p> <p>Due to the importance of this field (radioactive waste management) to the region and nationally, sensitivity is considered medium.</p>	?	Skill development may be time limited. Skills/ knowledge opportunities may be transferable to other waste management technologies/ waste types.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	uranium and plutonium.			
LT	Closure of future facilities <ul style="list-style-type: none"> Once reprocessing operations are completed, knowledge and skills would be lost. 	+	Given the potential transferability of spent fuel storage and reprocessing skills to management of other types of waste and radioactive material, and the importance of such skills nationally, the long-term impact on the national skill base in terms of available knowledge and skills may be minor positive.	? Potential transferability to other forms of waste/ radioactive material.
Education and Training (Potential Receptors: National Skill Base). (Indicators: Likely future skill requirements and contribution to improving the UK skill base).				
ST - MT	Development and operation of new facilities <ul style="list-style-type: none"> To ensure the correct skills are available to develop and implement reprocessing, some education and training may be required. This could create opportunities at regional and national spatial scales. 	+	If reprocessing operations are extended there may be some limited education and training opportunities created, however education and training related to disposal technologies such as encapsulation, which would occur under the baseline, would be lost. Overall there may be a minor positive impact from reprocessing the oxides inventory, which would likely occur in the short to medium-term during construction and operation, with benefits reducing following this period.	✓
LT	Closure of future facilities	0	Following completion of reprocessing, there will likely be a requirement for additional decommissioning expertise in order to close the reprocessing plant and supporting facilities. Given the existence of such knowledge and skills, it is unlikely there would be any significant requirement for or impact on education and training.	? The retention and availability of decommissioning skills over time.
Economy (Potential Receptors: Local and Regional economy). (Indicators: £ Gross Value Added).				
ST	Construction of new facilities <ul style="list-style-type: none"> Expenditure on oxides reprocessing could have knock-on impacts on local, 	+++	Average Gross Value Added (GVA) per employee data for UK regions ¹¹ can be multiplied by employment estimates for reprocessing in order to estimate total GVA contributions for this option.	? No. and extent of facilities requiring construction. Number of

¹¹ Office for National Statistics (2012)

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	<p>regional and national economic development.</p> <p>The nature and extent of benefits it provides is dependent on local supply linkages and the demographics of the area in which money is invested.</p>	<p>The value for West Cumbria is £19,032 per employee. Assuming the majority of employment is either sourced or based locally, this results in a 5 year total of construction GVA of between £95 million and £190 million, or a construction sector increase of approximately 6 - 12% a year. This would constitute a medium to high magnitude impact.</p> <p>The construction GVA of West Cumbria in 2013 was £333 million, which equated to approximately 5 – 10% of total GVA for West Cumbria. This suggests the sector is of medium sensitivity based on its importance to the regional economy, giving an overall major positive impact.</p>		workers required and construction timescales.
		N / A		N/A
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> • Could lead to ongoing economic contributions to the local and regional economy. 	<p>GVA per employee data can be multiplied by the expected FTE (jobs supported) per year of operation.</p> <p>The value for West Cumbria is £19,032 per employee. Assuming the majority of employment is either sourced or based locally, the result for operational GVA is between £3.8 million and £19 million per year for the duration of the operation period, equating to a manufacturing sector increase of approximately 0.2% to 2.3%. This would constitute a low magnitude impact.</p> <p>The manufacturing GVA of West Cumbria in 2013 was £1,666 million, (approximately 35 - 40% of total GVA for West Cumbria), suggesting the sector is of high sensitivity based on its importance to the regional economy.</p>	✓	
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> • Could reduce economic contributions to the local and regional economy due to loss of employment. 	-		Potential for facilities to be reused or repurposed.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
Local and National Assets (Potential Receptors: local, regional and national community). (Indicators: Indices of Multiple Deprivation (IMD) ranking for barriers to housing and services, the existence of alternative facilities)				
ST - MT	Construction and operation of new facilities <ul style="list-style-type: none"> New transport infrastructure may be developed or existing transport infrastructure enhanced to improve access during construction. This could have benefits at a local level. An increase in employment could change local travel patterns and may lead to a reduction in access to community facilities and services. 	0 Future transport of staff, materials and waste would likely be assessed in more detail at a site level, with negative impacts potentially mitigated through improvements in infrastructure. Transport movements are also likely to be spread out over a long period of time, in which case the overall impact of reprocessing on local assets can be considered neutral. The area around the Sellafield site (Copeland) is ranked within the 10% most deprived areas in relation to "Barriers to housing and services". The receptor could therefore have medium sensitivity to changes. ¹²	??	Potential changes to site access routes would be highly dependent on the location of any potential reprocessing/ supporting facility(ies) and the estimated no. of vehicle movements involved.
ST - LT	Development of new facilities <ul style="list-style-type: none"> At a national scale, development of reprocessing facilities and supporting infrastructure may provide opportunities for the management of other waste streams/ radioactive materials. 	+++ Opportunities may exist as part of this option to develop and maintain a national asset or assets, which could provide reprocessing capability for future spent fuel arisings. This would constitute a short to long-term medium magnitude positive impact. As THORP is scheduled for closure in 2018, implementation of this option would replace the loss of a national asset and the UK's ability to reprocess spent AGR fuel. Indicator sensitivity can therefore be considered high, making the overall impact of major significance.	✓	The suitability of any developed facilities to manage future spent fuel arisings, changes in government policy.
LT	Closure of future facilities	0 No significant impact on existing local and national assets is expected as a result of the closure of future facilities.	?	
HEALTH				

¹² This Index includes the indicators of: road distance to a GP surgery, road distance to a general store or supermarket, road distance to a primary school and road distance to a Post Office or sub post office

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
<p>Respiratory and cardiovascular effects associated with changes in air quality</p> <p>Cardiovascular health effects, respiratory illnesses and levels of chronic disease can be influenced by poor air quality. Studies have shown that there is a direct association between proximity to busy roads (including those travelled by a large number of heavy vehicles) and respiratory illness. Air quality can also influence levels of physical activity, which in turn can impact cardiovascular conditions and lead to stress.</p> <p>(Potential Receptors: The local population and non-motorised users in the local area, in particular infants, young children, the elderly and people with existing respiratory or cardiovascular conditions such as asthma).</p> <p>(Indicators: hospital admissions and mortality rates linked to cardiovascular illness, national health survey results).</p>				
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Construction works can negatively affect health through changes in air quality from emissions of pollutants such as NO_x, SO₂ and Particulate Matter. 	<p>–</p>	<p>Effects of construction likely to be confined within the site boundary, so the magnitude of health impacts on the community can be considered low. Use of dust suppression techniques and other construction management practices can mitigate the risk of impacts on health through changes in air quality. Any new facilities would be designed to comply with air emission standards.</p> <p>Activities beyond the site boundary, such as the movement of vehicles would need to be carefully monitored and managed to avoid effects upon recreation and amenity areas, and levels of physical activity.</p> <p>Copeland, the district Sellafield is located in, has a high level of under 75 year-old mortality associated with cardiovascular illness (100.6 deaths per 100,000 compared to 81.1 for England (2010-2012)). Indicator sensitivity to impacts which affect the risk of respiratory and cardiovascular illnesses and conditions may therefore be considered medium.</p>	<p>✓</p> <p>No. of vehicle movements and the timescales over which they occur, no. of facilities to be constructed, capacity of local medical facilities, proximity of residents and other receptors to activities.</p>
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> May result in dust and some pollutant emissions through the ongoing use of plant and equipment and transport, which can affect health. 	<p>–</p>	<p>Air quality changes during operations would likely be of low magnitude and continually monitored and mitigated. The magnitude of health impacts to the public would therefore also be low.</p> <p>Based on the health profile of Copeland, which suggests that the local population may be sensitive to health effects associated with changes in air quality, sensitivity can be considered medium. Cumulative effects on air quality at the site in the medium to long-term need to be considered.</p>	<p>?</p> <p>Length of the operation phase.</p>
ST and	<p>Closure of future facilities</p> <ul style="list-style-type: none"> Potential to negatively impact health 	<p>–</p>	<p>As with construction, effects of closure and demolition are likely to be confined within the site boundary and may be mitigated through the use of good construction and demolition practice. The magnitude of potential health</p>	<p>?</p> <p>Extent to which recreation and amenity areas would be impacted</p>

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
LT	<p>through dust and pollutant emissions from demolition, plant and vehicles.</p> <ul style="list-style-type: none"> Changes in air quality could also negatively impact the use of recreation and amenity areas and levels of physical activity. 	<p>impacts would therefore likely be low.</p> <p>Based on the health profile of Copeland, which has higher than average levels of cardiovascular illness and scored poorly on the most recent national health survey, sensitivity can be considered medium.</p>		and how the local population would respond to these changes, and the availability of other amenity and recreation areas in the local area.
<p>Annoyance, sleep disturbance, cardiovascular effects, potential hearing damage and other health effects associated with changes in noise levels</p> <p>Health effects from changes in noise levels can relate to communication, school performance, sleep, aggression and annoyance in addition to cardiovascular effects and potential hearing damage.</p> <p>(Potential Receptors: The local population and non-motorised users of the local area including the road network, in particular infants, young children and the elderly).</p> <p>(Indicator: hospital admissions and mortality rates linked to cardiovascular illness, national health survey results)</p>				
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Would likely cause increased noise and vibration, particularly from activities such as excavation and piling, and through the transport of plant and construction materials. 	<p>–</p> <p>It is likely that the impacts of construction and transport on noise and vibration would occur only in the short-term and be confined to a local scale (within or near the site boundary). Good construction practice can be used to ensure the magnitude of noise and vibration impacts is low.</p> <p>Noise and vibration impacts which affect the use of recreation and amenity areas and levels of physical activity may have a further negative impact on the health of the local population.</p> <p>Sensitivity of receptors to noise and vibration from traffic movements during construction, particularly those near to the site access road, may be medium.</p>	??	Extent of the construction works required, location of the new facilities, types of equipment and plant used, no. of transport movements and timescale over which they occur.
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Potential for increased noise and vibration from operation of facilities. 	<p>0</p> <p>As noise and vibration impacts during operation would be confined within the site boundary there are unlikely to be any significant health effects upon the local population.</p>	✓	
ST and LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> Noise and vibration levels can increase as a result of demolition, and have the potential to lead to negative impacts on health. 	<p>–</p> <p>Impacts of demolition noise and vibration would likely occur over a relatively short period of time but could extend beyond the site boundary. Good construction and demolition practice can be used to reduce the magnitude of noise and vibration impacts, in which case the magnitude of residual impacts would be low.</p>	?	Extent of the demolition required, types of equipment and plant used, no. of transport movements (linked to the

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
				proportion of waste material that can be reused on-site).	
<p>Effects on physical activity and obesity</p> <p>The UK government recommends that adults, children and young people should aim to be active daily. In addition to formal recreation facilities (e.g. playing fields and leisure centres), high quality walking and cycling infrastructure are increasingly recognised as important for promoting health. The use of recreation areas, local amenities and levels of physical activity undertaken by the local population can be impacted through environmental changes in air quality, noise, visual disturbance and traffic.</p> <p>(Potential Receptors: The local population, in particular groups who regularly use recreation and amenity areas, including children and users of national cycle routes). (Indicators: Levels of physical activity and obesity, availability of recreational facilities).</p>					
ST	<p>Expansion of new facilities</p> <ul style="list-style-type: none"> Can potentially reduce the attractiveness and usage of recreation and amenity areas through visual disturbance from plant and vehicles, and through changes in traffic volumes and patterns on the local road network. <p>This can lead to changes in levels of physical activity undertaken by the local population.</p>	–	<p>As the majority of environmental effects which could influence use of recreational areas and local amenities would be confined within or close to the site boundary, the magnitude of impacts from a health perspective is likely to be low.</p> <p>Copeland has a higher percentage of adults classed as obese (28.3%) and overweight or obese (75.9%) than the England average (23%) and (63.8%) respectively (Active People Survey 2012).</p> <p>Based on the health profile of Copeland and the proximity of recreational receptors (there is both a national and a local cycle route close to the site), sensitivity to impacts from construction may be medium.</p>	??	Extent of the construction required, location of the new facilities, types of equipment and plant required
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> A number of environmental effects (e.g. noise, air quality and landscape and visual) could impact the attractiveness of local recreational and amenity areas. 	0	<p>As most of the environmental effects anticipated to arise from operation of the new reprocessing plant and supporting facilities are likely to occur within the site boundary, impacts upon local recreational and amenity areas (and subsequently levels of physical activity) are unlikely to be significant.</p>	✓	
ST and LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> Changes in air quality, noise and visual disturbance associated with demolition and closure works (including transport 	–	<p>Decommissioning activities are likely to be confined mainly within the site boundary, but will require careful management through construction/ demolition good practice to ensure that the magnitude of impacts is low.</p> <p>Based on the health profile of Copeland and the proximity of receptors to the</p>	?	Proximity of future facilities to recreational and amenity areas, no. of transport movements

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
	of waste materials off-site) could reduce the use of recreation and amenity areas and levels of physical activity.		site, sensitivity to impacts from works to close existing facilities can be considered medium.	required (linked to amount of generated waste material that can be reused on-site).	
<p>Health and Safety Effects from Road Traffic Changes</p> <p>Studies have shown that people modify their behaviours in response to increased road traffic. As traffic increases, social networks tend to decrease. This affects people's sense of community and healthy social interaction. Increased traffic can also reduce levels of physical activity by discouraging non-motorised forms of transport such as walking and cycling.</p> <p>Potential health effects relating to road traffic changes include potential increases in the risk of road accidents, stress levels experienced whilst travelling and reduced levels of social contact.</p> <p>(Potential Receptors: The local population, in particular road users, non-motorised road users and groups who regularly use recreation and amenity areas e.g. children).</p> <p>(Indicators: Accident statistics).</p>					
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Can result in increased traffic levels due to the movement of plant and vehicles. This has the potential to increase driver stress, the risk of road accidents and exacerbate physical and mental health conditions. 	-	<p>Impacts on the local road network from transport in the short-term until the facilities are constructed. Vehicle movements would likely be spread out over a considerable length of time, making the magnitude of impact low.</p> <p>Given existing and historic accident figures for the A595, the main road which links to the site access road, sensitivity to traffic changes may be considered medium.</p>	?	No. / timing of transport movements (linked to no. of facilities constructed), cumulative developments, changes in local transport network and travel patterns.
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> There may be a requirement for ongoing transport movements. 	0	<p>During operation it is anticipated that the majority of transport movements would be intra-site. Given the relatively short distances involved and the secure nature of the site (i.e. no public access) it is not anticipated that there would be any significant impact on users of the local transport network.</p>	✓	No. and timing of transport movements.
ST and LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> An increase in transport movements during decommissioning could affect the local road network and has the potential to lead to increased stress, anxiety and 	-	<p>As transport movements during decommissioning would be spread out over a considerable period of time, any residual impacts upon the local road network would be of low magnitude.</p> <p>Given existing and historic accident figures for the A595, the main road which links to the site access road, sensitivity to traffic changes may be considered</p>	?	See construction of new facilities (above).

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
	risk of road accidents.	medium.			
Health effects relating to changes in the water environment					
<p>Changes to the water environment can affect drinking water and food supplies such as fish stocks. They can also affect agriculture, direct recreation facilities (e.g. recreational angling, kayaking) and wider recreational resources (e.g. views of water along countryside walks). Loss of such recreational water resources can reduce levels of physical activity, leading to a number of potential health effects. In some cases, water and food contamination can result in short and long-term illnesses. (Potential Receptors: The local population, groups who abstract water from local sources (e.g. for irrigation) and users of recreational water bodies). (Indicators: Water quality, hospital admissions, physical activity rates).</p>					
ST - MT	<p>Construction of new facilities</p> <ul style="list-style-type: none"> • Could potentially impact water quality at the site through run-off from roads used by plant and vehicles. • Likely to require an increase in water consumption which may put strain on water resources. 	<p>–</p>	<p>Short-term changes to the water environment from construction activities could have health implications if they affect drinking supplies or recreational resources. If a contaminant is long lasting, it could stay within water bodies or water systems for a prolonged period of time.</p> <p>Monitoring and the use of good construction practice would minimise impacts upon the water environment and ensure that any residual health impacts were of low magnitude. Requirements for water abstraction are unlikely to affect recreational use of water resources.</p>	<p>?</p>	<p>Dewatering required as part of construction, piling requirements and depths of excavations (could impact groundwater), type of contaminants and how long lasting they are.</p>
ST - LT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> • Possible requirement for water abstraction and discharges to water bodies. This can lead to health effects associated with water contamination. • Possible opportunities from avoiding risks associated with aqueous processes in the baseline. 	<p>–</p>	<p>During operation, requirements for water abstraction and risks of effects on water quality may constitute a medium magnitude impact. This includes the risks associated with using aqueous processes that produce liquid waste streams during reprocessing operations.</p> <p>As there are extensive existing controls in place to monitor and minimise discharges to waterbodies, including the use of ALARA and BAT, and given absence of water-based recreational activities downstream of the site, sensitivity is considered low.</p>	<p>?</p>	<p>The use of any aqueous processes.</p>
MT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> • Decommissioning has the potential to result in contamination of local water bodies. This could lead to health effects 	<p>–</p>	<p>As demolition activities would be confined within the site boundary and such activities would be controlled through construction good practice and monitoring, any residual impacts are likely to be of low magnitude.</p> <p>Given existing good water quality at the site and the non-use of nearby fresh</p>	<p>?</p>	<p>Changes in water quality at the site over time</p>

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
	upon the local population and any recreational users of these features.		water bodies for recreational purposes, sensitivity to minor contamination which could lead to health effects can be considered low.		
Radiological safety related health effects Effects relating to potential radiological exposure could include fear of exposure, and the mental health and wellbeing impacts associated with this, as well as direct exposure due to discharges. (Potential Receptors: Local population and in particular children and pregnant women). (Indicators: Discharge rates at the site, RIFE total reported dosages to the public).					
ST - MT - LT	Operation of new facilities <ul style="list-style-type: none"> Extended reprocessing to manage the oxides inventory could lead to radiological risks in terms of the production of Highly Active Liquor (HAL), a by-product of spent fuel reprocessing. 	-	Reprocessing of spent fuel produces uranium, plutonium and HAL (a high risk liquid waste). As this option would lead to production of greater quantities of these materials compared to the baseline, under which part of the oxides inventory would be disposed of, it can be considered to have a medium magnitude negative impact from a radiological safety perspective. Due to the use of extensive controls (including adherence to ALARA and BAT), the actual radiological health risk of reprocessing the oxides inventory is considered low. Sensitivity to changes is therefore also considered to be low, giving an overall minor negative impact from extended reprocessing.	✓	
Mental health and Wellbeing effects Changes in employment and income can influence people's mental health, as can changes in the environment through disturbance and pollution. Further health effects relating to mental health and wellbeing can include depression, anxiety, stress, changes in community cohesion and changes in levels of physical activity. (Potential Receptors: Mental health statistics for local population, visitors, regional population).					
ST	Construction of new facilities <ul style="list-style-type: none"> Likely to create employment opportunities, which studies have shown can influence mental health and wellbeing. 	+	Under the extended reprocessing option employment would be generated during construction. This may have a positive impact on the health and wellbeing of the local population. There may also be added benefits to the local economy which might also have a positive influence.	??	No. of jobs created, duration of construction, where employment is sourced from.
ST	Construction of new facilities <ul style="list-style-type: none"> May lead to negative impacts on mental health and wellbeing due to the range 	-	Construction can result in a number of adverse environmental effects, including increases in noise and vibration, reduced air quality and landscape and visual impacts. These impacts have the potential to adversely affect the	??	Extent of environmental impacts, duration of the construction works.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	and extent of environmental effects experienced by the local population. Such health effects might include annoyance, anxiety or stress.			
ST - MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Has the potential to offer socio-economic opportunities which may have positive effects for the mental health of those employed. Possible risk of adverse environmental effects which can influence health through increased stress and anxiety. 	+		Socio-economic opportunities available, whether these are made available to local population, environmental impacts and whether they can be mitigated.
ST and LT	<p>Closure of existing and future facilities</p> <ul style="list-style-type: none"> Can lead to negative environmental effects which might affect mental health and wellbeing, as well as negative socio-economic effects from possible job losses. Could have positive mental health and wellbeing effects such as reduced anxiety, stress and improved social cohesion from employment generated to carry out decommissioning and removal of facilities from the landscape. 	-		No. of jobs created, how many jobs lost/transferred, timescales for closures. Nature and extent of environmental impacts.

4.0 Nuclear Materials

4.1 Plutonium

4.1.1 Dispose – Description of Option

Option	Build facilities to immobilise plutonium, interim store the product and dispose of to a geological disposal facility (GDF) (Dispose)	
Site	Sellafield	
Description	<p>As all plutonium options ultimately end in disposal, this option is defined as disposal at the earliest opportunity. There are a number of potential technologies that could be used to condition the material ahead of disposal. Some of the most common have been used to inform the assessment. Conditioning (immobilisation) would take place at Sellafield, which would need to retain land to build an immobilisation plant. The material would need to be placed in interim storage pending transfer to a GDF. This would require intra-site transport.</p> <p>The four conditioning technologies used to inform this assessment (Cementation, Vitrification, Hot Isostatic Press and Reuse as Low Spec MOX) would each involve construction of one or more facilities (including a combination of treatment plant(s) and stores). It should be noted that whilst these options represent some of the more common treatment technologies available to manage radioactive wastes, they are by no means the only options available. Alternative treatment technologies may be considered in future assessment work.</p>	
Details/ Activities	<p>Construction of new facilities Regardless of which conditioning technology is implemented, there would be a requirement for construction. The extent of construction activities could range from a single treatment plant and interim store to multiple plants and stores as would be the case for a technology such as cementation.</p> <p>Operation of new facilities Effects associated with operation would vary depending on the conditioning technology used, as would the duration of this phase.</p>	<p>Closure of existing and future facilities Disposal would result in closure of existing facilities used to manage the plutonium inventory. There would also be an eventual requirement to close the new facilities once the inventory had been fully disposed of to a GDF.</p> <p>Avoid need to maintain existing facilities Disposal at the earliest opportunity would avoid the need to replace existing stores and repackage the plutonium, which under the baseline scenario would continue indefinitely. Repackaging is needed approximately every 30 years, whilst the stores are built to a 100-year design life but may require regular</p>

Option	Build facilities to immobilise plutonium, interim store the product and dispose of to a geological disposal facility (GDF) (Dispose)	
	Cementation is a relatively simple process carried out on a large scale, whereas Vitrification and Hot Isostatic Press are more complex but could be undertaken in a single facility.	maintenance works.

4.1.2 Dispose – Assessment

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
ENVIRONMENT					
Air Quality					
(Potential receptors: Residents neighbouring the site, nearby ecological features (incl. flora and fauna), non-motorised users of the local transport network, e.g. pedestrians, equestrians and cyclists).					
(Indicators: Local air quality (concentrations of relevant pollutants: NO _x , PM ₁₀ and SO ₂)).					
ST - MT	Construction of new facilities <ul style="list-style-type: none"> • Generation of dust • Emissions of pollutants such as NO_x, SO₂ and PM. This can be directly through the use of plant or indirectly through the transport of materials and waste.	–	Vehicle movements required for construction would likely be spread out over a sufficient period of time for the effect upon local air quality to be insignificant. Standard construction good practice and additional mitigation measures can reduce dust generation (which usually has a short range) and ensure that any impacts upon air quality are of low magnitude. Existing air quality at the site is well within national Air Quality Objectives so indicator sensitivity is low.	✓	No. of facilities requiring construction, the timing of construction (including seasonal works which may influence the dispersal of pollutant emissions).
MT	Operation of new facilities <ul style="list-style-type: none"> • Emissions of pollutants through use of equipment and plant. • Emissions associated with transport of plutonium from existing stores to the treatment facility(ies) and interim stores. 	–	Given the nature of conditioning technologies and controls in place to manage pollutant emissions, magnitude can be considered low. Existing air quality at the site is well within Air Quality Objectives so sensitivity is low.	✓	Conditioning technology used, duration of the operational phase.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
MT	Closure of existing facilities <ul style="list-style-type: none"> Pollutant-emitting activities such as demolition and transport movements. 	-	Impacts on air quality from transport are unlikely to be significant as movements would be spread out over a sufficient period of time. Impacts from generation of dust and other air pollutants would be mitigated through standard construction good practice, so residual impacts on local air quality would be of low magnitude.	✓	No. of transport movements required to transport materials and wastes.
MT - LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> In the baseline existing facilities used to store plutonium would be maintained indefinitely, with the plutonium repackaged every 30 years or so. 	+	In the medium and long-term there could be positive effects associated with avoiding activities to repackage the plutonium and maintain existing facilities, which may include construction and transport which can generate emissions of pollutants. As air quality at the site is anticipated to remain well within Air Quality Objectives, sensitivity of the indicator to minor improvements is considered low.	?	Extent of activities required to maintain existing stores, the build-up rate of hazardous daughter products of plutonium.
LT	Closure of future facilities <ul style="list-style-type: none"> During decommissioning there may be effects on air quality associated with activities such as demolition and the transport of plant, equipment and waste. 	-	Although multiple facilities would be closed, air quality impacts from transport are unlikely to be significant as movements would be spread out over a sufficient period of time. Impacts from generation of dust and other air pollutants would be mitigated through standard construction good practice, so residual impacts upon local air quality would be of low magnitude. Air quality at the site is not anticipated to significantly worsen in the long-term, so indicator sensitivity would remain low.	?	See construction of new facilities (above).
Biodiversity, Flora and Fauna (Potential Receptors: SSSIs, SACs, Ramsar, Ancient Woodland, National and Local Nature Reserves, Local Wildlife Sites).					
ST - LT	Construction of new facilities <ul style="list-style-type: none"> Possible land-take from designated or non-designated sites of value for nature conservation. There could be direct impacts through severance from or destruction to habitats, and/ or declines in populations of species. Effects on ecological receptors from disturbance or pollution-generating 	-	The significance of potential impacts on biodiversity, flora and fauna is difficult to determine based on the information currently available. If assumptions are made that: a) an assessment of receptor sensitivity is undertaken prior to any works commencing, b) construction best practice would be followed, c) any sensitive or designated species relocated if appropriate and d) there would be no land take from adjacent or nearby designated or non-designated sites, the magnitude of impacts would likely be low even if the receptor was of medium sensitivity.	??	No. and scale of facilities requiring construction, characteristics of nearby sites of value for nature conservation (both designation and non-designated) and other ecological receptors, no. of transport movements

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
	activities (air, noise, water etc.)			involved and the time over which they occur.	
MT	Operation of new facilities <ul style="list-style-type: none"> Pollution in the form of noise and vibration, air quality, water and landscape and visual impacts has the potential to impact nearby ecological receptors. 	0	Given the distances from the site to the nearest receptors it is unlikely that there would be any significant effects upon biodiversity, flora and fauna during operation. It is likely that this would need to be verified through further assessment.	?	Technology used, no. of transport movements required to transport materials and workers, duration of the operational phase.
MT	Closure of existing facilities <ul style="list-style-type: none"> Could involve pollutant-emitting activities such as demolition and transport movements which could affect ecological receptors. 	–	<p>The significance of potential impacts on biodiversity, flora and fauna is difficult to determine based on information currently available, as the sensitivity of receptors will vary from case to case.</p> <p>If assumptions outlined above are made, the magnitude of impacts would likely be low even if the receptor was of medium sensitivity.</p>	??	See construction of new facilities (above).
MT – LT	Avoid maintaining existing facilities	0	As repackaging activities and works to replace stores takes place infrequently over a number of years, any effects are unlikely to have a significant impact upon ecological receptors in the surrounding area. The effect of avoiding such impacts is therefore negligible.	✓	
LT	Closure of future facilities <ul style="list-style-type: none"> Possible effects on ecological receptors from disturbance, pollutant-generating activities such as demolition and transport. 	–	<p>The significance of potential impacts on biodiversity, flora and fauna is difficult to determine based on the information currently available, as the sensitivity of receptors will vary from case to case.</p> <p>If assumptions outlined above are made the magnitude of impacts would likely be low even if the receptor was of medium sensitivity.</p>	??	See construction of new facilities (above).
Climate Change and Energy (Potential Receptors: The atmosphere, the oceans, flora and fauna, soils, people). (Indicators: Industrial process sector greenhouse gas emissions and sector contribution to total UK emissions).					
ST – MT	Construction of new facilities <ul style="list-style-type: none"> Generation of CO₂ emissions Use of energy and materials, which 	--	Taking into account the extent of construction likely to be required and the material volumes involved in building multiple facilities (particularly in the case of a conditioning technology such as cementation), the magnitude of impact	?	Embodied carbon of materials used, complexity/ no. of

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	<p>could have further implications in terms of embodied carbon.</p> <p>The impact of increased CO₂ emissions may continue beyond the end of construction.</p>	<p>in terms of CO₂ emissions may be high in the short-term.</p> <p>Decommissioning and the management of radioactive waste fall under the 'industrial processes' sector for the purpose of UK greenhouse gas emissions reporting, defined as 'emissions from industry except for those associated with fuel combustion (for example, emissions from cement manufacture)'.¹³</p> <p>Given the overall steady decline in CO₂ emissions in the industrial process sector between 1990 and 2014, and the relatively modest contribution of the sector to UK emissions, indicator sensitivity is considered low.</p>		<p>facilities (may affect construction programmes)</p>
MT – LT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Impacts on climate change and energy use from use of plant and equipment. 	<p>–</p> <p>The facilities may be operational and using substantial amounts of energy and generating CO₂ emissions over a period of many years, making the potential impact of medium magnitude. As the impact would likely be small in the context of industrial process sector emissions as a whole, indicator sensitivity is considered low.</p>	??	<p>Contribution of the facilities to sector CO₂ emissions, changes in targets, extent to which waste packages need to be infilled.</p>
MT	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> CO₂ generating activities such as demolition and transport of plant, equipment and waste. 	<p>–</p> <p>CO₂ emissions may be generated and energy used to demolish the facilities and manage the waste over a period of years. Impact magnitude could therefore be considered medium.</p> <p>Given the overarching downward trend in carbon emissions from the industrial process sector, the indicator is likely to have low sensitivity to impacts from closure of the existing facilities.</p>	?	<p>If international and national carbon emission targets become stricter in the medium to long-term, indicator sensitivity may increase.</p>
MT – LT	<p>Avoid maintaining existing facilities</p> <ul style="list-style-type: none"> Maintaining stores and repackaging plutonium indefinitely under the baseline scenario could generate CO₂ emissions and require energy use. 	<p>+</p> <p>Although the activities involved in maintaining existing facilities would generate some emissions of CO₂, the spread out nature of work (i.e. every 30 years for repackaging and 50-100 years for replacing stores) would make the impact magnitude low. Avoiding these impacts may therefore have a minor positive effect in the medium to long-term.</p>	?	<p>The extent of activities required to repackage plutonium and replace stores.</p>
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> CO₂ emission-generating activities such as demolition and transport of plant, 	<p>---</p> <p>Closing the future facilities could have a high magnitude impact in terms of CO₂ emissions and energy use, particularly if wastes produced are transported off-site for disposal.</p>	??	<p>Changes in CO₂ targets / legislation and technology, volume of</p>

¹³ <https://www.gov.uk/government/statistics/provisional-uk-greenhouse-gas-emissions-national-statistics-2014>

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
	equipment and waste. <ul style="list-style-type: none"> • Would require energy use. 	In the future, international and national carbon emission targets are likely to be stricter. Indicator sensitivity may therefore increase to medium.		waste generated and whether this can be reused or recycled.	
Coastal Change and Flood Risk (Potential Receptors: Local population and infrastructure in coastal areas and areas at risk of flooding). (Indicators: Environmental Agency Flood Risk Map).					
ST	Construction of new facilities <ul style="list-style-type: none"> • Potential to affect surface water runoff and filtration rates through soil. This can lead to increased flood risk. • Construction in coastal regions can affect existing coastal defences (natural and man-made) and may provide opportunities to further protect coastlines from erosion. 	-	Construction works could affect hydrology at the site by increasing the presence of hard surfaces. This can increase surface water runoff and restrict drainage. As these risks would be designed-out in line with standard practice, the magnitude of the residual impact on flood risk can be considered low. Sellafield is located in Flood Zone 1, defined as having less than a 1 in 1000 chance of flooding occurring each year. The site has an elevation of 5-50m above sea level and is generally protected from coastal flooding by cliffs, a shingle spit and a railway embankment. Given the very small risk of flooding and existing defences which protect the site from coastal erosion, sensitivity in the short to medium-term is low.	?	The extent of any coastal erosion / sea level rise, any changes to existing coastal defences.
MT	Operation of new facilities <ul style="list-style-type: none"> • Relocating the plutonium could provide an opportunity to reduce risk related to flooding and coastal erosion. 	0	Given the small risk of flooding from seas or rivers at the site, which is likely to continue into the medium-term, there are unlikely to be any significant effects from moving the plutonium.	✓	
MT	Closure of existing facilities <ul style="list-style-type: none"> • Could reduce the extent of hard surfaces at the site, which may improve surface water drainage. 	0	Given the industrial nature of the site, including the presence of numerous other structures and facilities, it is unlikely that removal of the existing stores will have a significant impact in terms of reducing flood risk. There are also unlikely to be any significant effects relating to coastal change.	✓	
LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> • Disposal of the plutonium inventory could reduce the risk associated with storing the material indefinitely in facilities which may be at risk of flooding 	+	As the disposal option would involve conditioning the plutonium into a safer form, this would provide an opportunity to mitigate against any future changes in flood risk; regarded as an ongoing issue for Sellafield in the future due to raised sea level, higher waves and more frequent storm surges. Such an impact could be of medium magnitude.	?	Durability of coastal defences, extent of sea level rise and other coastal change.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	and coastal change.			
		Although risk of flooding from rivers and the sea at the site is considered to be very small and is not anticipated to change in the medium-term, under the baseline scenario the plutonium would be stored in its current form indefinitely. It is therefore likely that at some point in the long-term the risk could increase, either through changes in coastal erosion rates or sea level rise brought about by climate change.		
LT	Closure of future facilities <ul style="list-style-type: none"> Decommissioning may create opportunities to reduce flood risk. 	0	Given that the site is located in Flood Zone 1, the category least at risk of flooding, sensitivity to minor improvements in drainage would be low and the overall impact negligible.	? Changes in flood risk at the site over time.
Cultural Heritage (Potential Receptors: Listed buildings, Scheduled Ancient Monuments, Registered Parks and Gardens, Conservation Areas).				
ST	Construction of new facilities <ul style="list-style-type: none"> Potential to affect cultural and built heritage receptors directly through changes to their setting or indirectly through other environmental effects. 	-	Construction works likely to be confined within the site boundary. Direct impacts through damage or degradation of buildings/ structures would therefore be unlikely. This could change if land beyond the existing boundary was required. Construction activities may also generate vibration and noise, which may have an impact on nearby heritage features. Assuming appropriate mitigation is put in place, any residual impacts would be of low magnitude. Although the sensitivity of receptors cannot be determined based on the information currently available, there are several heritage features within a few hundred meters of the site. Even if these receptors were determined to be of medium sensitivity, assuming appropriate mitigation is in place the overall impact would likely be of minor significance.	?? This is a very site-specific consideration which would depend on the proximity of receptors to the site and activities, and the sensitivity of the receptors themselves, including whether they are statutorily designated.
MT	Operation of new facilities <ul style="list-style-type: none"> Could affect cultural heritage features through changes in noise and other environmental effects. 	0	Aside from potential movements associated with transporting wastes to a GDF (which will be covered in assessments elsewhere), activities involved in operation would be intra-site, meaning there are unlikely to be any direct effects upon cultural heritage during operation. Assuming monitoring is undertaken if required and appropriate mitigation is used to manage impacts from noise etc., residual impacts are unlikely to be significant.	✓

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
MT	<p>Closure of existing and future facilities</p> <ul style="list-style-type: none"> Demolition, transport and other activities involved in closing facilities can affect the setting of cultural heritage features. Removal of facilities from the landscape could improve the setting of heritage features. 	<p>–</p> <p>Decommissioning works would likely be confined within the site boundary, making direct impacts through damage or degradation of buildings/ structures unlikely. Activities such as demolition generate vibration and noise, which may have an impact on nearby heritage features. Assuming appropriate mitigation is put in place, any residual impacts would be of low magnitude.</p> <p>Although the sensitivity of receptors cannot be determined based on the information currently available, there are several heritage features within a few hundred meters of the site. Even if these receptors were determined to be of medium sensitivity, assuming appropriate mitigation is in place, the overall impact would likely be of minor significance</p> <p>In the long-term, the setting of heritage features could be beneficially affected through the removal of features that act as detractors in the environment. However, given the presence of many other industrial facilities at the site, such impacts are unlikely to be significant.</p>	??	See construction of new facilities (above).
LT	Avoid maintaining existing facilities	<p>0</p> <p>Unlikely to be any significant effects upon cultural heritage receptors from avoiding impacts associated with maintaining existing stores and repackaging plutonium due to the distance of receptors to the site.</p>	✓	
<p>Geology and Soils (Potential Receptors: Geodiversity, designated geological sites, high quality land such as that used for agriculture).</p>				
ST - MT	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Possible adverse effects on soil quality at the site. Potential for non-radioactive releases to the ground, leading to land contamination within the site boundary. 	<p>–</p> <p>Impacts of construction activities upon geology and soils would likely be confined within the site boundary. The use of ALARA and BAT principles and other institutional controls would minimise releases. Given the extent of construction works that may be required, the magnitude of impacts could be medium.</p> <p>Taking into account the industrial nature of the site, which already experiences land contamination in a number of locations, changes to soil and ground quality at the site are likely to be minor and within statutory limits. Receptor sensitivity is therefore considered low. Cumulative effects needs to be considered.</p>	✓	The extent of construction activities and proximity to areas of existing contamination.

Time-scale	Risk / Opportunity for Impact	Significance of Impact		Un-certainty	Factors affecting uncertainty
	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Soil resources would likely be used up during construction and/ or excavation activities. <p>This may vary depending on the conditioning technology used but would be substantial compared to the baseline.</p>	--	<p>Given the potential construction activities required, the magnitude of impacts on soil use can be considered high. Some material may be sourced locally or reused from other parts of the site, in which case the magnitude of the impact could be reduced.</p> <p>Construction unlikely to extend beyond the existing site boundary and would most likely take place on brownfield land that is of low sensitivity to impacts.</p>	✓	
MT	<p>Operation of new facilities</p>	0	<p>Provided that appropriate monitoring and established practices such as the use of ALARA and BAT principles are maintained, there are unlikely to be any releases to ground which could lead to significant effects on geology and soil at the site during operation.</p>	?	
MT	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> Activities such as demolition have the potential to result in ground contamination. 	-	<p>As the stores and packages used to contain plutonium may become contaminated over time, efforts would need to be made to minimise contamination spreading to the ground and soil through discharges. Potential impacts on geology and soils may have medium magnitude.</p> <p>Given the existing quality of land and soil at the site, which is considered to be of low value, sensitivity to further contamination can be considered low. Cumulative effects need to be considered.</p>	?	Extent of decommissioning activity required (including transport of wastes off-site), potential use of remediation techniques to clean-up the land as part of work to close facilities.
LT	<p>Avoid maintaining existing facilities</p>	0	<p>As maintaining the stores and repackaging the plutonium requires only minor construction works on brownfield land within the existing site, avoiding these activities is unlikely to have any significant effects upon geology and soils.</p>	?	Nature of repackaging activities, risk of contamination/ discharges e.g. from plutonium decay.
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> Decommissioning the treatment and storage facilities could impact soil quality and land contamination at the site. 	-	<p>During decommissioning there may be potential for adverse effects on geology and soils at the site and at the sites where waste arisings are managed. The use of ALARA and BAT principles and other institutional controls would help to minimise releases and the spread of contamination. Given the potential extent of decommissioning works required, the magnitude</p>	??	See closure of existing facilities (above).

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
Landscape and Visual				
(Potential Receptors: The local population, cyclists, pedestrians and equestrians using local routes, fauna, tourists and other visitors to the area).				
(Indicators: The local landscape).				
ST	Construction of new facilities <ul style="list-style-type: none"> Potential adverse effect on the local landscape from construction of multiple industrial facilities. 	-	During the short-term there would be adverse impacts associated with the movement of construction plant and vehicles, and possibly additional transport movements to remove waste from the site. Such activities could have a medium magnitude effect upon the landscape and may adversely affect views from nearby locations. Given the industrial nature of the site and its prominence in the local landscape, sensitivity of the surrounding landscape to further adverse changes can be considered low.	✓ Potential reuse of waste materials would reduce requirement for transport movements. If construction of facilities was to extend beyond the existing site boundary this could have increased visual impacts.
MT - LT	Operation of new facilities <ul style="list-style-type: none"> Once operational, the facilities would be a constant feature of the landscape for many years. Transport movements associated with transporting wastes to a disposal facility. 	-	Following construction and extending into the long-term there may be adverse landscape and visual effects associated with the facilities themselves and the ongoing transport of conditioned wastes, firstly to an interim store and then to a disposal facility (covered in assessments elsewhere). As multiple facilities may be required, the magnitude of impacts could be medium. Given the industrial nature of the site and its prominence in the local landscape, sensitivity is considered low	? Decommissioning of other facilities at the site could increase the prominence of the plutonium treatment and storage. Location of facilities/ stores.
MT - LT	Closure of existing and future facilities <ul style="list-style-type: none"> May create landscape and visual impact opportunities. Could lead to improved views nearby. 	+	Removal of industrial facilities could have a low magnitude positive on the local landscape. Given the number of other facilities on site and its prominence in the landscape, sensitivity of the indicator to minor changes is considered low.	? The no. and scale of facilities removed and other facilities on the site.
LT	Avoid maintaining existing facilities	0	Due to the extensive industrial nature of the site, there are unlikely to be any significant landscape and visual effects associated with avoiding activities to	✓

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
		replace stores and repackage the plutonium.		
Materials and Waste				
(Potential Receptors: Local, regional and national waste management facilities, local landfills, the Low Level Waste Repository).				
ST	Construction of new facilities <ul style="list-style-type: none"> Would likely require substantial volumes of material. Some of this may be sourced from reusable material already on-site, and some may be imported from primary sources. 	<p>Material requirements may differ depending on the conditioning technology used, but would involve substantial volumes of construction materials such as concrete and steel. There may also be a requirement for scarcer or finite resources. Material impacts of disposal via any conditioning technology would have high magnitude compared to the baseline scenario of indefinite storage.</p> <p>Although there may be some opportunities to reuse existing material on the site, it is likely given the volumes of material required that some would need to be imported. The greater the distances involved in transporting material, the greater the secondary environmental impacts such as changes in air quality are likely to be.</p>	✓	Complexity/ design of the treatment / storage facilities (likely to alter material requirements). Distances over which material need to be imported, and whether material on-site can be reused.
MT	Operation of new facilities <ul style="list-style-type: none"> Conditioning the plutonium would generate substantial volumes of waste during operation. For technologies such as vitrification and cementation, conditioned waste volumes increase significantly. 	<p>Compared to the baseline of indefinitely storing the plutonium as a nil value asset, disposal would require classifying all the material as waste. This option therefore generates a substantial volume of waste (several hundred to more than a thousand tonnes), and the nature of plutonium is such that the waste would be hazardous and require careful management. The magnitude of impact is therefore high.</p>	✓	Potential for extended storage of waste due to GDF programme delays.
MT	Closure of existing facilities <ul style="list-style-type: none"> Activities such as demolition and excavation have the potential to generate considerable volumes of waste material. 	<p>Decommissioning the existing plutonium stores is likely to generate considerable volumes of waste, some of which may have low levels of radioactivity and a very small amount may qualify as ILW. This waste would need to be stored on- site prior to management via reuse, treatment or disposal in a suitable facility, e.g. the LLWR near Drigg. The bulk of waste generated from closing existing facilities is likely to be non-radioactive and may be suitable for reuse. Generation of this waste material, of varying volumes and nature, would constitute a high magnitude negative impact.</p> <p>Given the considerable volumes of waste material stored on site (in 2012 this</p>	?	The volume and nature of waste generated, the extent to which waste materials can be reused.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> Maintaining stores and repackaging the plutonium indefinitely requires materials and produce waste. 	<p>++</p> <p>Although the timescale before existing facilities need replacing is relatively long, undertaking such maintenance activities indefinitely would have a substantial material requirement and waste generation potential. Avoiding this may therefore be considered a high magnitude positive impact.</p> <p>Given the material requirement needed to maintain existing stores and repackage the materials in the context of material requirements and impacts at the site as a whole, sensitivity can be considered low.</p>	✓	Where materials are sourced from. The greater the distances material must be transported, the greater the magnitude of impact.
LT	Closure of future facilities <ul style="list-style-type: none"> Potential to generate substantial volumes of Intermediate Level Waste (ILW), Low Level Waste (LLW), and non-radioactive waste. 	<p>--</p> <p>In the long-term, closure of the new facilities would generate waste. Given the potential scale of facilities and the risk that material will become contaminated with radiation, the magnitude of impacts could be high.</p> <p>Taking into account the success of the UK Strategy for the management of solid Low Level Waste, considerable progress has been made in diverting LLW and VLLW from disposal at the LLWR and similar facilities through reuse, recycling and decontamination. This means that any LLW or VLLW generated from the closure of future facilities is likely to have a suitable waste management route available. Sensitivity is therefore considered low.</p>	?	Capacity of the LLWR and availability of other low level waste disposal facilities, the nature of the waste (i.e. radioactive or non-radioactive), the programme, availability and capacity of a GDF to manage ILW arisings.
Noise				
(Potential Receptors: Local population, residential properties, schools, hospitals and other community facilities).				
ST	Construction of new facilities <ul style="list-style-type: none"> Potential for increased noise and vibration, particularly from construction activities such as excavation and piling, and through the transport of plant and construction materials. 	<p>-</p> <p>Impacts would be confined within the site boundary or along site access roads, provided that no piling activities are required. Given existing noise levels at the site, the magnitude of noise impacts would likely be low.</p> <p>Where piling activities are required, noise impacts could extend beyond the site boundary and might be considered medium to high magnitude on a short-term basis.</p>	??	The location and extent of construction works, no. of transport movements and the timescale over which they occur.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
		<p>Construction management procedures and design measures could be used to minimise noise and vibration levels, in which case residual impacts would be of low magnitude.</p> <p>Given that a number of residential properties are located within a few hundred metres of the site and site access road, receptor sensitivity can be considered medium. It is likely that this would need to be verified through further assessment.</p>			
MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Potential noise and vibration impacts associated with the processes used to treat plutonium. Noise from intra-site transport of the material from existing stores to the treatment and interim storage facilities. 	<p>0</p>	<p>Any noise and vibration impacts associated with operation of the new facilities would likely be confined within the site boundary. The design of the new facilities may also include measures to minimise noise and vibration impacts.</p> <p>Given the timescale over which transport movements are likely to occur and that they will be mostly intra-site (movements associated with transporting wastes to a GDF will be covered in assessments elsewhere), there are unlikely to be any significant noise and vibration impacts during operation.</p>	<p>✓</p>	
MT	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> May include noise-generating activities such as demolition and transport movements associated with plant, equipment and waste. 	<p>–</p>	<p>Although there is potential that noise and vibration impacts could extend beyond the site boundary, this could be mitigated through construction/ demolition management procedures. There may be an increase in traffic to and from the site involved in transporting plant, equipment and waste material, but this is likely to be spread out over a period of years. Magnitude is therefore considered low.</p> <p>Sensitivity of receptors within a few hundred metres of the site access road to noise and vibration impacts from transport can be considered medium.</p>	<p>?</p>	<p>No. of transport movements required and the timescales over which they occur.</p>
LT	<p>Avoid maintaining existing facilities</p> <ul style="list-style-type: none"> Replacing stores and repackaging the plutonium may generate noise and vibration. 	<p>0</p>	<p>As there are no receptors directly adjacent to the site boundary, no significant effects are anticipated from avoiding the need to replace existing stores and repackaging the plutonium.</p>	<p>✓</p>	
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> Decommissioning activities such as demolition, excavation and transport of 	<p>–</p>	<p>Noise and vibration impacts from decommissioning activities can be mitigated through standard construction/ demolition good practice. Any residual impacts would be of low magnitude.</p>	<p>??</p>	<p>The no. of transport movements required. This could be reduced if waste material can be</p>

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	plant, equipment and waste may be noise and vibration-generating.	Potential receptors, including residents within a few hundred metres of the site and access roads, may have medium sensitivity to noise and vibration impacts from transport. This needs to be verified through further assessment.		reused on site.
Radiological Discharges (Potential Receptors: The environment, people, flora and fauna). (Indicators: Discharge rates at the site, extent of controls and existing mitigation in place).				
MT - LT	Operation of new facilities <ul style="list-style-type: none"> Conversion of plutonium into safer and more secure form for long-term storage could reduce radiological risk. 	++ Conditioning the plutonium would reduce the risk associated with continuously storing it in its existing form. Plutonium decay in storage gives rise to neutron and gamma radiation which can be hazardous and requires careful management. Conditioning the plutonium would convert it into a safer, immobilised form. The magnitude of impact may therefore be high. Due to existing mitigation and controls in place to manage the risk of radiological effects, including the use of ALARA and BAT principles, and the site's current radiological discharge rates, sensitivity is considered low.	?	The potential build-up of plutonium daughter products via radioactive decay.
MT - LT	Closure of existing and future facilities <ul style="list-style-type: none"> Decommissioning activities such as demolition of facilities have the potential to result in discharges of radioactivity. 	0 Due to the extensive procedures and controls in place to minimise or avoid discharges of radioactivity during decommissioning, including adherence to ALARA and BAT principles, any impacts associated with closure of existing or future facilities are unlikely to be significant.	✓	
Water Resources and Quality (Potential Receptors: Flora and fauna, people, waterbodies, water abstraction points). (Indicators: Local water quality (EU Water Directive Rating), water abstraction volumes).				
ST	Construction of new facilities <ul style="list-style-type: none"> Could potentially impact water quality at the site through run-off from roads used by construction plant and vehicles. May require an increase in water consumption which could put strain on water resources. 	--- Construction would likely take place within the existing site boundary, with appropriate management procedures in place to keep pollutant discharges to a minimum. There would likely be considerable water abstraction requirements to construct the treatment and storage facilities, making the impact on water resources and quality of medium magnitude. Because existing water quality at the site is considered to be good (in accordance with the Water Framework Directive), sensitivity to contamination	?	The extent of construction activities would affect the volume of water that needs to be abstracted.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
		<p>is considered to be medium.</p> <p>The very large volumes of water currently abstracted by the site (in 2012 this was reported as some 6 million cubic metres) suggests that sensitivity to further water consumption may be high.</p> <p>Cumulative impacts may have the potential to be of very high magnitude.</p>		
MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Depending on the conditioning technology used, there may be a requirement for water abstraction and risks of discharges to waterbodies. 	<p>–</p> <p>During operation, radioactive and non-radioactive discharges to water from any of the plutonium conditioning options are considered to be very small as non-aqueous processes are almost exclusively used. As there are extensive existing controls in place to monitor and minimise discharges to waterbodies, the magnitude of residual impacts is considered to be low.</p> <p>Given the extensive existing controls in place to monitor and minimise discharges to waterbodies, and the existing status of water quality and resources at the site, sensitivity to impacts is considered low.</p>	?	Extent of indirect water abstraction and consumption needed to support workers etc.
MT	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> Could require increased water abstraction. May increase the risk of pollutant discharges to water receptors. 	<p>–</p> <p>To decommission the existing facilities there may be a small increase in water consumption. There may also be heightened risk of discharges to water as the facilities could be contaminated, either radioactively or with other forms of hazardous contamination. Given the extensive existing controls in place to minimise discharges to water bodies, residual impacts would likely be of low magnitude.</p> <p>Due to existing high levels of water abstraction and usage by the site, any increases in water consumption may put additional strain on water resources. Sensitivity to impacts on water resources could therefore be medium.</p>	??	Water requirements during decommissioning.
LT	<p>Avoid maintaining existing facilities</p>	<p>0</p> <p>Given the relatively small volumes of water required in replacing the stores and repackaging the plutonium, the impact of avoiding such activities is unlikely to be significant.</p>	?	Water requirements during store replacement and repackaging.
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> There may be substantial requirements for water abstraction and an increased risk of discharges to nearby waterbodies 	<p>– –</p> <p>Taking into account the potential extent of decommissioning activities required, the magnitude of impacts in terms of contamination and water abstraction may be medium.</p> <p>Because water quality at the site is good, its sensitivity to effects is medium. This is not anticipated to decline in the medium to long-term, and may</p>	??	Changes in water abstraction and consumption at the site, (linked to timescales for decommissioning)

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	from decommissioning activities.	improve once operations such as spent fuel reprocessing are complete. Water abstraction involved in closing future facilities may place an additional burden on water resources at the site. Water consumption is currently very high and this may continue into the long-term. Sensitivity to increased water abstraction may therefore be considered medium.		activities e.g. completion of spent fuel reprocessing operations), changes in Water Framework Directive classifications.
SOCIO-ECONOMICS				
Employment (Potential Receptors: Regional and national employment). (Indicators: Employment created / sustained, contribution to local labour market).				
ST	Construction of new facilities <ul style="list-style-type: none"> Any conditioning technology selected would create a full range of employment, from construction to highly-skilled and managerial jobs. 	+++ Estimates for jobs associated with conditioning options range from 200 to 3,500 FTE per year for a construction period of at least 5 years. ¹⁴ The low end of the range is based on construction of a small vitrification plant, while the upper end is based on construction of multiple cementation plants. Construction is assumed to occur at Sellafield, which is within the Copeland district. Currently 5.5% (1,819 people) of the local population works in construction, suggesting it is an important contributor to local employment markets. Sensitivity is therefore considered medium. The potential increase in construction capacity of between 11% and 192% per year would constitute a high magnitude impact.	??	Conditioning technology used, potential employment requirements for other national nuclear projects.
MT	Operation of new facilities <ul style="list-style-type: none"> Would create a range of employment opportunities. 	++ Estimates suggest that cementation and Hot Isostatic Press (HIP) conditioning technologies could generate in the region of 700-1000 jobs per year, whilst vitrification and reuse as low spec Mixed Oxide Fuel (MOX) may result in around 300-500 jobs per year. ¹⁴ The current contribution of the “manufacturing” sector (which includes most decommissioning and fuel reprocessing work) to the local employment market in terms of jobs is roughly 10,000. Sensitivity is therefore considered high based on the importance of manufacturing jobs to the local labour market.	?	Proportion of jobs created as new jobs, and the number transferred from other activities in the industry. For example, those involved in indefinite storage of plutonium.

¹⁴ based on estimates from “Macro-economic study of Nuclear Materials” (ERM on behalf of the NDA, 2008) and estimates provided for analogous facilities.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
MT	Closure of existing facilities <ul style="list-style-type: none"> Decommissioning has the potential to create employment opportunities. 	0		Complexity involved in decommissioning, the availability of relevant expertise.
LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> Disposal would lead to eventual closure of existing stores and potential job losses associated with repackaging materials and maintaining the stores. 	0		No. of jobs supported by existing stores, the transferability of existing jobs to new facilities.
LT	Closure of future facilities <ul style="list-style-type: none"> Decommissioning of future facilities could result in job losses. 	-		Opportunities to retain/transfer jobs. Potential for facilities to be repurposed.
Knowledge and Skills (Potential Receptors: National skill base). (Indicators: Existence and degree of maintenance of skills, anticipated demand for nuclear skills, national nuclear knowledge and capabilities).				
ST - MT	Development of new facilities <ul style="list-style-type: none"> Will likely draw heavily on the local and regional supply of construction, engineering and civils workers. 	-		Specific skills required and the availability of such skills in the local or regional area.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> As disposal via cement and vitrification are established technologies, there is little opportunity to develop or enhance knowledge and skills. There may be opportunities to develop skills and enhance knowledge for the HIP and low spec MOX disposal options as both technologies are relatively immature and would likely require R&D. 	<p>+++</p> <p>Likely that disposal would both maintain existing skills and facilitate the development of new skills and knowledge, as storage and conditioning techniques may both be required and used during the operational period. This would constitute a high magnitude positive impact. Such skills and knowledge may also be transferable to management of other forms of radioactive waste.</p> <p>Due to the importance of this field (radioactive waste management) to the region and nationally, sensitivity is considered medium.</p>	?	Skill development may be time limited, skills and knowledge opportunities may be transferable to other areas of the nuclear industry.	
MT	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> Could create opportunities to enhance or maintain decommissioning skills and expertise. 	0	It is not expected that this requirement will be large or complex enough to result in significant impacts on skills development, or to significantly improve the knowledge or available skill base.	✓	
LT	<p>Avoid maintaining existing facilities</p> <ul style="list-style-type: none"> Employment from management of the current plutonium stores may be lost. 	0	There may be some transferability of these roles to the new facilities. It is therefore unlikely that the closure of these facilities will significantly impact the skill base for this type of work.	✓	
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> Once disposal operations are completed and the plutonium inventory has been fully managed, knowledge and skills would be lost. 	+	Given the potential transferability of disposal and storage skills to management of other types of waste, and the importance of such skills nationally, the long-term impact on the national skill base in terms of knowledge and skills may be minor positive.	?	
<p>Education and Training (Potential Receptors: National Skill Base). (Indicators: Likely future skill requirements and contribution to improving the UK skill base).</p>					
ST – MT -	<p>Development and operation of new facilities</p>	++	HIP and low spec MOX conditioning technologies in particular would create education and training opportunities as these are the least technically mature	?	Conditioning technology implemented.

Time-scale	Risk / Opportunity for Impact	Significance of Impact		Un-certainty	Factors affecting uncertainty
LT	<ul style="list-style-type: none"> To ensure the correct skills are available to develop and implement disposal, considerable education and training may be required. This could create opportunities at regional and national spatial scales. 		options. If disposal via cement or vitrification is implemented, there would still be some education and training opportunities created compared to the baseline of indefinite storage, but they would likely be on a much smaller scale. This impact on education and training is likely to occur in the short to medium-term during construction and operation, with benefits reducing following this period.		
MT	Closure of existing facilities	0	It is unlikely that closure of existing facilities used to store the plutonium inventory would have any significant impacts in terms of education and training. The skills and knowledge to carry out such decommissioning activities already exist.	✓	
LT	Avoid maintaining existing facilities	0	No significant impacts on education and training are likely to arise from no longer maintaining and replacing the existing stores.	✓	
LT	Closure of future facilities	0	Following completion of disposal, there will likely be a requirement for additional decommissioning personnel in order to close the new facilities. Given the existence of such knowledge and skills, it is unlikely that there would be any significant requirement for or impact on education and training.	?	Technology used, extent to which facilities may be contaminated/ require a specialist approach to decommissioning.
Economy (Potential Receptors: Local and Regional economy). (Indicators: £ Gross Value Added).					

Time-scale	Risk / Opportunity for Impact	Significance of Impact		Un-certainty	Factors affecting uncertainty
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Expenditure on plutonium disposal could have knock-on impacts on local, regional and national economic development. <p>The nature and extent of potential benefits is dependent on local supply linkages and the demographics of the area in which money is invested.</p>	++	<p>Average Gross Value Added (GVA) per employee data for UK regions¹⁵ can be multiplied by employment estimates for conditioning in order to estimate total GVA contributions for the disposal option.</p> <p>The value for West Cumbria is £19,032 per employee. Assuming the majority of employment is either sourced or based locally, this results in a 5 year total of construction GVA of between £19 million to £333 million, or a construction sector increase of approximately 5% to 100%. This would constitute a low to high magnitude impact.</p> <p>The construction GVA of West Cumbria in 2013 was £333 million, which equated to approximately 5 – 10% of total GVA for West Cumbria, which suggests the sector is of medium sensitivity based on its importance to the regional economy, giving an overall moderate positive impact.</p>	?	<p>Skill development may be time limited. Skills/ knowledge opportunities may be transferable to other areas of the nuclear industry.</p>
		N / A	<p>At the national level, economic impacts are tied to the capital spend required to achieve the objectives, offset by any financial benefits such as sale of fuel or generation of power. Cost has not been considered in this IIA and will be assessed in an independent assessment elsewhere.</p>	N/A	
MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Could lead to ongoing economic contributions to the local and regional economy. 	++	<p>GVA per employee data can be multiplied by the expected FTE (jobs supported) per year of operation.</p> <p>The value for West Cumbria is £19,032 per employee. Assuming the majority of employment is either sourced or based locally, the result for operational GVA is between £5.7 million and £100 million per year for the duration of the operation period, equating to a manufacturing sector increase of between 0.4% - 6%. This would constitute a low to medium magnitude impact.</p> <p>The manufacturing GVA of West Cumbria in 2013 was £1,666 million, (approximately 35 - 40% of total GVA for West Cumbria), suggesting the sector is of high sensitivity based on its importance to the regional economy.</p>	??	<p>Conditioning technology implemented, potential transferability to other areas of the nuclear industry, future arisings of plutonium requiring management.</p>
MT	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> Decommissioning may require economic 	0	<p>Given the existing national skill base available to undertake decommissioning work, it is unlikely that there would be a need for significant investment in new</p>	?	<p>Decommissioning programmes at other sites, availability of</p>

¹⁵ Office for National Statistics (2012)

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	investment.		skills or employment to enable the future facilities to close.	personnel and expertise.
LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> • Could lead to changes in the supply chain involved in indefinitely storing the plutonium. 	0	Deviation from the indefinite storage baseline could mean a loss of economic opportunities for some businesses but gains for others. This should be assessed at a local level.	?? Opportunities for existing supply chain to be maintained, resilience of existing suppliers to adapt.
LT	Closure of future facilities <ul style="list-style-type: none"> • Could reduce economic contributions to the local and regional economy due to loss of employment. 	-	Eventual closure of the treatment and storage facilities could reduce spending and investment into the local economy. Given the size of the Sellafield site, and the number of other operations that take place (and are assumed will continue to take place in the long-term), the magnitude of such impacts on the local economy are likely to be of low magnitude.	?? The site decommissioning programme, cumulative effects of other facilities closing.
Local and National Assets (Potential Receptors: local, regional and national community). (Indicators: Indices of Multiple Deprivation (IMD) ranking for barriers to housing and services, the existence of alternative facilities)				
ST - LT	Construction and operation of new facilities <ul style="list-style-type: none"> • New transport infrastructure may be developed or existing transport infrastructure enhanced to improve access during construction. This could have benefits at a local level. • An increase in employment could change local travel patterns and may lead to a reduction in access to community facilities and services. 	0	Future transport of staff, materials and waste would likely be assessed in more detail at a site level, with negative impacts potentially mitigated through improvements in infrastructure. Transport movements are also likely to be spread out over a long period of time, in which case the overall impact of disposal on local assets can be considered neutral. The area around the Sellafield site (Copeland) is ranked within the 10% most deprived areas in relation to "Barriers to housing and services". The receptor could therefore have medium sensitivity to changes. ¹⁶	?? Potential changes to site access routes would be highly dependent on the location of any facility(ies) and the estimated no. of vehicle movements involved.

¹⁶ This Index includes the indicators of: road distance to a GP surgery, road distance to a general store or supermarket, road distance to a primary school and road distance to a Post Office or sub post office

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
MT - LT	Development of new facilities <ul style="list-style-type: none"> At a national scale, development of one or more conditioning and storage facilities may provide opportunities for the management of other waste streams. 	<p style="text-align: center;">+</p> <p>Vitrification and cementation are common methods for immobilising radioactive waste. Opportunities may therefore exist as part of the disposal route to develop and maintain a national asset or assets. This would constitute a medium to long-term positive impact of medium magnitude. As alternative treatment facilities already exist or are likely to be developed over time to manage other waste streams regardless of whether or not the disposal option is implemented, receptor sensitivity can be considered low.</p>	✓	The suitability of any developed facilities to manage future arisings, changes in government policy.	
MT - LT	Closure of existing facilities and avoiding need to maintain them	0	No significant impact on existing local and national assets is expected as a result of decommissioning the existing facilities.	✓	
LT	Closure of future facilities	0	No significant impact on existing local and national assets is expected as a result of the closure of future facilities.	?	
HEALTH					
<p>Respiratory and cardiovascular effects associated with changes in air quality</p> <p>Cardiovascular health effects, respiratory illnesses and levels of chronic disease can be influenced by poor air quality. Studies have shown that there is a direct association between proximity to busy roads (including those travelled by a large number of heavy vehicles) and respiratory illness. Air quality can also influence levels of physical activity, which in turn can impact cardiovascular conditions and lead to stress.</p> <p>(Potential Receptors: The local population and non-motorised users in the local area, in particular infants, young children, the elderly and people with existing respiratory or cardiovascular conditions such as asthma).</p> <p>(Indicators: hospital admissions and mortality rates linked to cardiovascular illness, national health survey results).</p>					
ST	Construction of new facilities <ul style="list-style-type: none"> Construction works can negatively affect health through changes in air quality 	-	Effects of construction likely to be confined within the site boundary, so the magnitude of health impacts on the community can be considered low. Use of dust suppression techniques and other construction management practices	✓	No. of vehicle movements and the timescales over which

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	from emissions of pollutants such as NO _x , SO ₂ and Particulate Matter.	<p>can mitigate the risk of impacts on health through changes in air quality. Any new facilities would be designed to comply with air emission standards.</p> <p>Activities beyond the site boundary, such as the movement of vehicles would need to be carefully monitored and managed to avoid effects upon recreation and amenity areas, and levels of physical activity.</p> <p>Copeland, the district Sellafield is located in, has a high level of under 75 year-old mortality associated with cardiovascular illness (100.6 deaths per 100,000 compared to 81.1 for England (2010-2012)). Indicator sensitivity to impacts which affect the risk of respiratory and cardiovascular illnesses and conditions may therefore be considered medium.</p>		they occur, no. of facilities to be constructed, capacity of local medical facilities, proximity of residents and other receptors to activities.
MT - LT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> May result in dust and some pollutant emissions through the ongoing use of plant and equipment and transport, which can affect health. 	<p>–</p> <p>Air quality changes during operations would likely be of low magnitude and continually monitored and mitigated. The magnitude of health impacts to the public would therefore also be low.</p> <p>Based on the health profile of Copeland, which suggests that the local population may be sensitive to health effects associated with changes in air quality, sensitivity can be considered medium. Cumulative effects on air quality at the site in the medium to long-term need to be considered.</p>	?	Length of the operation phase and the conditioning technology used, no. of transport movements.
MT - LT	<p>Closure of existing and future facilities</p> <ul style="list-style-type: none"> Potential to negatively impact health through dust and pollutant emissions from demolition plant and vehicles. Changes in air quality could negatively impact use of recreation and amenity areas and levels of physical activity. 	<p>–</p> <p>As with construction, effects of closure and demolition are likely to be confined within the site boundary and may be mitigated through the use of good construction and demolition practice. The magnitude of potential health impacts would therefore likely be low.</p> <p>Based on the health profile of Copeland, which has higher than average levels of cardiovascular illness and scored poorly on the most recent national health survey, sensitivity can be considered medium.</p>	?	Extent to which recreation and amenity areas would be impacted and how the local population would respond to these changes, availability of other facilities in area.
MT - LT	<p>Avoid maintaining existing facilities</p> <ul style="list-style-type: none"> Could help to reduce the risk of respiratory and cardiovascular illness through avoidance of ongoing construction and maintenance activities. 	<p>+</p> <p>In the medium and long-term there could be positive health effects from avoiding activities to repackage the plutonium and maintain existing facilities. Given the relatively minor extent of construction activities required and the fact that they are spread out over a relatively long period of time, impact magnitude is low.</p>	??	Activities required to maintain existing stores and repackage the plutonium, changes to the health baseline of the

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
			Taking into account the health profile of Copeland, sensitivity is considered medium.	local population (may become more or less sensitive).	
<p>Annoyance, sleep disturbance, cardiovascular effects, potential hearing damage and other health effects associated with changes in noise levels</p> <p>Health effects from changes in noise levels can relate to communication, school performance, sleep, aggression and annoyance in addition to cardiovascular effects and potential hearing damage.</p> <p>(Potential Receptors: The local population and non-motorised users of the local area including the road network, in particular infants, young children and the elderly).</p> <p>(Indicator: hospital admissions and mortality rates linked to cardiovascular illness, national health survey results)</p>					
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> • Could cause increased noise and vibration, particularly from activities such as excavation and piling, and through the transport of plant and construction materials. 	-	<p>Impacts of construction and transport on noise and vibration would occur mainly in the short-term and be confined to within or near the site boundary. Good construction practice can ensure the magnitude of impacts is low.</p> <p>Noise and vibration impacts which affect use of recreation and amenity areas and levels of physical activity may have further negative impacts on health.</p> <p>Sensitivity of receptors to noise and vibration from traffic movements during construction, particularly those near to the site access road, may be medium.</p>	??	Extent of the construction works required, location of the new facilities, types of equipment and plant used, no. of transport movements and timescale over which they occur.
MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> • Increased noise and vibration from operation of plant and stores. 	0	As noise and vibration impacts during operation would be confined within the site boundary there are unlikely to be any significant health effects upon the local population.	✓	
MT	<p>Closure of existing and future facilities</p> <ul style="list-style-type: none"> • Noise and vibration levels can increase as a result of demolition, and have the potential to lead to negative impacts on health. 	-	<p>Impacts of demolition noise and vibration would occur over a relatively short period of time but could extend beyond the site boundary. Good construction and demolition practice can reduce the magnitude of noise and vibration impacts, in which case the magnitude of residual impacts would be low.</p> <p>Taking into account the proximity of residential properties and local cycle routes, receptor sensitivity may be medium.</p>	?	Extent of the demolition required, types of equipment and plant used, no. of transport movements.
LT	<p>Avoid maintaining existing facilities</p> <ul style="list-style-type: none"> • Reuse would avoid ongoing noise and vibration-generating. 	0	As activities required to repackage the plutonium and maintain existing facilities would be confined within the site boundary, there are unlikely to be any significant health effects from changes in noise and vibration.	✓	

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
Effects on physical activity and obesity					
<p>The UK government recommends that adults, children and young people should aim to be active daily. In addition to formal recreation facilities (e.g. playing fields and leisure centres), high quality walking and cycling infrastructure are increasingly recognised as important for health. The use of recreation areas, local amenities and levels of physical activity undertaken by the local population can be impacted through environmental changes in air quality, noise, visual disturbance and traffic.</p> <p>(Potential Receptors: The local population, in particular groups who regularly use recreation and amenity areas, including children and users of national cycle routes).</p> <p>(Indicators: Levels of physical activity and obesity, availability of recreational facilities).</p>					
ST	<p>Expansion of new facilities</p> <ul style="list-style-type: none"> • Could reduce the attractiveness and usage of recreation and amenity areas through visual disturbance from plant and vehicles, and through changes in traffic volumes and patterns. <p>This can lead to changes in levels of physical activity undertaken.</p>	<p>–</p>	<p>As most environmental effects which could influence use of recreational areas and local amenities would be confined within or close to the site, the magnitude of impacts from a health perspective is likely to be low.</p> <p>Copeland has a higher percentage of adults classed as obese (28.3%) and overweight or obese (75.9%) than the England average (23%) and (63.8%) respectively (Active People Survey 2012).</p> <p>Based on the health profile of Copeland and the proximity of recreational receptors (there is both a national and a local cycle route close to the site), sensitivity to impacts from construction may be medium.</p>	<p>??</p>	<p>Extent of the construction required, location of the new facilities, types of equipment and plant required</p>
MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> • A number of environmental effects (e.g. noise, air quality and landscape and visual) could impact the attractiveness of local recreational and amenity areas. 	<p>0</p>	<p>Due to the relatively minor environmental effects anticipated to arise from operation of the new treatment and storage facilities, impacts on local recreational and amenity areas (and subsequently levels of physical activity) are unlikely to be significant.</p>	<p>✓</p>	
MT - LT	<p>Closure of existing and future facilities</p> <ul style="list-style-type: none"> • Changes in air quality, noise and visual disturbance associated with demolition and closure works, and transport could reduce use of recreation and amenity areas and levels of physical activity. 	<p>–</p>	<p>Decommissioning activities are likely to be confined mainly within the site boundary, but will require careful management through construction/ demolition good practice to ensure that the magnitude of impacts is low.</p> <p>Based on the health profile of Copeland and the proximity of receptors to the site, sensitivity to impacts from works to close existing facilities can be considered medium.</p>	<p>?</p>	<p>Proximity of existing stores to recreational and amenity areas, no. of transport movements required.</p>
LT	<p>Avoid maintaining existing facilities</p> <ul style="list-style-type: none"> • Avoiding activities which affect use of 	<p>0</p>	<p>As activities to maintain and replace existing facilities used to store the plutonium inventory take place over a relatively long period of time and are confined within the site boundary, there are unlikely to be any significant</p>	<p>✓</p>	

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
	local recreation and amenity areas could lead to increased levels of physical activity and lower levels of obesity.		effects on local recreation and amenity features from avoiding them.		
<p>Health and Safety Effects from Road Traffic Changes</p> <p>Studies have shown that people modify their behaviours in response to increased road traffic. As traffic increases, social networks tend to decrease. This affects people's sense of community and healthy social interaction. Increased traffic can also reduce levels of physical activity by discouraging non-motorised forms of transport such as walking and cycling.</p> <p>Potential health effects relating to road traffic changes include potential increases in the risk of road accidents, stress levels experienced whilst travelling and reduced levels of social contact.</p> <p>(Potential Receptors: The local population, in particular road users, non-motorised road users and groups who regularly use recreation and amenity areas e.g. children).</p> <p>(Indicators: Accident statistics).</p>					
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Can result in increased traffic levels due to the movement of plant and vehicles. This has the potential to increase driver stress, the risk of road accidents and exacerbate physical and mental health conditions. 	-	<p>Impacts on the local road network from transport in the short-term until the facilities are constructed. Vehicle movements would likely be spread out over a considerable length of time, making the magnitude of impact low.</p> <p>Given existing and historic accident figures for the A595, the main road which links to the site access road, sensitivity to traffic changes may be considered medium.</p>	?	No. / timing of transport movements (linked to no. of facilities constructed), cumulative developments, changes in local transport network and travel patterns.
MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> There may be a requirement for ongoing transport movements. 	0	<p>During operation, it is anticipated that the majority of transport movements would be intra-site. Depending on the location of the reactors in which the fuel is to be used, there may be a requirement for off-site transport movements. This would require further assessment.</p>	??	Location of reactors, no. and timing of transport movements.
MT - LT	<p>Closure of existing and future facilities</p> <ul style="list-style-type: none"> An increase in transport movements during decommissioning could affect the local road network and has the potential to lead to increased stress, anxiety and risk of road accidents. 	-	<p>As transport movements during decommissioning would be spread out over a considerable period of time, any residual impacts upon the local road network would be of low magnitude.</p> <p>Given existing and historic accident figures for the A595, the main road which links to the site access road, sensitivity to traffic changes may be considered medium.</p>	?	The no. and timing of transport movements, changes in the local transport network and travel patterns.

Time-scale	Risk / Opportunity for Impact	Significance of Impact		Un-certainty	Factors affecting uncertainty
LT	Avoid maintaining existing facilities	0	Unlikely to be any significant effects on the local transport network or any effects which alter the risk of traffic accidents from avoiding activities to replace and maintain the existing stores.	✓	
<p>Health effects relating to changes in the water environment</p> <p>Changes to the water environment can affect drinking water and food supplies such as fish stocks. They can also affect agriculture, direct recreation facilities (e.g. recreational angling, kayaking) and wider recreational resources (e.g. views of water along countryside walks). Loss of such recreational water resources can reduce levels of physical activity, leading to a number of potential health effects. In some cases, water and food contamination can result in short and long-term illnesses. (Potential Receptors: The local population, groups who abstract water from local sources (e.g. for irrigation) and users of recreational water bodies). (Indicators: Water quality, hospital admissions, physical activity rates).</p>					
ST - MT	<p>Construction of new facilities</p> <ul style="list-style-type: none"> • Could potentially impact water quality at the site through run-off from roads used by plant and vehicles. • Likely to require an increase in water consumption which may put strain on water resources. 	-	<p>Short-term changes to the water environment from construction activities could have health implications if they affect drinking supplies or recreational resources. If a contaminant is long lasting, it could stay within water bodies or water systems for a prolonged period of time.</p> <p>Monitoring and the use of good construction practice would minimise impacts upon the water environment and ensure that any residual health impacts were of low magnitude. Requirements for water abstraction are unlikely to affect recreational use of water resources.</p>	?	Dewatering required as part of construction, piling requirements and depths of excavations (could impact groundwater), type of contaminants and how long lasting they are.
MT - LT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> • There may be potential for radioactive and non-radioactive discharges to local water bodies. This can lead to health effects associated with water contamination. 	-	<p>As discharges from all conditioning technologies are considered to be very small due to the almost exclusive use of non-aqueous processes, the magnitude of impacts on water receptors and associated health effects on the local population are likely to be low.</p> <p>Given the extensive existing controls in place to monitor and minimise discharges to waterbodies, including the use of ALARA and BAT, and the absence of water-based recreational activities downstream of the site, sensitivity is considered low.</p>	?	Conditioning technology used and the use of any aqueous processes.
MT - LT	<p>Closure of existing and future facilities</p> <ul style="list-style-type: none"> • Decommissioning has the potential to result in contamination of local water bodies. This could lead to health effects 	-	<p>As demolition activities would be confined within the site boundary and such activities would be controlled through construction good practice and monitoring, any residual impacts are likely to be of low magnitude.</p> <p>Given existing good water quality at the site and the non-use of nearby fresh</p>	✓	

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
	upon the local population and recreational users of these features.		water bodies for recreational purposes, sensitivity to minor contamination which could lead to health effects is low.		
LT	Avoid maintaining existing facilities	0	There are unlikely to be any significant effects on the water environment or associated health effects on the local population from avoiding activities to replace and maintain existing stores.	✓	
Radiological safety related health effects Effects relating to potential radiological exposure could include fear of exposure, and the mental health and wellbeing impacts associated with this, as well as direct exposure due to discharges. (Potential Receptors: Local population and in particular children and pregnant women). (Indicators: Discharge rates at the site, RIFE total reported dosages to the public).					
ST - MT - LT	Operation of new facilities and closure of existing facilities <ul style="list-style-type: none"> Disposal of the plutonium inventory offers potential health opportunities as the material would be removed from existing facilities (which may be deteriorating) and converted into a safer and more secure form. 	++	In the short-term there may be a potential spike in the risk profile associated with managing the plutonium due to intra-site transport to the newly constructed facilities. Such transport movements would be carefully managed and subject to appropriate safety assessments and management. In the medium to long-term, conditioning the plutonium inventory would convert it into a safer and more secure form. This could significantly reduce the risk profile of the material to a level well below that in the baseline scenario, under which the material would be stored indefinitely in its current form. The magnitude of this positive impact would be high. Due to the use of extensive controls (including adherence to ALARA and BAT principles), the radiological health risk of keeping plutonium indefinitely in its current form is considered low. Sensitivity to changes is therefore low, giving an overall moderate positive impact.	✓	
Mental health and Wellbeing effects Changes in employment and income can influence people's mental health, as can changes in the environment through disturbance and pollution. Further health effects relating to mental health and wellbeing can include depression, anxiety, stress, changes in community cohesion and changes in levels of physical activity. (Potential Receptors: Mental health statistics for local population, visitors, regional population).					
ST	Construction of new facilities	+	Under disposal option employment would be generated during construction.	??	No. of jobs created,

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	<ul style="list-style-type: none"> Likely to create employment opportunities, which studies have shown can positively influence mental health and wellbeing. 			duration of the construction works, where employment is sourced from.
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> May lead to negative impacts on mental health and wellbeing due to the range and extent of environmental effects experienced by the local population. Such health effects might include annoyance, anxiety or stress. 	-		Extent of environmental impacts, duration of the construction works.
MT - LT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Has the potential to offer socio-economic opportunities which may have positive effects for the mental health of those employed. Possible risk of adverse environmental effects which can influence health through increased stress and anxiety. 	+		Socio-economic opportunities available, whether these are made available to local population, environmental impacts and whether they can be mitigated.
ST - LT	<p>Closure of existing and future facilities</p> <ul style="list-style-type: none"> Can lead to negative environmental effects which might affect mental health and wellbeing, as well as negative socio-economic effects from possible job losses. Could have positive mental health and wellbeing effects such as reduced anxiety, stress and improved social cohesion from employment generated to carry out decommissioning and removal 	-		No. of jobs created, how many jobs lost/transferred, timescales for closures. Nature and extent of environmental impacts.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	of facilities from the landscape.	Overall, there is likely to be a minor negative effect on mental health and wellbeing associated with closing facilities.		

4.1.3 Reuse – Description of Option

Option	Build facilities to reuse plutonium in nuclear fuel, irradiate in reactors and dispose of spent fuel to a geological disposal facility (GDF) (Reuse)		
Site	Sellafield		
Description	<p>Reuse is a credible option for making use of the UK's civil stocks and in doing so would produce plutonium in a disposable form, i.e. as an irradiated fuel. In this option, plutonium fuel would be fabricated in the UK prior to transport to the reactor in which it is to be used.</p> <p>Plutonium reuse as fuel would require design and construction of a new plant at Sellafield (a Plutonium Fuel Fabrication Facility, PFFF), and reactors which can use plutonium as fuel. This option would therefore create jobs in R&D, construction, plant operation and decommissioning.</p> <p>Some of the plutonium inventory may need pre-treatment prior to fuel fabrication to remove impurities. This may require construction of a specialist treatment process as part of the PFFF. In the event that it is impractical to treat part of the inventory, then this material may be managed as a waste for disposal. However, for this assessment it has been assumed that the NDA's entire inventory of civil plutonium could be reused under this option.</p>		
Details/ Activities	Construction of new facilities Implementation of the reuse option to manage the plutonium inventory	Closure of existing and future facilities Implementation of reuse would result in closure of existing facilities used to	

Option	Build facilities to reuse plutonium in nuclear fuel, irradiate in reactors and dispose of spent fuel to a geological disposal facility (GDF) (Reuse)	
	<p>would require construction. This may include, but not necessarily be limited to, a Plutonium Fuel Fabrication Facility (PFFF) and potentially one or more interim stores.</p> <p>Operation of new facilities Plutonium from reprocessed spent fuel is usually fabricated into new fuel as soon as possible to avoid problems with the decay of short-lived plutonium isotopes. Once constructed, the fuel fabrication facilities and supporting infrastructure would be operational for a number of years, supporting a wide range of jobs and potentially providing a financially viable fuel source for nuclear power generation.</p>	<p>manage the plutonium inventory. There would also be an eventual requirement to close the new facilities once the inventory had been fully fabricated into fuel and irradiated in reactors.</p> <p>Avoid need to maintain existing facilities Reusing the plutonium in new fuel would avoid the need to replace existing stores and repackage the plutonium, which under the baseline scenario would continue indefinitely. Repackaging is needed approximately every 30 years or so, whilst the stores are built to a 100-year design life but may require regular maintenance works.</p>

4.1.4 Reuse – Assessment

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
ENVIRONMENT				
Air Quality				
(Potential receptors: Residents neighbouring the site, nearby ecological features (incl. flora and fauna), non-motorised users of the local transport network, e.g. pedestrians, equestrians and cyclists).				
(Indicators: Local air quality (concentrations of relevant pollutants: NO _x , PM ₁₀ and SO ₂)).				
ST - MT	<p>Construction of new facilities</p> <ul style="list-style-type: none"> • Generation of dust • Emissions of pollutants such as NO_x, SO₂ and PM. <p>This can be directly through the use of plant or indirectly through the transport of materials and waste.</p>	<p>–</p> <p>Vehicle movements required for construction would likely be spread out over a sufficient period of time for the effect upon local air quality to be insignificant. Standard construction good practice and additional mitigation measures can reduce dust generation (which usually has a short range) and ensure that any impacts upon air quality are of low magnitude. Existing air quality at the site is well within national Air Quality Objectives so indicator sensitivity is low.</p>	<p>✓</p>	<p>No. of facilities requiring construction, the timing of construction (including seasonal works which may influence the dispersal of pollutant emissions).</p>
MT	<p>Operation of new facilities</p>	<p>–</p> <p>Given the nature of nuclear fuel fabrication technologies and controls in place</p>	<p>✓</p>	<p>Fuel fabrication</p>

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	<ul style="list-style-type: none"> Emissions of pollutants through use of equipment and plant. 	<p>to manage pollutant emissions, magnitude can be considered medium. Existing air quality at the site is well within Air Quality Objectives so indicator sensitivity is low.</p>		technology, duration of the operational phase.
MT - LT	<p>Closure of existing and future facilities</p> <ul style="list-style-type: none"> During decommissioning there may be effects on air quality associated with activities such as demolition and the transport of plant, equipment and waste. 	<p>–</p> <p>Although multiple facilities would be closed, air quality impacts from transport are unlikely to be significant as movements would be spread out over a sufficient period of time. Impacts from generation of dust and other air pollutants would be mitigated through standard construction good practice, so residual impacts upon local air quality would be of low magnitude. Air quality at the site is not anticipated to significantly worsen in the long-term, so indicator sensitivity would remain low.</p>	?	See construction of new facilities (above).
MT - LT	<p>Avoid maintaining existing facilities</p> <ul style="list-style-type: none"> In the baseline existing facilities used to store plutonium would be maintained indefinitely, with the plutonium repackaged every 30 years or so. 	<p>+</p> <p>In the medium and long-term there could be positive effects associated with avoiding activities to repackage the plutonium and maintain existing facilities, which may include construction and transport which can generate dust and emissions of other pollutants. As air quality at the site is anticipated to remain well within Air Quality Objectives, the sensitivity of the indicator to minor improvements is considered low.</p>	?	Extent of activities required to maintain existing stores.
<p>Biodiversity, Flora and Fauna (Potential Receptors: SSSIs, SACs, Ramsar, Ancient Woodland, National and Local Nature Reserves, Local Wildlife Sites).</p>				
ST - LT	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Possible land-take from designated or non-designated sites of value for nature conservation. There could be direct impacts through severance from or destruction to habitats, and/ or declines in populations of species. Effects on ecological receptors from disturbance or pollution-generating activities (air, noise, water etc.) 	<p>–</p> <p>The significance of potential impacts on biodiversity, flora and fauna is difficult to determine based on the information currently available. If assumptions are made that: a) an assessment of receptor sensitivity is undertaken prior to any works commencing, b) construction best practice would be followed, c) any sensitive or designated species relocated if appropriate and d) there would be no land take from adjacent or nearby designated or non-designated sites, the magnitude of impacts would likely be low even if the receptor was of medium sensitivity.</p>	??	No. and scale of facilities requiring construction, characteristics of nearby sites of value for nature conservation (both designation and non-designated) and other ecological receptors, no. of transport movements involved and the time over which they occur.

Time-scale	Risk / Opportunity for Impact	Significance of Impact		Un-certainty	Factors affecting uncertainty
MT	Operation of new facilities <ul style="list-style-type: none"> Pollution in the form of noise and vibration, air quality, water and landscape and visual impacts has the potential to impact nearby ecological receptors. 	0	Given the distances from the site to the nearest receptors it is unlikely that there would be any significant effects upon biodiversity, flora and fauna during operation. It is likely that this would need to be verified through further assessment.	✓	Technology used, no. of transport movements required to transport materials and workers, duration of the operational phase.
MT – LT	Closure of future facilities <ul style="list-style-type: none"> Possible effects on ecological receptors from disturbance, pollutant-generating activities such as demolition and transport. 	–	The significance of potential impacts on biodiversity, flora and fauna is difficult to determine based on the information currently available, as the sensitivity of receptors will vary from case to case. If assumptions outlined above are made the magnitude of impacts would likely be low even if the receptor was of medium sensitivity.	??	See construction of new facilities (above).
MT – LT	Avoid maintaining existing facilities	0	As repackaging activities and works to replace stores takes place infrequently over a number of years, any effects are unlikely to have a significant impact upon ecological receptors in the surrounding area. The effect of avoiding such impacts is therefore negligible.	✓	
Climate Change and Energy					
(Potential Receptors: The atmosphere, the oceans, flora and fauna, soils, people).					
(Indicators: Industrial process sector greenhouse gas emissions and sector contribution to total UK emissions).					
ST – MT	Construction of new facilities <ul style="list-style-type: none"> Generation of CO₂ emissions Use of energy and materials, which could have further implications in terms of embodied carbon. <p>The impact of increased CO₂ emissions may continue beyond the end of construction.</p>	--	Taking into account the extent of construction that is likely to be required and the volumes of material involved in building a fuel fabrication plant and potentially one or more interim stores, the magnitude of impact in terms of energy use and CO ₂ emissions generated may be high in the short-term. Decommissioning and the management of radioactive waste fall under the 'industrial processes' sector for the purpose of UK greenhouse gas emissions reporting. This is defined as 'emissions from industry except for those associated with fuel combustion (for example, emissions from cement manufacture) ¹⁷ . Given the overall steady decline in CO ₂ emissions in the industrial process	?	Embodied carbon of materials used, complexity/ no. of facilities (may affect construction programmes)

¹⁷ <https://www.gov.uk/government/statistics/provisional-uk-greenhouse-gas-emissions-national-statistics-2014>

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
MT – LT	Operation of new facilities <ul style="list-style-type: none"> Impacts on climate change and energy from use of plant and equipment. 	–		<p>sector between 1990 and 2014, and the relatively modest contribution of the sector to UK emissions, indicator sensitivity is considered low.</p> <p>The facilities may be operational and using substantial amounts of energy and generating CO₂ emissions over a period of many years, making the potential impact of medium magnitude. As the impact would likely be small in the context of industrial process sector emissions as a whole, sensitivity of the indicator is considered low.</p>	<p>?</p> <p>Technology used, contribution of the facilities to industrial process sector CO₂ emissions, changes in sector targets.</p>
MT – LT	Closure of existing and future facilities <ul style="list-style-type: none"> CO₂ emission-generating activities such as demolition and transport of plant, equipment and waste. Would require energy use. 	--		<p>Closing facilities could have a medium magnitude impact in terms of CO₂ emissions and energy use, particularly if wastes produced are transported off-site for disposal.</p> <p>In the future, international and national carbon emission targets are likely to be stricter. Indicator sensitivity may therefore increase to medium.</p>	<p>?</p> <p>Changes in CO₂ targets / legislation and technology, volume of waste generated and whether this can be reused or recycled.</p>
MT – LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> Maintaining stores and repackaging plutonium indefinitely under the baseline scenario could generate CO₂ emissions and require energy use. 	+		<p>Although the activities involved in maintaining existing facilities would generate some emissions of CO₂, the spread out nature of the work (i.e. every 30 years for repackaging and 50-100 years for replacing stores), would make the impact magnitude low. Avoiding these impacts may therefore have a minor positive effect in the medium to long-term.</p>	<p>?</p> <p>The extent of activities required to repackage plutonium and replace stores.</p>
Coastal Change and Flood Risk (Potential Receptors: Local population and infrastructure in coastal areas and areas at risk of flooding). (Indicators: Environmental Agency Flood Risk Map).					
ST	Construction of new facilities <ul style="list-style-type: none"> Potential to affect surface water runoff and filtration rates through soil. This can lead to increased flood risk. Construction in coastal regions can affect existing coastal defences (natural and man-made) and may provide 	–		<p>Construction works could affect hydrology at the site by increasing the presence of hard surfaces. This can increase surface water runoff and restrict drainage. As these risks would be designed-out in line with standard practice, the magnitude of the residual impact on flood risk can be considered low.</p> <p>Sellafield is located in Flood Zone 1, defined as having less than a 1 in 1000 chance of flooding occurring each year. The site has an elevation of 5-50m above sea level and is generally protected from coastal flooding by cliffs, a</p>	<p>?</p> <p>The extent of any coastal erosion / sea level rise, any changes to existing coastal defences.</p>

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	opportunities to further protect coastlines from erosion.			
MT	Operation of new facilities <ul style="list-style-type: none"> Relocating the plutonium to new facilities could provide an opportunity to reduce risk related to flooding and coastal erosion. 	0		
MT	Closure of existing facilities <ul style="list-style-type: none"> Could reduce the extent of hard surfaces at the site, which may improve surface water drainage. 	0	✓	
LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> Disposition of the plutonium inventory via reuse could reduce the risk associated with storing the material indefinitely in facilities which may be at risk of flooding and coastal change. 	+	?	See construction of new facilities (above).
LT	Closure of future facilities <ul style="list-style-type: none"> Decommissioning may create opportunities to reduce flood risk. 	0	?	Changes in flood risk at the site over time, extent of coastal change.
Cultural Heritage (Potential Receptors: Listed buildings, Scheduled Ancient Monuments, Registered Parks and Gardens, Conservation Areas).				

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Potential to affect cultural and built heritage receptors directly through changes to their setting or indirectly through other environmental effects. 	<p>–</p> <p>Construction works likely to be confined within the site boundary. Direct impacts through damage or degradation of buildings/ structures would therefore be unlikely. This could change if land beyond the existing boundary was required. Construction activities may also generate vibration and noise, which may have an impact on nearby heritage features. Assuming appropriate mitigation is put in place, any residual impacts would be of low magnitude.</p> <p>Although the sensitivity of receptors cannot be determined based on the information currently available, there are several heritage features within a few hundred meters of the site. Even if these receptors were determined to be of medium sensitivity, assuming appropriate mitigation is in place the overall impact would likely be of minor significance.</p>	??	This is a very site-specific consideration which would depend on the proximity of receptors to the site and activities, and the sensitivity of the receptors themselves, including whether they are statutorily designated.
MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Could affect cultural heritage features through changes in noise and other environmental effects. 	<p>0</p> <p>Aside from potential movements associated with transporting the fabricated fuel to the reactors in which it will be irradiated (which will be covered in assessments elsewhere), activities involved in operation would be intra-site, meaning it is unlikely there would be direct impacts upon cultural heritage features. Assuming monitoring is undertaken if required and appropriate mitigation is used to manage impacts from noise etc., residual impacts are unlikely to be significant.</p>	✓	
MT – LT	<p>Closure of existing and future facilities</p> <ul style="list-style-type: none"> Demolition, transport and other activities involved in closing facilities can affect the setting of cultural heritage features. Removal of facilities from the landscape could improve the setting of heritage features. 	<p>–</p> <p>Decommissioning works would likely be confined within the site boundary, making direct impacts through damage or degradation of buildings/ structures unlikely. Activities such as demolition generate vibration and noise, which may have an impact on nearby heritage features. Assuming appropriate mitigation is put in place, any residual impacts would be of low magnitude.</p> <p>Although the sensitivity of receptors cannot be determined based on the information currently available, there are several heritage features within a few hundred meters of the site. Even if these receptors were determined to be of medium sensitivity, assuming appropriate mitigation is in place, the overall impact would likely be of minor significance</p> <p>In the long-term, the setting of heritage features could be beneficially affected through the removal of features that act as detractors in the environment.</p>	??	See construction of new facilities (above).

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
LT	Avoid maintaining existing facilities	0 Unlikely to be any significant effects upon cultural heritage receptors from avoiding impacts associated with maintaining existing stores.	✓	
Geology and Soils (Potential Receptors: Geodiversity, designated geological sites, high quality land such as that used for agriculture).				
ST - MT	Construction of new facilities <ul style="list-style-type: none"> Possible adverse effects upon soil quality at the site. May result in non-radioactive releases to the ground, leading to land contamination within the site boundary. 	- Impacts of construction on geology and soils would likely be confined within the site boundary. The use of ALARA and BAT principles and other institutional controls would minimise releases. Given the extent of construction works required, the magnitude of impacts could be medium. Taking into account the industrial nature of the site, which experiences land contamination in multiple locations, changes to soil and ground quality would likely be minor and within statutory limits. Receptor sensitivity is therefore considered low. Cumulative effects should be considered.	✓	The extent of construction activities and proximity to areas of existing contamination.
	Construction of new facilities <ul style="list-style-type: none"> Soil resources would likely be used up during construction and/ or excavation activities. 	- Given the potential construction activities required, which would increase if additional plutonium pre-treatment and storage facilities are needed, the magnitude of construction on soil use can be considered medium. Some material may be sourced locally or reused from other parts of the site, in which case the magnitude of the impact could be reduced. Construction is unlikely to extend beyond the existing site boundary and would most likely take place on brownfield land with low sensitivity to impacts.	✓	
MT	Operation of new facilities	0 Provided that appropriate monitoring and established practices such as the use of ALARA and BAT principles are maintained, there are unlikely to be any releases to ground which could lead to significant effects on geology and soil at the site during operation.	✓	
MT	Closure of existing facilities	- As the stores and packages used to contain plutonium may have become	?	Extent of

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	<ul style="list-style-type: none"> Activities such as demolition have the potential to result in ground contamination. 	<p>contaminated over time, efforts would need to be made to minimise contamination spreading to the ground and soil through discharges. Potential impacts on geology and soils may have medium magnitude.</p> <p>Given the existing quality of land and soil at the site, which is considered to be of low value, sensitivity to further contamination can be considered low. Cumulative effects need to be considered.</p>		decommissioning required (including transport of wastes off-site), potential use of remediation techniques to clean-up the land.
LT	Avoid maintaining existing facilities	0	As maintaining the stores and repackaging the plutonium requires only minor construction works on brownfield land within the existing site, avoiding these activities is unlikely to have any significant effects upon geology and soils.	? Nature of repackaging activities, risk of contamination/ discharges e.g. from plutonium decay.
LT	Closure of future facilities <ul style="list-style-type: none"> Decommissioning the plutonium fuel fabrication facility and any pre-treatment/ storage facilities could impact soil quality and land contamination at the site. 	-	<p>During decommissioning there may be potential for adverse effects on geology and soils at the site and at the sites where waste arisings are managed. The use of ALARA and BAT principles and other institutional controls would help to minimise releases and the spread of contamination. Given the potential extent of works required, impact magnitude could be medium.</p> <p>In the future, as the site moves through its decommissioning programme, there may either be worsening or improvement in ground and soil conditions at the site. This could alter the sensitivity of the receptor to effects.</p>	?? Extent of decommissioning activity required (including transport of wastes off-site), potential use of remediation techniques to clean-up land at the site.
Landscape and Visual (Potential Receptors: The local population, cyclists, pedestrians and equestrians using local routes, fauna, tourists and other visitors to the area). (Indicators: The local landscape).				
ST	Construction of new facilities <ul style="list-style-type: none"> Potential adverse effect on the local landscape from construction of multiple industrial facilities. 	-	<p>During the short-term there would be adverse impacts associated with the movement of construction plant and vehicles, and possibly additional transport movements to remove waste from the site. Such activities could have a medium magnitude effect upon the landscape and may adversely affect views from nearby locations.</p> <p>Given the industrial nature of the site and its prominence in the local landscape, sensitivity of the surrounding landscape to further adverse</p>	✓ Reuse of waste materials would reduce transport movements. If construction of facilities/ stores were to extend beyond the existing site boundary this could have

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
				increased visual impacts.
MT - LT	Operation of new facilities <ul style="list-style-type: none"> Once operational, the facilities would be a constant feature of the landscape for many years. Ongoing transport movements associated with transporting the plutonium fuel to the reactors. 	<p>changes can be considered low. Cumulative effects need to be considered</p> <p>–</p> <p>Following construction and extending into the long-term there may continue to be adverse landscape and visual effects associated with the presence of the facilities themselves and the ongoing transport of plutonium fuel to the reactors in which it is to be irradiated (this will be covered in assessments elsewhere). As multiple facilities may be required, the magnitude of impacts could be medium.</p> <p>Given the industrial nature of the site and its prominence in the local landscape, sensitivity is considered low.</p>	?	Decommissioning of other facilities at the site could increase the prominence of the plutonium fuel fabrication facility. Location of facilities/ stores.
MT - LT	Closure of existing and future facilities <ul style="list-style-type: none"> May create landscape and visual impact opportunities. Could lead to improved views from nearby locations. 	<p>Removal of industrial facilities could have a low magnitude positive on the local landscape.</p> <p>+</p> <p>Given the number of other facilities on the site and its prominence in the local landscape, the sensitivity of the indicator to minor improvements is considered low.</p>	?	The no. and scale of facilities removed and other facilities on the site.
LT	Avoid maintaining existing facilities	<p>0</p> <p>Due to the extensive industrial nature of the site, there are unlikely to be any significant landscape and visual effects associated with avoiding activities to replace stores and repackage the plutonium.</p>	✓	
Materials and Waste (Potential Receptors: Local, regional and national waste management facilities, local landfills, the Low Level Waste Repository).				
ST	Construction of new facilities <ul style="list-style-type: none"> Would likely require substantial volumes of material. Some of this may be sourced from reusable material already on-site and some may be imported from primary sources. 	<p>Material requirements may differ depending on how the plutonium fuel is fabricated and the nature of the pre-treatment process, but would involve substantial volumes of construction materials such as concrete and steel. There may also be a requirement for scarcer or finite resources. Material impacts of reuse would have high magnitude compared to the baseline.</p> <p>---</p> <p>Although there may be some opportunities to reuse existing material on the site, it is likely given the volumes of material which may be required that some would need to be imported. The greater the distances involved in transporting material, the greater the secondary environmental impacts such as changes</p>	✓	Complexity/ design of the fuel fabrication / storage facilities (likely to alter material requirements). Distances over which material need to be imported, and whether material on-site can be reused.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
		-		
MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Under this option plutonium would be fabricated into fuel which could be irradiated in nuclear reactors to generate power. 	<p>0</p> <p>The reuse option would involve converting the entire plutonium inventory into fuel, which could then be irradiated in nuclear reactors to provide power. This means that it would not be treated as a waste. Compared to the baseline, in which the plutonium is also stored indefinitely as a nil value asset and not as a waste, the impact is neutral.</p>	✓	If part of the plutonium inventory is not suitable for fuel fabrication and cannot be pre-treated, it may be classified as waste for disposal.
MT	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> Activities such as demolition and excavation have the potential to generate considerable volumes of waste material. 	<p>--</p> <p>Decommissioning the existing plutonium stores is likely to generate considerable volumes of waste, some of which may have low levels of radioactivity and a very small amount may qualify as ILW. This waste would need to be stored on-site prior to management via reuse, treatment or disposal in a suitable facility, e.g. the LLWR near Drigg. The bulk of waste generated from closing existing facilities is likely to be non-radioactive and may be suitable for reuse. Generation of this waste material, of varying volumes and nature, would constitute a high magnitude negative impact.</p> <p>Given the considerable volumes of waste material already stored on the site (in 2012 there was estimated to be over 1,700, 75,000 and 4,000 cubic metres of HLW, ILW and LLW respectively), the generation of waste in the volumes that might be expected from closing existing facilities is relatively small. Sensitivity could therefore be considered low. Cumulative impacts need to be considered, as does the capacity of facilities to receive any LLW or VLLW arisings.</p>	?	The volume and nature of waste generated, the extent to which waste materials can be reused.
LT	<p>Avoid maintaining existing facilities</p> <ul style="list-style-type: none"> Maintaining stores and repackaging the plutonium indefinitely requires materials and produce waste. 	<p>++</p> <p>Although the timescale before existing facilities need replacing is relatively long, undertaking such maintenance activities indefinitely would have a substantial material requirement and waste generation potential. Avoiding this may therefore be considered a high magnitude positive impact.</p> <p>Given the material requirement needed to maintain existing stores and repackaging the materials in the context of material requirements and impacts at the site as a whole, sensitivity can be considered low.</p>	✓	Where materials are sourced from. The greater the distances material must be transported, the greater the magnitude of impact.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> Potential to generate substantial volumes of Intermediate Level Waste (ILW), Low Level Waste (LLW), and non-radioactive waste. 	<p>--</p> <p>In the long-term, closure of the new facilities would generate waste. Given the scale of facilities to be constructed and the risk material will become contaminated with radiation, the magnitude of impacts could be high.</p> <p>Taking into account the success of the UK Strategy for the management of solid Low Level Waste, considerable progress has been made in diverting LLW and VLLW from disposal at the LLWR and similar facilities through reuse, recycling and decontamination. This means that any LLW or VLLW generated from the closure of future facilities is likely to have a suitable waste management route available. Sensitivity is therefore considered low.</p>	?	Capacity of the LLWR and availability of other low level waste disposal facilities, the nature of the waste (i.e. radioactive or non-radioactive), the programme, availability and capacity of a GDF to manage ILW arisings.
<p>Noise (Potential Receptors: Local population, residential properties, schools, hospitals and other community facilities).</p>				
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Potential for increased noise and vibration, particularly from activities such as excavation and piling, and through the transport of plant and construction materials. 	<p>-</p> <p>Impacts would be confined within the site boundary or along site access roads, provided that no piling activities are required. Given existing noise levels at the site, the magnitude of noise impacts would likely be low.</p> <p>Where piling activities are required, noise impacts could extend beyond the site boundary and might be considered medium to high magnitude on a short-term basis.</p> <p>Construction management procedures and design measures could be used to minimise noise and vibration levels, in which case residual impacts would be of low magnitude.</p> <p>Given that a number of residential properties are located within a few hundred metres of the site and site access road, receptor sensitivity can be considered medium. It is likely that this would need to be verified through further assessment.</p>	??	The location and extent of construction works, no. of transport movements and the timescale over which they occur.
MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Potential noise and vibration impacts associated with the processes used to fabricate plutonium fuel. Noise from intra-site transport of the 	<p>0</p> <p>Any noise and vibration impacts associated with operation of the new facilities would likely be confined within the site boundary. The design of the new facilities may also include measures to minimise noise and vibration impacts.</p> <p>Given the timescale over which transport movements are likely to occur and the fact that they will be mostly intra-site (movements associated with</p>	✓	

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
	material from existing stores to the facilities, and potential off-site transport to reactors.		transporting new fuel to reactors will be covered in assessments elsewhere), there are unlikely to be any significant noise and vibration impacts during operation.		
MT - LT	Closure of existing and future facilities <ul style="list-style-type: none"> May include noise-generating activities such as demolition and transport movements associated with plant, equipment and waste. 	-	<p>Although considerable decommissioning activities may be required, noise and vibration impacts from such activities can be mitigated through standard construction/ demolition good practice. Any residual impacts would be of low magnitude.</p> <p>Potential receptors, including residents within a few hundred metres of the site and access roads, may have medium sensitivity to noise and vibration impacts from transport movements. This would need to be verified through further assessment.</p>	??	The number of transport movements required. This could be reduced if waste material can be reused on site.
LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> Replacing stores and repackaging may generate noise and vibration. 	0	As there are no receptors directly adjacent to the site boundary, no significant effects are anticipated from avoiding the need to replace existing stores and repackaging the plutonium.	✓	
Radiological Discharges (Potential Receptors: The environment, people, flora and fauna). (Indicators: Discharge rates at the site, extent of controls and existing mitigation in place).					
MT - LT	Operation of new facilities <ul style="list-style-type: none"> Conversion of plutonium into safer and more secure form for long-term storage could reduce radiological risk. 	++	<p>Converting the plutonium into fuel would reduce the risk associated with continuously storing it in its existing form. Plutonium decay in storage gives rise to neutron and gamma radiation which can complicate the fuel fabrication process. Fabricating the plutonium into fuel would convert it into a safer, immobilised form. The magnitude of impact may therefore be high.</p> <p>Due to existing mitigation and controls in place to manage the risk of radiological effects, including the use of ALARA and BAT principles, and the site's current radiological discharge rates, sensitivity is considered to be low.</p>	?	The potential build-up of plutonium daughter products via radioactive decay.
MT - LT	Closure of existing and future facilities <ul style="list-style-type: none"> Decommissioning activities such as demolition of facilities have the potential 	0	Due to the extensive procedures and controls in place to minimise or avoid discharges of radioactivity during decommissioning, including adherence to ALARA and BAT principles, any impacts associated with closure of existing or future facilities are unlikely to be significant.	✓	

Time-scale	Risk / Opportunity for Impact	Significance of Impact		Un-certainty	Factors affecting uncertainty
	to result in discharges of radioactivity.				
Water Resources and Quality					
(Potential Receptors: Flora and fauna, people, waterbodies, water abstraction points).					
(Indicators: Local water quality (EU Water Directive Rating), water abstraction volumes).					
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> • Could potentially impact water quality at the site through run-off from roads used by construction plant and vehicles. • May require an increase in water consumption which could put strain on water resources. 	---	<p>Construction would likely take place within the existing site boundary, with appropriate management procedures in place to keep pollutant discharges to a minimum. Impacts would therefore be of low magnitude.</p> <p>Because existing water quality at the site is considered to be good in accordance with the Water Framework Directive, sensitivity to contamination is considered to be medium.</p> <p>The very large volumes of water currently abstracted by the site (in 2012 this was reported as some 6 million cubic metres) suggest that sensitivity to further water consumption (likely during construction) may be high.</p>	?	The extent of construction activities would affect the volume of water that needs to be abstracted.
MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> • Depending on the pre-treatment technology used, there may be a requirement for water abstraction and risks of discharges to waterbodies. 	---	<p>During operation, radioactive and non-radioactive discharges to water from the fuel fabrication process are likely to be very small as non-aqueous processes are almost exclusively used.</p> <p>Processes such as solvent extraction may however be used in the plutonium pre-treatment process and can produce a number of liquid waste streams containing various separated impurities. The impurities in the feed material would likely have a lower radioactive content than liquid wastes from spent fuel reprocessing, making the liquid wastes easier to manage, but because they would not be produced in the baseline, the magnitude of impact can be considered high.</p> <p>As there are extensive existing controls in place to monitor and minimise discharges to waterbodies, and given the existing status of water quality and resources at the site, sensitivity to impacts during operation is considered to be low. There would be no planned discharges of contaminated solvents under any circumstances.</p>	?	Whether there is a requirement for a pre-treatment process, the proportion of the plutonium inventory that may require pre-treatment, the extent of indirect water abstraction and consumption needed to support workers etc.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
MT	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> • Could require increased water abstraction. • May increase the risk of pollutant discharges to water receptors. 	<p>–</p> <p>To decommission the existing facilities there may be a small increase in water consumption. There may also be heightened risk of discharges to water as the facilities could be contaminated, either radioactively or with other forms of hazardous contamination. Given the extensive existing controls in place to minimise discharges to water bodies, residual impacts would likely be of low magnitude.</p> <p>Due to existing high levels of water abstraction and usage by the site, any increases in water consumption may put additional strain on water resources. Sensitivity to impacts on water resources could therefore be medium.</p>	??	Water requirements during decommissioning.
LT	<p>Avoid maintaining existing facilities</p>	<p>0</p> <p>Given the relatively small volumes of water required in replacing the stores and repackaging the plutonium, the impact of avoiding such activities is unlikely to be significant.</p>	?	Water requirements during store replacement and repackaging.
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> • There may be substantial requirements for water abstraction and an increased risk of discharges to nearby waterbodies from decommissioning activities. 	<p>--</p> <p>Taking into account the potential extent of decommissioning activities required, the magnitude of impacts in terms of contamination and water abstraction may be medium.</p> <p>Because water quality at the site is good, its sensitivity to effects is considered medium. This is not anticipated to decline in the medium to long-term, and may improve once operations such as reprocessing are complete.</p> <p>Requirements for water abstraction involved in closing future facilities may place an additional burden on water resources at the site. Water consumption is currently very high and this may continue into the long-term. Sensitivity to increased water abstraction may therefore be considered medium.</p>	??	Changes in water abstraction and consumption at the site, (linked to timescales for decommissioning activities e.g. completion of spent fuel reprocessing operations). Changes in Water Framework Directive classifications.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
SOCIO-ECONOMICS				
Employment (Potential Receptors: Regional and national employment). (Indicators: Employment created / sustained, contribution to local labour market).				
ST	Development of new facilities <ul style="list-style-type: none"> Would create a full range of employment, from construction to highly-skilled and managerial jobs. 	<p>+++</p> <p>Employment estimates for construction of a fuel fabrication facility and one or more interim stores range from several hundred to a few thousand FTE per year.¹⁸ This could increase should one or more reactors need to be constructed to utilise the plutonium fuel.</p> <p>Construction is assumed to occur at Sellafield, which is within the Copeland district. Currently 5.5% (1,819 people) of the local population works in construction, suggesting it is an important contributor to local employment markets. Sensitivity is therefore considered medium.</p> <p>The potential construction requirement associated with this option is currently unknown, but up to double the existing capacity may be needed, which would constitute a high magnitude impact.</p>	??	Fuel fabrication technology used, potential employment requirements for other national nuclear projects.
MT	Operation of new facilities <ul style="list-style-type: none"> Would create a range of employment opportunities. 	<p>++</p> <p>Estimates suggest reuse could generate in the region of several hundred jobs.¹⁸ There may also be additional jobs associated with plutonium pre-treatment, transport and management of reactor sites.</p> <p>The current contribution of the “manufacturing” sector (which includes most decommissioning and fuel reprocessing work) to the local employment market in terms of jobs is roughly 10,000. Sensitivity is therefore considered high based on the importance of manufacturing jobs to the local labour market.</p> <p>The potential increase in employment in this sector from reuse is unknown, but is likely to constitute a low magnitude impact based on knowledge of facilities of a similar nature.</p>	??	Proportion of jobs created as new jobs, and the number transferred from other activities in the industry. For example, those involved in indefinite storage of plutonium.
MT	Closure of existing facilities Decommissioning has the potential to	<p>0</p> <p>To decommission existing facilities used to store the plutonium inventory, nuclear civil, construction, engineering and waste management experience may be required. However, this requirement is unlikely to generate enough</p>	✓	The complexity involved in decommissioning the

¹⁸ based on estimates from “Macro-economic study of Nuclear Materials” (ERM on behalf of the NDA, 2008) and estimates provided for analogous facilities.

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	create employment opportunities.			facilities. The availability of relevant expertise.
LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> Reuse would lead to eventual closure of existing stores and potential job losses associated with repackaging materials and maintaining the stores. 	0		No. of jobs supported by existing stores, the transferability of existing jobs to new facilities.
LT	Closure of future facilities <ul style="list-style-type: none"> Decommissioning of future facilities could result in job losses. 	-		Potential for facilities to be repurposed. Opportunities to retain/transfer jobs.
Knowledge and Skills				
(Potential Receptors: National skill base).				
(Indicators: Existence and degree of maintenance of skills, anticipated demand for nuclear skills, national nuclear knowledge and capabilities).				
ST - MT	Development of new facilities <ul style="list-style-type: none"> Will likely draw heavily on the local and regional supply of construction, engineering and civils workers. 	++		Specific skills required and the availability of such skills in the local or regional area.
MT	Operation of new facilities <ul style="list-style-type: none"> Could create opportunities to develop or enhance knowledge and skills. 	+++		Skill development may be time limited. Skills/knowledge opportunities may be transferable to other areas of the

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty	
		<p>knowledge may also be transferable to other areas of the nuclear industry. The magnitude of impact may therefore be high.</p> <p>Due to the importance of this field (nuclear power generation) to the region and nationally, sensitivity is considered medium.</p>		nuclear industry.	
MT	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> • Could create opportunities to enhance or maintain decommissioning skills and expertise. 	0	It is not expected that this requirement will be large or complex enough to result in significant impacts on skills development, or to significantly improve the knowledge or available skill base.	✓	
LT	<p>Avoid maintaining existing facilities</p> <ul style="list-style-type: none"> • Employment from management of the current plutonium stores may be lost. 	0	There may be some transferability of these roles to the new facilities. It is therefore unlikely that the closure of these facilities will significantly impact the skill base for this type of work.	✓	
LT	<p>Closure of future facilities</p> <ul style="list-style-type: none"> • Once fuel fabrication operations are completed and the plutonium inventory has been fully irradiated in the reactors, knowledge and skills would be lost. 	++	Given the potential transferability of nuclear fuel fabrication, radioactive material treatment and storage skills to other areas of the nuclear industry and the importance of such skills nationally, the long-term impact on the national skill base in terms of available knowledge and skills may be moderate positive.	?	Technologies used, potential transferability to other areas of the nuclear industry, future arisings of plutonium.
<p>Education and Training (Potential Receptors: National Skill Base). (Indicators: Likely future skill requirements and contribution to improving the UK skill base).</p>					
ST – MT - LT	<p>Development and operation of new facilities</p> <ul style="list-style-type: none"> • To ensure the correct skills are available to develop and implement reuse, education and training may be required. This could create opportunities at regional and national spatial scales. 	++	<p>Development of plutonium fuel fabrication and pre-treatment technologies may create education and training opportunities compared to the baseline of indefinite storage. This would likely occur in the short to medium-term during construction and operation, with benefits reducing following this period.</p> <p>R&D activities associated with plutonium reuse could benefit the UK in the long-term and may lead to further R&D programmes and education in the area of nuclear power generation and spent fuel management.</p>	?	Fuel fabrication and reactor technology implemented.
MT	<p>Closure of existing facilities</p>	0	It is unlikely that closure of existing facilities used to store the plutonium inventory would have any significant impacts in terms of education and	✓	

Time-scale	Risk / Opportunity for Impact	Significance of Impact		Un-certainty	Factors affecting uncertainty
			training. The skills and knowledge to carry out such decommissioning activities already exist.		
LT	Avoid maintaining existing facilities	0	No significant impacts on education and training are likely to arise from no longer maintaining and replacing the existing stores.	✓	
LT	Closure of future facilities	0	Following completion of fuel fabrication, there will likely be a requirement for additional decommissioning expertise to close the new facilities. Given the existence of such knowledge and skills, it is unlikely that there would be any significant requirement for or impact on education and training.	?	Technology used, whether facilities require a specialist approach to decommissioning.
Economy (Potential Receptors: Local and Regional economy). (Indicators: £ Gross Value Added).					
ST	Construction of new facilities <ul style="list-style-type: none"> Expenditure on plutonium reuse could have knock-on impacts on local, regional and national economic development. The nature and extent of potential benefits is dependent on local supply linkages and the demographics of the area in which money is invested.	++	Average Gross Value Added (GVA) per employee data for UK regions ¹⁹ can be multiplied by employment estimates for fuel fabrication in order to estimate total GVA contributions for the reuse option. The value for West Cumbria is £19,032 per employee. Depending on the number of construction jobs created (assuming the majority of employment is either sourced or based locally), which could range from hundreds of workers to a few thousand and the duration of the construction period (assumed to be 5 years), this results in a 5 year total of construction GVA of approximately £55 million to £400 million, or a construction sector increase of 3% - 24% a year. This would constitute a low to high magnitude impact. The construction GVA of West Cumbria in 2013 was £333 million, which equated to approximately 5 – 10% of total GVA for West Cumbria. This suggests the sector is of medium sensitivity based on its importance to the regional economy, giving an overall moderate positive impact.	??	Skill development may be time limited. Skills/ knowledge opportunities may be transferable to other areas of the nuclear industry.
		N/A	At the national level, economic impacts are tied to the capital spend required to achieve the objectives, offset by any financial benefits such as sale of fuel or generation of power. Cost has not been considered in this IIA and will be	N/A	

¹⁹ Office for National Statistics (2012)

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
				assessed in an independent assessment elsewhere.
MT	Operation of new facilities <ul style="list-style-type: none"> • Could lead to ongoing economic contributions to the local and regional economy. 	<p>++</p> <p>GVA per employee data can be multiplied by the expected FTE (jobs supported) per year of operation. The value for West Cumbria is £19,032 per employee. Assuming the majority of employment is either sourced or based locally, the result for operational GVA (depending on the scale of facilities) is between £5 million to £15 million per year for the duration of the operation period, equating to a manufacturing sector increase of approximately 0.3% to 0.9%. This would constitute a low magnitude impact.</p> <p>The manufacturing GVA of West Cumbria in 2013 was £1,666 million, (approximately 35 - 40% of total GVA for West Cumbria), suggesting the sector is of high sensitivity based on its importance to the regional economy.</p>	?	Fuel fabrication and reactor technology implemented, potential transferability to other areas of the nuclear industry, future arisings of plutonium requiring management.
MT	Closure of existing facilities <ul style="list-style-type: none"> • Decommissioning may require economic investment. 	<p>0</p> <p>Given the existing national skill base available to undertake decommissioning work, it is unlikely that there would be a need for significant investment in new skills or employment to enable the future facilities to close.</p>	?	Decommissioning programmes at other sites, availability of personnel and expertise.
LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> • Could lead to changes in the supply chain involved in indefinitely storing the plutonium. 	<p>0</p> <p>Deviation from the indefinite storage baseline could mean a loss of economic opportunities for some businesses but gains for others. This should be assessed at a local level.</p>	??	Opportunities for existing supply chain to be maintained, resilience of existing suppliers to adapt.
LT	Closure of future facilities <ul style="list-style-type: none"> • Could reduce economic contributions to the local and regional economy due to loss of employment. 	<p>-</p> <p>Eventual closure of the fuel fabrication and storage facilities could reduce spending and investment into the local economy. Given the size of the Sellafield site and the number of other operations that take place (and are assumed will continue to take place in the long-term), the magnitude of such impacts on the local economy are likely to be low.</p>	??	The site decommissioning programme, cumulative effects of other facilities closing.
Local and National Assets (Potential Receptors: local, regional and national community).				

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
(Indicators: Indices of Multiple Deprivation (IMD) ranking for barriers to housing and services, the existence of alternative facilities)				
ST - LT	Construction and operation of new facilities <ul style="list-style-type: none"> New transport infrastructure may be developed or existing transport infrastructure enhanced to improve access during construction. This could have benefits at a local level. An increase in employment could change local travel patterns and may lead to a reduction in access to community facilities and services. 	0 <p>Future transport of staff, materials and waste would likely be assessed in more detail at a site level, with negative impacts potentially mitigated through improvements in infrastructure. Transport movements are also likely to be spread out over a long period of time, in which case the overall impact of reuse on local assets can be considered neutral.</p> <p>The area around the Sellafield site (Copeland) is ranked within the 10% most deprived areas in relation to "Barriers to housing and services". The receptor could therefore have medium sensitivity to changes.²⁰</p>	??	Potential changes to site access routes would be highly dependent on the location of any facility(ies) and the estimated no. of vehicle movements involved.
MT - LT	Development of new facilities <ul style="list-style-type: none"> At a national scale, development of fuel fabrication, treatment and storage facilities may provide opportunities for the management of future arisings of plutonium. 	+ <p>The plutonium fuel fabrication facility and supporting infrastructure could potentially be retained or repurposed following the end of operation, providing opportunities to develop and maintain a national asset or assets capable of managing future arisings of plutonium from spent nuclear fuel, weapons material or foreign stockpiles. This could constitute a medium to long-term positive impact of medium magnitude.</p> <p>As alternative facilities already exist or are likely to be developed over time regardless of whether or not plutonium reuse is implemented, indicator sensitivity can be considered low.</p>	✓	The suitability of any developed facilities to manage future arisings, changes in government policy.
MT - LT	Closure of existing facilities and avoiding need to maintain them	0 <p>No significant impact on existing local and national assets is expected as a result of closing and decommissioning existing facilities and avoiding the need to maintain them.</p>	✓	
LT	Closure of future facilities	0 <p>No significant impact on existing local and national assets is expected as a result of the closure of future facilities.</p>	?	

²⁰ This Index includes the indicators of: road distance to a GP surgery, road distance to a general store or supermarket, road distance to a primary school and road distance to a Post Office or sub post office

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
HEALTH				
Respiratory and cardiovascular effects associated with changes in air quality				
<p>Cardiovascular health effects, respiratory illnesses and levels of chronic disease can be influenced by poor air quality. Studies have shown that there is a direct association between proximity to busy roads (including those travelled by a large number of heavy vehicles) and respiratory illness. Air quality can also influence levels of physical activity, which in turn can impact cardiovascular conditions and lead to stress.</p> <p>(Potential Receptors: The local population and non-motorised users in the local area, in particular infants, young children, the elderly and people with existing respiratory or cardiovascular conditions such as asthma).</p> <p>(Indicators: hospital admissions and mortality rates linked to cardiovascular illness, national health survey results).</p>				
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Construction works can negatively affect health through changes in air quality from emissions of pollutants such as NO_x, SO₂ and Particulate Matter. 	<p>–</p> <p>Effects of construction likely to be confined within the site boundary, so the magnitude of health impacts on the community can be considered low. Use of dust suppression techniques and other construction management practices can mitigate the risk of impacts on health through changes in air quality. Any new facilities would be designed to comply with air emission standards.</p> <p>Activities beyond the site boundary, such as the movement of vehicles would need to be carefully monitored and managed to avoid effects upon recreation and amenity areas, and levels of physical activity.</p> <p>Copeland, the district Sellafield is located in, has a high level of under 75 year-old mortality associated with cardiovascular illness (100.6 deaths per 100,000 compared to 81.1 for England (2010-2012)). Indicator sensitivity to impacts which affect the risk of respiratory and cardiovascular illnesses and conditions may therefore be considered medium.</p>	✓	<p>No. of vehicle movements and the timescales over which they occur, no. of facilities to be constructed, capacity of local medical facilities, proximity of residents and other receptors to activities.</p>
MT - LT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> May result in dust and some pollutant emissions through the ongoing use of plant and equipment and transport, which can affect health. 	<p>–</p> <p>Air quality changes during operations would likely be of low magnitude and continually monitored and mitigated. The magnitude of health impacts to the public would therefore also be low.</p> <p>Based on the health profile of Copeland, which suggests that the local population may be sensitive to health effects associated with changes in air quality, sensitivity can be considered medium. Cumulative effects on air quality at the site in the medium to long-term need to be considered.</p>	?	<p>Length of the operation phase and the fuel fabrication technology used, no. of transport movements.</p>

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
MT - LT	<p>Closure of existing and future facilities</p> <ul style="list-style-type: none"> Potential to negatively impact health through dust and pollutant emissions from demolition plant and vehicles. Changes in air quality could negatively impact use of recreation and amenity areas and levels of physical activity. 	<p>–</p> <p>As with construction, effects of closure and demolition are likely to be confined within the site boundary and may be mitigated through the use of good construction and demolition practice. The magnitude of potential health impacts would therefore likely be low.</p> <p>Based on the health profile of Copeland, which has higher than average levels of cardiovascular illness and scored poorly on the most recent national health survey, sensitivity can be considered medium.</p>	?	How recreation and amenity areas would be impacted and how the local population would respond, availability of other amenity and recreation areas.
MT - LT	<p>Avoid maintaining existing facilities</p> <ul style="list-style-type: none"> Could help to reduce the risk of respiratory and cardiovascular illness through avoidance of ongoing construction and maintenance activities. 	<p>+</p> <p>In the medium and long-term there could be positive health effects from avoiding activities to repackage the plutonium and maintain existing facilities. Given the relatively minor extent of construction activities required and the fact that they are spread out over a relatively long period of time, impact magnitude is low.</p> <p>Taking into account the health profile of Copeland, sensitivity is considered medium.</p>	??	Extent of maintenance and repackaging activities required, changes to the health baseline of the local population (may become more or less sensitive).
<p>Annoyance, sleep disturbance, cardiovascular effects, potential hearing damage and other health effects associated with changes in noise levels</p> <p>Health effects from changes in noise levels can relate to communication, school performance, sleep, aggression and annoyance in addition to cardiovascular effects and potential hearing damage.</p> <p>(Potential Receptors: The local population and non-motorised users of the local area including the road network, in particular infants, young children and the elderly). (Indicator: hospital admissions and mortality rates linked to cardiovascular illness, national health survey results)</p>				
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Could cause increased noise and vibration, particularly from activities such as excavation and piling, and through the transport of plant and construction materials. 	<p>–</p> <p>Impacts of construction and transport on noise and vibration would likely occur only in the short-term and be confined within or near the site boundary. Good construction practice can ensure the magnitude of impacts is low.</p> <p>Noise and vibration impacts which affect the use of recreation and amenity areas and levels of physical activity may have a further negative impact on the health of the local population.</p> <p>Sensitivity of receptors to noise and vibration from traffic movements during construction, particularly those near to the site access road, may be medium.</p>	??	Extent of the construction works required, location of the new facilities, types of equipment and plant used, no. of transport movements and timescale over which they occur.
MT	<p>Operation of new facilities</p>	<p>0</p> <p>As noise and vibration impacts during operation would be confined within the</p>	✓	

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	<ul style="list-style-type: none"> Increased noise and vibration from operation of plant and facilities. 	<p>site boundary there are unlikely to be any significant health effects upon the local population.</p>		
MT	<p>Closure of existing and future facilities</p> <ul style="list-style-type: none"> Noise and vibration levels can increase as a result of demolition, and have the potential to lead to negative impacts on health. 	<p>–</p> <p>Impacts of demolition noise and vibration would likely occur over a relatively short period of time but could extend beyond the site boundary. Good construction and demolition practice can reduce the magnitude of noise and vibration impacts, in which case residual impact magnitude would be low. Taking into account the proximity of residential properties and local cycle routes, receptor sensitivity may be medium.</p>	?	Demolition required, types of equipment and plant used, no. of transport movements (linked to the proportion of waste material that can be reused on-site).
LT	<p>Avoid maintaining existing facilities</p> <ul style="list-style-type: none"> Reuse would avoid the noise and vibration-generating works needed to replace and maintain existing stores. 	<p>0</p> <p>Given the extent of activities required to repackaging the plutonium and maintain existing facilities, and the fact that they would be confined within the site boundary, there are unlikely to be any significant health effects from changes in noise and vibration.</p>	✓	
<p>Effects on physical activity and obesity</p> <p>The UK government recommends that adults, children and young people should aim to be active daily. In addition to formal recreation facilities (e.g. playing fields and leisure centres), high quality walking and cycling infrastructure are increasingly recognised as important for promoting health. The use of recreation areas, local amenities and levels of physical activity undertaken by the local population can be impacted through environmental changes in air quality, noise, visual disturbance and traffic.</p> <p>(Potential Receptors: The local population, in particular groups who regularly use recreation and amenity areas, including children and users of national cycle routes). (Indicators: Levels of physical activity and obesity, availability of recreational facilities).</p>				
ST	<p>Expansion of new facilities</p> <ul style="list-style-type: none"> Can potentially reduce the attractiveness and usage of recreation and amenity areas through visual disturbance from plant and vehicles, and through changes in traffic volumes and patterns on the local road network. <p>This can lead to changes in levels of physical activity undertaken by the local</p>	<p>–</p> <p>As the majority of environmental effects which could influence use of recreational areas and local amenities would be confined within or close to the site boundary, the magnitude of impacts from a health perspective is likely to be low.</p> <p>Copeland has a higher percentage of adults classed as obese (28.3%) and overweight or obese (75.9%) than the England average (23%) and (63.8%) respectively (Active People Survey 2012).</p> <p>Based on the health profile of Copeland and the proximity of recreational receptors (there is both a national and a local cycle route close to the site),</p>	??	Extent of the construction required, location of the new facilities, types of equipment and plant required

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
	population.		sensitivity to impacts from construction may be medium.	
MT	Operation of new facilities <ul style="list-style-type: none"> There may be a number of environmental effects (e.g. noise, air quality and landscape and visual) which could impact the attractiveness of local recreational and amenity areas. 	0	Due to the relatively minor environmental effects anticipated to arise from operation of the new fuel fabrication and storage facilities, impacts on local recreational and amenity areas (and subsequently levels of physical activity) are unlikely to be significant.	✓
MT - LT	Closure of existing and future facilities <ul style="list-style-type: none"> Changes in air quality, noise and visual disturbance associated with demolition and closure works (including transport of waste materials off-site) could reduce the use of recreation and amenity areas and levels of physical activity. 	-	Decommissioning activities are likely to be confined mainly within the site boundary, but will require careful management through construction/ demolition good practice to ensure that the magnitude of impacts is low. Based on the health profile of Copeland and the proximity of receptors to the site, sensitivity to impacts from works to close existing facilities can be considered medium.	?
LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> Avoiding activities which affect use of local recreation and amenity areas could lead to increased levels of physical activity and lower levels of obesity. 	0	As activities to maintain and replace existing facilities used to store the plutonium inventory take place over a relatively long period of time and are confined within the site boundary, there are unlikely to be any significant effects on local recreation and amenity features from avoiding them.	✓
Health and Safety Effects from Road Traffic Changes Studies have shown that people modify their behaviours in response to increased road traffic. As traffic increases, social networks tend to decrease. This affects people's sense of community and healthy social interaction. Increased traffic can also reduce levels of physical activity by discouraging non-motorised forms of transport such as walking and cycling. Potential health effects relating to road traffic changes include potential increases in the risk of road accidents, stress levels experienced whilst travelling and reduced				

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
<p>levels of social contact. (Potential Receptors: The local population, in particular road users, non-motorised road users and groups who regularly use recreation and amenity areas e.g. children). (Indicators: Accident statistics).</p>				
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Can result in increased traffic levels due to the movement of plant and vehicles. This has the potential to increase driver stress, the risk of road accidents and exacerbate physical and mental health conditions. 	<p>–</p> <p>Impacts on the local road network from transport in the short-term until the facilities are constructed. Vehicle movements would likely be spread out over a considerable length of time, making the magnitude of impact low. Given existing and historic accident figures for the A595, the main road which links to the site access road, sensitivity to traffic changes may be considered medium.</p>	?	No. / timing of transport movements (linked to no. of facilities constructed), cumulative developments, changes in the local transport network and travel patterns.
MT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> There may be a requirement for ongoing transport movements. 	<p>0</p> <p>During operation, it is anticipated that the majority of transport movements would be intra-site (movements associated with transporting fuel to the reactors will be covered in assessments elsewhere). Given the relatively short distances involved and the secure nature of the site (i.e. no public access) it is not anticipated that there would be significant impacts on users of the local transport network.</p>	??	Location of reactors, no. and timing of transport movements.
MT - LT	<p>Closure of existing and future facilities</p> <ul style="list-style-type: none"> An increase in transport movements during decommissioning could affect the local road network and has the potential to lead to increased stress, anxiety and risk of road accidents. 	<p>–</p> <p>As transport movements during decommissioning would be spread out over a considerable period of time, any residual impacts upon the local road network would be of low magnitude. Given existing and historic accident figures for the A595, the main road which links to the site access road, sensitivity to traffic changes may be considered medium.</p>	?	See construction of new facilities (above).
LT	<p>Avoid maintaining existing facilities</p>	<p>0</p> <p>Unlikely to be any significant effects on the local transport network or any effects which alter the risk of traffic accidents from avoiding activities to replace and maintain the existing stores.</p>	✓	
<p>Health effects relating to changes in the water environment Changes to the water environment can affect drinking water and food supplies such as fish stocks. They can also affect agriculture, direct recreation facilities (e.g.</p>				

Time-scale	Risk / Opportunity for Impact	Significance of Impact	Un-certainty	Factors affecting uncertainty
recreational angling, kayaking) and wider recreational resources (e.g. views of water along countryside walks). Loss of such recreational water resources can reduce levels of physical activity, leading to a number of potential health effects. In some cases, water and food contamination can result in short and long-term illnesses. (Potential Receptors: The local population, groups who abstract water from local sources (e.g. for irrigation) and users of recreational water bodies). (Indicators: Water quality, hospital admissions, physical activity rates).				
ST - MT	Construction of new facilities <ul style="list-style-type: none"> • Could potentially impact water quality at the site through run-off from roads used by plant and vehicles. • Likely to require an increase in water consumption which may put strain on water resources. 	- Short-term changes to the water environment from construction activities could have health implications if they affect drinking supplies or recreational resources. If a contaminant is long lasting, it could stay within water bodies or water systems for a prolonged period of time. Monitoring and the use of good construction practice would minimise impacts upon the water environment and ensure that any residual health impacts were of low magnitude. Requirements for water abstraction are unlikely to affect recreational use of water resources.	?	Dewatering required as part of construction, piling requirements and depths of excavations (could impact groundwater), type of contaminants and how long lasting they are.
MT - LT	Operation of new facilities <ul style="list-style-type: none"> • There may a requirement for water abstraction and potential for radioactive and non-radioactive discharges to local water bodies. This can lead to health effects associated with water contamination. 	0 Processes such as solvent extraction may be used in the plutonium pre-treatment process and can produce a number of low level radioactive liquid waste streams. However, under no circumstances would there be planned discharges of contaminated solvents to waterbodies. As there are extensive existing controls in place to monitor and minimise discharges to waterbodies, including the use of ALARA and BAT, and given absence of water-based recreational activities downstream of the site, there are unlikely to be any significant effects on health relating to changes in the water environment during operation.	?	Technology used and the use of any aqueous processes.
MT - LT	Closure of existing and future facilities <ul style="list-style-type: none"> • Decommissioning has the potential to result in contamination of local water bodies. This could lead to health effects upon the local population and recreational users of these features. 	- As demolition activities would be confined within the site boundary and controlled through construction good practice and monitoring, any residual impacts are likely to be of low magnitude. Given existing good water quality at the site and the non-use of nearby waterbodies for recreational purposes, sensitivity to minor contamination which could lead to health effects is low.	✓	

Time-scale	Risk / Opportunity for Impact	Significance of Impact		Un-certainty	Factors affecting uncertainty
LT	Avoid maintaining existing facilities	0	There are unlikely to be any significant effects on the water environment or associated health effects on the local population from avoiding activities to replace and maintain existing stores.	✓	
<p>Radiological safety related health effects Effects relating to potential radiological exposure could include fear of exposure, and the mental health and wellbeing impacts associated with this, as well as direct exposure due to discharges. (Potential Receptors: Local population and in particular children and pregnant women). (Indicators: Discharge rates at the site, RIFE total reported dosages to the public).</p>					
ST - MT - LT	<p>Operation of new facilities and closure of existing facilities</p> <ul style="list-style-type: none"> Reusing the plutonium inventory offers potential health opportunities as the material would be removed from existing facilities (which may be deteriorating) and converted into a safer and more secure form. 	++	<p>In the short-term there may be a potential spike in risk associated with managing the plutonium due to intra-site transport to the newly constructed facilities. Such transport movements would be carefully managed and subject to appropriate safety cases.</p> <p>In the medium to long-term, producing plutonium in a disposable form (irradiated fuel) would make it safer and more secure. This could significantly reduce the risk profile of the material to a level well below that in the baseline scenario, under which the material would be stored indefinitely in its current form. The magnitude of this positive impact would be high.</p> <p>Due to the use of extensive controls (including adherence to ALARA and BAT principles), the radiological health risk of keeping plutonium indefinitely in its current form is considered low. Sensitivity to changes is therefore low.</p>	✓	
<p>Mental health and Wellbeing effects Changes in employment and income can influence people's mental health, as can changes in the environment through disturbance and pollution. Further health effects relating to mental health and wellbeing can include depression, anxiety, stress, changes in community cohesion and changes in levels of physical activity. (Potential Receptors: Mental health statistics for local population, visitors, regional population).</p>					
ST	Construction of new facilities	+	Under the reuse option employment would be generated during construction.	??	No. of jobs created,

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	<ul style="list-style-type: none"> Likely to create employment opportunities, which studies have shown can positively influence mental health and wellbeing. 			duration of the construction works, where employment is sourced from.
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> May lead to negative impacts on mental health and wellbeing due to the range and extent of environmental effects experienced by the local population. Such health effects might include annoyance, anxiety or stress. 	-		Extent of environmental impacts, duration of the construction works.
MT - LT	<p>Operation of new facilities</p> <ul style="list-style-type: none"> Has the potential to offer socio-economic opportunities which may have positive effects for the mental health of those employed. Possible risk of adverse environmental effects which can influence health through increased stress and anxiety. 	+		Socio-economic opportunities available, whether these are made available to local population, environmental impacts and whether they can be mitigated.
ST - LT	<p>Closure of existing and future facilities</p> <ul style="list-style-type: none"> Can lead to negative environmental effects which might affect mental health and wellbeing, as well as negative socio-economic effects from possible job losses. Could have positive mental health and wellbeing effects such as reduced anxiety, stress and improved social cohesion from employment generated to carry out decommissioning and removal 	-		No. of jobs created, how many jobs lost/transferred, timescales for closures. Nature and extent of environmental impacts.

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January 2016

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	of facilities from the landscape.	Overall, there is likely to be a minor negative effect on mental health and wellbeing associated with closing facilities.		

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