



Nuclear
Decommissioning
Authority



NDA Strategy (2021)

Integrated Impact Assessment Report

Volume 2: Detailed Options Assessment

Post-Consultation Final

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1.0 Introduction

This Volume of the Integrated Impact Assessment (IIA) Report (2021) contains detailed assessment tables presenting the results of the assessment of the NDA Strategy (2021). 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 topic strategies 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 topic strategies have been assessed

Theme	Topic strategy	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 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 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 through discussion of potential environmental, socio-economic and health effects associated with them.
	Land Use	x	✓	Land Use is a site-specific consideration, so there is no single preferred option. Consequently, Land Use has no baseline scenario and these options have been assessed through discussion of potential environmental, socio-economic and health effects associated with them.
Spent Fuels	Spent oxide fuels	✓		<p>There are two credible options for managing the remaining inventory of spent oxide fuel:</p> <ul style="list-style-type: none"> continued interim storage of fuel in existing facilities pending treatment and packaging prior to disposal to a Geological Disposal Facility (GDF); build new storage facilities and interim store pending treatment and packaging prior to disposal to a GDF. <p>The preferred option in the 2016 Strategy was to manage spent oxide fuels in existing</p>

Theme	Topic strategy	Assessed...		Reason
		in detail	through discussion	
				reprocessing and storage facilities in line with contractual commitments, with interim storage of unprocessed spent oxide fuel pending a future decision on whether to declare them as waste for disposal in a GDF. Consequently, the credible options in this 2021 Strategy can both be viewed as a continuation of that preferred option. However, the first of these two options (storage in existing facilities) forms the baseline in this assessment.
	Spent Magnox fuels	✓		<p>There are three credible options for managing the remaining inventory of spent Magnox fuel:</p> <ul style="list-style-type: none"> • Continue as planned, maximise the reprocessing of suitable Spent Magnox fuels prior to ending operations in late 2021. Interim store remaining material pending treatment and packaging prior to disposal to a GDF. This is taken as the baseline scenario. • Stop reprocessing of suitable Magnox fuel early and interim store the remaining material pending treatment and packaging prior to disposal to a GDF. This is a credible alternative option assessed in detail. • Extend reprocessing operations to ensure all suitable Spent Magnox fuels is reprocessed and interim store Spent Magnox fuels not suitable for reprocessing pending treatment and packaging prior to disposal to a GDF. This is a credible alternative option assessed in detail.
	Exotics	×	✓	<p>Credible options for the disposition of exotic spent fuels have been developed since the 2016 Strategy. Two options have been identified:</p> <ul style="list-style-type: none"> • consolidate exotic spent fuels at Sellafield, and interim store in existing or modified facilities pending treatment and packaging prior to disposal in a GDF; • consolidate exotic spent fuels at Sellafield, build new storage facilities and interim store pending treatment and packaging prior to disposal in a GDF. <p>There are a number of different types of exotic fuels and the preferred option may vary with the fuel type, therefore credible options have been assessed through discussion of their potential environmental, socio-economic and health effects.</p>

Theme	Topic strategy	Assessed...		Reason
		in detail	through discussion	
Nuclear Materials	Plutonium	✓		<p>There are three credible options for managing the NDA inventory of civil plutonium:</p> <ul style="list-style-type: none"> Continued safe and secure storage, renovating and replacing stores as required, which was the preferred option in the previous Strategy and forms the baseline in this assessment, Build facilities to make fuel to enable use in a third-party reactor prior to storage and disposal of the irradiated fuel to a GDF (credible alternative option assessed in detail). Build facilities to condition and treat plutonium prior to storage and disposal to a GDF (credible alternative option assessed in detail).
	Uranium	✗	✓	<p>There are two credible options for the management of the uranium inventory:</p> <ul style="list-style-type: none"> Continued safe and secure storage pending sale for reuse where practicable. Continued safe and secure storage pending conditioning to an appropriate form for disposal. <p>No preferred option was identified in the previous Strategy for the management of uranium because of its diversity. Similarly, in this Strategy, no single preferred management option for the whole inventory is identified. The preferred option will need to be determined on a group-by-group basis. Therefore, credible options have been assessed through discussion of their potential environmental, socio-economic and health effects.</p>
Integrated Waste Management	Radioactive Waste	✗	✓	<p>Decisions regarding management of higher activity waste are undertaken on a case-by-case basis. As such there is no baseline scenario and options have been assessed through discussion of potential environmental, socio-economic and health effects associated with them.</p> <p>The NDA strategy for managing solid Low Level Waste (LLW), which includes Very Low Level Waste (VLLW), is consistent with the UK Nuclear Industry LLW Strategy [1]. Therefore, from an NDA perspective, there are no strategic decisions to make and no credible options to assess.</p>
	Liquid and Gaseous Discharges	✗	✗	<p>In June 2018, the UK government reviewed its UK Strategy for Radioactive Discharges [2]. As the NDA had a significant role in the development and implementation of the UK</p>

Theme	Topic strategy	Assessed...		Reason
		in detail	through discussion	
				Strategy for Radioactive Discharges, a separate strategy for the NDA estate is not required.
	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. In this Volume 2 we provide the detailed assessment of options where more than one credible option has been identified and sufficient information is available for this assessment to be undertaken. In these cases, credible options are assessed against the identified baseline strategy, so the baseline strategy is not assessed in this volume.

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 England, Scotland and Wales. No NDA sites are located in Northern Ireland, but the geographic scope of this assessment still includes Northern Ireland in cases where impacts may affect Northern Ireland.

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 (around 2120). However, it is also assumed that the Strategy 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 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 Spent Oxide Fuels

3.1.1 New storage facilities – Description of Option

Option	Build new storage facilities and interim store pending treatment and packaging prior to disposal to a GDF (New storage facilities)	
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 had been irradiated in UK reactors was reprocessed in the Thermal Oxide Reprocessing Plant (THORP) at Sellafield which started operation in 1994 and ceased operation in 2018.</p> <p>Reprocessing of spent fuel in THORP provided uranium and plutonium products. Now that operations at THORP have ceased, the only strategic decision for the NDA is how to store the remaining unprocessed inventory. The baseline scenario assumes that the remaining spent fuel will be stored in THORP Receipt and Storage before being disposed of to a GDF.</p> <p>As a result, in this option, new storage facilities are built to store the spent oxide fuel inventory pending treatment and packaging prior to disposal at a GDF. This store could be in a new pond, cask store or dry store. It should be noted that under the baseline scenario, the spent oxide fuels inventory will be stored in existing facilities pending treatment and packaging prior to disposal at a GDF. Thus, the main differences between this option and the baseline relate to the building of new stores rather than the scale of disposal facilities, and the treatment and packaging required prior to disposal.</p>	
Details/ Activities	<p>Construction of new facilities This option would involve building new storage capacity for AGR spent fuel compared to the baseline.</p> <p>Operation of new facilities Under this option, the spent oxide fuels inventory would need to be moved from the existing stores into the new facilities, before being moved again to be disposed in a GDF.</p>	<p>Closure of existing and new facilities As the spent oxide fuels inventory will be stored in existing facilities in the baseline scenario, this option would lead to the closure of those facilities. However, the existing facilities will be closed anyway, once the spent oxide fuels inventory has been disposed of to a GDF. Thus, implementation of this option would bring forward the closure programme by a number of decades, but not lead to closure of existing facilities directly. There would however be an eventual requirement to close the new facilities once the inventory had been fully disposed of.</p> <p>Avoid need to maintain existing facilities Building new facilities would avoid the need to maintain or replace existing facilities.</p>

3.1.2 New storage facilities – Assessment

Timescale	Risk / Opportunity for Impact	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. This can be directly through the use of plant or indirectly through the transport of materials and waste.	-	Magnitude may be low in the short-term, because vehicle movements are likely to be spread out over a sufficient period of time for the effect upon local air quality to be low. Standard construction good practice and additional mitigation measures can reduce the generation of dust (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.	?	Number of facilities requiring construction, the timing of construction (including seasonal works which may influence the dispersal of pollutant emissions).
MT – LT	Operation of existing and new facilities <ul style="list-style-type: none"> • Emissions of pollutants through use of equipment and plant to move spent oxide fuels inventory into new facilities, and operation of new storage facilities. 	0	There are two competing effects in the operation of the new facilities. New storage facilities would be more modern, and so may have lower operational emission of pollutants, although this impact is likely to be small. The movement of the spent oxide fuels inventory into the new facilities will lead to an increase in emission over the baseline, however the magnitude of this effect will likely be small. Existing air quality at the site is well within Air Quality Objectives so indicator sensitivity is low. Given the nature of the likely stores and controls in place to manage pollutant emissions magnitude can be considered low.	✓	Number of fuel movements required. Operational emissions of new storage facilities.
MT	Closure of existing facilities <ul style="list-style-type: none"> • Pollutant-emitting activities such as demolition and transport movements. 	0	As the existing facilities will require closing in the future anyway, implementation of this option would bring forward impacts on air quality but would not significantly affect their magnitude.	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
LT	<p>Closure of new 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>As these new facilities would eventually require decommissioning there would be a minor negative impact on air quality for implementation of this option at some point in the future. The impact would be small because controls can be applied during decommissioning to mitigate impacts on air quality. Air quality at the site is not anticipated to significantly worsen in the long-term, so indicator sensitivity would remain low.</p>	✓	<p>Number of facilities requiring decommissioning, the timing of demolition (including seasonal works)</p>
<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, 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>	??	<p>Number and scale of facilities requiring construction, characteristics of nearby sites of value for nature conservation (both designated and non-designated) and other ecological receptors, number of transport movements involved and the time over which they occur.</p>
MT – LT	<p>Operation of existing and new facilities</p> <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. 	<p>0</p> <p>Given the nature of the storage facilities 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.</p>	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
MT	Closure of existing facilities <ul style="list-style-type: none"> Pollutant-emitting activities such as demolition and transport movements could affect ecological receptors. 	0	As the existing facilities will require closing in the future anyway, implementation of this option would bring forward impacts on biodiversity, flora and fauna but would not significantly affect their magnitude.	✓	
LT	Closure of new 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 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 could have further implications in terms of embodied carbon. Impacts on climate change and energy use from use of plant and equipment. <p>The impact of increased CO₂ emissions may continue beyond the end of construction.</p>	--	<p>Considering the size and likely activities associated with construction of new facilities, which are not needed in the baseline option, the magnitude of impact in terms of CO₂ emissions 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, defined as 'emissions from industry except for those associated with fuel combustion (for example, emissions from cement manufacture)' [3].</p> <p>Given the overall steady decline in CO₂ emissions in the industrial process sector between 1990 and 2018, and the relatively modest contribution of the sector to UK emissions, indicator sensitivity is considered low.</p>	?	<p>Embodied carbon of materials used, complexity and number of facilities (may affect construction programmes)</p> <p>Contribution of the facility(ies) to industrial process sector CO₂ emissions, changes in sector targets. Ability to adapt to avoid, mitigate and offset carbon emissions.</p>

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
MT – LT	Operation of existing and 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 storage facilities and the fact that effects on climate change and energy use during operation would likely be similar to those under the baseline scenario, the impact can be considered neutral.	?	Contribution of the facility(ies) to industrial process sector CO ₂ emissions, changes in sector targets. Ability to adapt to avoid, mitigate and offset carbon emissions.
MT	Closure of existing facilities <ul style="list-style-type: none"> CO₂ generating activities such as demolition and transport of plant, equipment and waste. 	0	As the existing facilities will require closing in the future anyway, implementation of this option would bring forward impacts on climate change and energy use but would not significantly affect their magnitude.	✓	
LT	Closure of new 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. 	--	Considering the size and likely activities associated with decommissioning of new facilities, which are not needed in the baseline option, the magnitude of impact in terms of CO ₂ emissions generated may be medium in the long-term, when the new storage facilities are decommissioned. In the future, international and national carbon emission targets are likely to be stricter. Indicator sensitivity may therefore increase to medium.	??	Changes in CO ₂ targets or legislation and technology (including vehicle and industrial carbon capture), volume of waste generated and whether this can be reused or recycled. Ability to adapt to avoid, mitigate and offset carbon emissions.
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).					

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty	
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 affect existing coastal defences (natural and man-made) and may provide opportunities to further protect coastlines from erosion. 	<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>The vast majority of the Sellafeld site 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 coastal erosion and sea level rise, any changes to existing coastal defences.	
MT – LT	Operation of existing and new facilities	0	There are unlikely to be any significant effects in terms of coastal change and flood risk from operation of newly-built stores or from operation of existing facilities.	✓	
MT	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 of existing storage facilities will have a significant impact in terms of reducing flood risk. There is unlikely to be any significant coastal change over this timeframe.	✓	
LT	<p>Closure of new facilities</p> <ul style="list-style-type: none"> Decommissioning may create opportunities to reduce flood risk. 	0	Given that the vast majority of 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).
<p>Cultural Heritage (Potential Receptors: Listed buildings, Scheduled Ancient Monuments, Registered Parks and Gardens, Conservation Areas).</p>					
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Potential to affect cultural and built heritage receptors directly through 	0	Given the likelihood that any construction works would be confined within the site boundary, there are unlikely to be any significant effects upon cultural heritage.	✓	.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
	changes to their setting or indirectly through other environmental effects.				
MT – LT	Operation of existing and 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 final waste products to a GDF (which will be covered in assessments elsewhere) and would be required under the baseline scenario, activities involved in operation would be intra-site. As such, 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.	✓	
MT	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 the existing facilities will require closing in the future anyway, implementation of this option would bring forward potential impacts on cultural heritage but would not significantly affect their magnitude.	✓	
LT	Closure of new facilities See closure of existing facilities (above).	0	As most 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	Construction 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 (as low as reasonably achievable) and BAT (best available techniques) principles and other institutional controls would minimise releases. Given the extent of construction works required to build new facilities, the impact magnitude would likely be medium.	✓	The extent of construction activities and proximity to areas of existing contamination.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty	
	Construction of new facilities <ul style="list-style-type: none"> Soil resources would likely be used up during construction and excavation activities. 	<p>–</p> <p>Given the likely extent of construction activities required to build interim stores, the magnitude of the impact 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 impact magnitude could be reduced to low.</p> <p>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.</p>	✓		
MT – LT	Operation of existing and new facilities	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 either from under implementation of this option or in the baseline scenario.</p>	✓	
MT	Closure of existing facilities <ul style="list-style-type: none"> Activities such as demolition have the potential to result in ground contamination. 	0	As the existing facilities will require closing in the future anyway, implementation of this option would bring forward impacts on geology and soils but would not significantly affect their magnitude.	✓	
LT	Closure of new facilities <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>Implementation of this option would lead to new facilities requiring decommissioning, so the effect on the geology and soils both 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 decommissioning 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. 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.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
<p>Landscape and Visual (Potential Receptors: The local population, cyclists, pedestrians and equestrians using local routes, flora and fauna, tourists and other visitors to the area). (Indicators: The local landscape).</p>				
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Potential adverse effect on the local landscape from construction of multiple industrial facilities. 	<p style="text-align: center;">-</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>Although Sellafield is located near a National Park, the industrial nature of the site and its prominence in the local landscape means sensitivity of the surrounding landscape to further adverse changes can be considered low. Cumulative effects need to be considered</p>	✓	<p>Potential reuse of waste materials would reduce requirement for transport movements. If construction of facilities were to extend beyond the existing site boundary this could have increased visual impacts.</p>
MT - LT	<p>Operation of existing and 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 style="text-align: center;">0</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). However, such effects would also occur if existing facilities continued to be used. Overall, no additional landscape or visual impacts are expected with the implementation of this option compared to the baseline.</p> <p>Although Sellafield is located near a National Park, the industrial nature of the site and its prominence in the local landscape means sensitivity of the surrounding landscape to further adverse changes can be considered low.</p>	?	<p>Decommissioning of other facilities at the site could increase the prominence of the interim stores. Location of stores.</p>
MT	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> Could create some landscape and visual opportunities. 	<p style="text-align: center;">0</p> <p>As the existing facilities will require closing in the future anyway, implementation of this option would bring forward positive landscape and visual impacts. However, given the relatively short timeframes involved, the effect of this is unlikely to be significant.</p>	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
LT	Closure of new 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.	?	Type of storage facility constructed.
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 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 build new stores would involve materials such as concrete and steel, which could have an additional high magnitude impact 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 a large amount of new material would need to be imported.	?	Ability to reuse existing materials from site.
MT - LT	Operation of existing and new facilities <ul style="list-style-type: none"> Wastes and materials associated with operation of new stores. 	+	New facilities may be more efficient than existing facilities, and so require fewer materials and generate less waste. However, stores do not use much material or produce much waste in any case, so any impact compared to the baseline is expected to be minor, but positive.	?	Efficiency improvements associated with new stores.
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. 	0	As the existing facilities will require closing in the future anyway, implementation of this option would simply bring forward any demolition activities, and associated material usage and waste generation. Thus, no significant additional impacts are expected.	✓	
LT	Closure of new facilities <ul style="list-style-type: none"> Potential for generating substantial volumes of radioactive and non-radioactive waste. 	--	Any new stores would lead to a large volume of additional waste being generated above the baseline, some of which may be radioactive. Overall, this would result in a high magnitude negative impact. Taking into account the success of the UK Strategy for the management of management of radioactive wastes, considerable progress has been made	?	Capacity of the LLWR and other disposal facilities, the nature of the waste (i.e. radioactive or non-

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
				radioactive), the programme.
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. 	<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>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>	??	The location and extent of construction works, number of transport movements and the timescale over which they occur.
MT - LT	Operation of existing and new facilities <ul style="list-style-type: none"> Potential noise and vibration impacts associated with additional intra-site transports from existing stores to the new facilities. 	<p>Any noise and vibration impacts associated with 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 compared to the baseline.</p>	?	Number of intra-site transports.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
MT	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 existing facilities will require closing in the future anyway, implementation of this option would simply bring forward noise and vibration impacts but would not significantly affect their magnitude.	✓	
LT	Closure of new 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. 	-	Noise and vibration impacts from decommissioning activities can be mitigated through standard demolition good practice. Any residual impacts would be of low magnitude. 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	??	The number 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 existing and new facilities <ul style="list-style-type: none"> May include radiological discharges associated with operation of new stores. 	0	New stores may have slightly lower radiological discharges than existing facilities as a result of design improvement. However, any such improvements would have a minimal effect over the baseline, as discharges associated with existing facilities are already very small. Any positive impacts of new facilities will also be offset by the potential for increased discharges as a result of transporting the spent oxide fuels inventory from the current facilities into the new stores. Due to existing mitigation and controls in place to manage the risk of radiological effects, including the use of ALARA and BAT principles, sensitivity is considered low.	✓	
MT	Closure of existing facilities	0	As the existing facilities will require closing in the future anyway, implementation of this option would simply bring forward impacts on radiological discharges but would not significantly affect their magnitude.	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
	<ul style="list-style-type: none"> Decommissioning activities such as demolition of facilities have the potential to result in discharges of radioactivity. 				
LT	<p>Closure of new facilities</p> <ul style="list-style-type: none"> Decommissioning activities such as demolition of facilities have the potential to result in discharges of radioactivity. 	-	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 new facilities are likely to be low. Discharge rates for the site as a whole are likely to decrease in the long-term, so receptor sensitivity is considered medium.	?	Future site discharge rates
<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).</p>					
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. Given the likely extent of construction works required to build new 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 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, changes in volume of water abstracted as site activities change, proportion of water volume new construction activity uses.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
MT-LT	Operation of existing and new facilities <ul style="list-style-type: none"> Potential requirement for water abstraction. 	+	<p>Given current storage facilities for spent oxide fuels is in ponds, new dry storage facilities may lead to reduced requirements on water abstraction. New wet storage facilities would not be associated with this benefit. Overall, implementation of this option is deemed to lead to a low magnitude positive impact on water resources and quality.</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 is low.</p>	?	Type of storage facility used. Indirect water abstraction and consumption needed to support workers etc.
MT	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	<p>As the existing facilities will require closing in the future anyway, implementation of this option would simply bring forward impacts on water resources and quality but would not significantly affect their magnitude.</p>	✓	
LT	Closure of new facilities <ul style="list-style-type: none"> There may be substantial requirements for water abstraction and an increased risk of discharges to nearby waterbodies. 	--	<p>Building new facilities will lead to an increase in decommissioning activities required compared to the baseline, and the magnitude of impacts in terms of contamination and water abstraction would likely be medium.</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.</p> <p>Water abstraction involved in closing the new 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 also be considered medium.</p>	??	<p>Changes in water abstraction and consumption at the site, (linked to timescales for decommissioning activities).</p> <p>Changes in Water Framework Directive classifications.</p>

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
SOCIO-ECONOMICS				
Employment (Potential Receptors: Regional and national employment). (Indicators: Employment created or sustained, contribution to employment markets).				
ST	Construction of new facilities • Construction of the interim stores would create a full range of employment, from construction to highly-skilled and managerial jobs.	++ There would be new jobs associated with the construction of new storage facilities compared to the baseline. The precise number of such jobs, and their distribution within the supply chain, will depend on the type of store constructed. However, it is likely that construction of a new store would lead to up to about a few hundred jobs for a number of years. Construction is assumed to occur at Sellafield, which is within the Copeland district. About 9.2% (3,030 people) of the local population works in construction [4], suggesting it is an important contributor to local employment markets. Sensitivity is therefore considered medium. The potential increase in construction capacity of about 10% would constitute a medium magnitude impact.	??	Type of facilities constructed, construction duration period, number of jobs associated with construction.
MT-LT	Operation of existing and new facilities	0 Assuming new stores and current stores would require similar levels of resource to function, building new facilities would not have an impact on the number of jobs in the region in the long-term. However, in the medium-term, both stores would need to be operational while the spent oxide fuels inventory was transferred into the new store, which may have a positive impact on jobs during this period. However, the size of this impact is sufficiently small that it is likely to be insignificant.	✓	
MT	Closure of existing facilities • Decommissioning of current facilities would create a range of employment opportunities.	0 As the existing facilities will require closing in the future anyway, implementation of this option would simply bring forward impacts on jobs but would not significantly affect their magnitude.	✓	
LT	Closure of new facilities	++ Decommissioning of the new stores would lead to a number of jobs being created compared to the baseline scenario. However, given extant	?	Potential for facilities to be modified to manage

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
	<ul style="list-style-type: none"> Decommissioning of new facilities. 		decommissioning activities on site, the magnitude of this impact is likely to be low. The contribution of the “manufacturing” sector (which includes most decommissioning and fuel reprocessing work) to the local employment market in terms of jobs is roughly 6,578 [4]. Sensitivity is therefore considered high based on the importance of manufacturing jobs to the local labour market.		other waste streams. Proportion of jobs created as new 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. 	+	To build new storage facilities, 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. Given the anticipated demand for nuclear engineering, civil and construction workers over the next decade to work on the UK’s new nuclear projects, building a new storage facility could have a negative impact, although likely small, through increasing pressure on the national skill base. However, this impact would likely be mitigated by the transfer of workers from the national workforce to nuclear roles. Overall, this option is deemed to have an overall low magnitude positive impact on knowledge and skills compared to the baseline, and sensitivity is considered low.	?	Specific skills required and the availability of such skills in the local or regional area.
MT-LT	Operation of existing and new facilities <ul style="list-style-type: none"> Could create opportunities to develop or enhance knowledge and skills. 	0	This option would maintain existing skills, which would be used during operation of the stores, but do little to facilitate the development of new skills and improve knowledge. As such skills would be maintained under the baseline, there are unlikely to be any significant effects associated with implementation of this option.	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
MT-LT	Closure of existing facilities <ul style="list-style-type: none"> • Could create opportunities to develop or enhance knowledge and skills. 	+	Requirements for decommissioning associated with closure of the existing storage facilities 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.	✓	
LT	Closure of new 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. 	0	Once any new facilities were closed, there would be an associated loss of knowledge and skills. However, such loss would also be expected for the baseline scenario, and so any impacts associated with the implementation of this option would be insignificant.	✓	
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	0	As the minor education and training benefits that could be achieved from storing the spent oxide fuels in new stores rather than existing stores would be achieved under the baseline, implementation of this option is unlikely to have any significant additional effects.	✓	
MT	Closure of existing facilities	0	It is unlikely that closure of existing storage facilities 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 or require a specialist approach.
LT	Closure of new facilities	0	Following completion of disposal, there will likely be a requirement for decommissioning expertise to close the new 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).					

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST	Construction of new facilities <ul style="list-style-type: none"> Expenditure on building new stores 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. 	+	<p>Average Gross Value Added (GVA) per employee data for UK regions can be multiplied by employment estimates to estimate total GVA contributions for this option.</p> <p>The value for West Cumbria is £22,030 per employee [5]¹. Assuming the majority of employment is either sourced or based locally, and construction employs between 100 and 500 workers for about 2 years this results in a total construction GVA of between £4 million and £22 million, or a construction sector increase of between 1% and 4% a year. This would constitute a low magnitude impact.</p> <p>The construction GVA of West Cumbria in 2018 was £279 million, which equated to about 5% 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 minor positive impact.</p>	?	<p>Number of workers required and construction timescales.</p> <p>Type of storage facility constructed.</p>
		N / A	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.	N/A	
MT-LT	Operation of existing and new facilities <ul style="list-style-type: none"> Could lead to ongoing economic contributions to the local and regional economy. 	0	<p>Assuming new stores and current stores would require similar levels of resource to function, building new facilities would not have an impact on the number of jobs in the region in the long-term. However, in the medium-term, both stores would need to be operational while the spent oxide fuels inventory was transferred into the new store, which may have a small positive impact on the economy during this period.</p> <p>However, the size of this impact is sufficiently small that it is likely to be insignificant.</p>	?	Proportion of jobs created as new jobs, and the number transferred from other activities in the industry. Duration of the operation phase.
MT	Closure of existing facilities	0	As the existing facilities will require closing in the future anyway, implementation of this option would simply bring forward impacts on the economy but would not significantly affect their magnitude.	✓	

¹ Value is for 2018, which is provisional. The value for 2017 is £21,430 suggesting numbers reported here will be insensitive to finalisation of this 2018 value.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
	<ul style="list-style-type: none"> Could reduce economic contributions to the local and regional economy due to loss of employment. 				
LT	<p>Closure of new facilities</p> <ul style="list-style-type: none"> Decommissioning may require nuclear civils, construction and engineering experience, which could lead to economic investment. 	++	<p>Closure of new storage facilities is likely to lead to a low magnitude positive impact on jobs compared to the baseline. This would have a corresponding low magnitude impact on GVA.</p> <p>The manufacturing GVA of West Cumbria in 2018 was £1,627 million (about 32% of total GVA for West Cumbria), suggesting the sector is of high sensitivity based on its importance to the regional economy. Thus, implementation of this option is deemed to have an overall positive moderate impact compared to the baseline.</p>	??	<p>Potential for stores to be used for alternative waste streams.</p> <p>Proportion of jobs created as new jobs.</p>
<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 of new facilities</p> <ul style="list-style-type: none"> 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 disposal on local assets can be considered neutral.</p> <p>The area around the Sellafield site (Copeland) is ranked the 215th most-deprived Local Authority District out of 317 in England in relation to “Barriers to housing and services”. The receptor therefore has low sensitivity to changes.²</p>	??	<p>Potential changes to site access routes would be highly dependent on the location of treatment and storage facilities and the estimated number of vehicle movements involved.</p>
ST - LT	<p>Development of new facilities</p> <ul style="list-style-type: none"> At a national scale, development of storage facilities may provide 	0	<p>Opportunities may exist as part of storing the spent oxide fuels inventory to develop and maintain a national asset(s), which could be useful for other waste streams. This would constitute a positive impact of low magnitude.</p>	✓	

² 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, road distance to a Post Office or sub post office, measures of household overcrowding, homelessness and housing affordability.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
	opportunities for the management of other waste streams.		However, interim stores already exist under the baseline scenario, so there are unlikely to be any additional significant effects in terms of national assets from implementation of this option.		
MT - LT	Closure of existing and new facilities	0	No significant impact on existing local and national assets is expected as a result of the closure of existing or new 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	Construction 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.	-	Magnitude may be low in the short-term, because vehicle movements are likely to be spread out over a sufficient period of time for the effect upon local air quality to be low. General health statistics for residents in the Copeland are slightly poorer than the health statistics for the UK as a whole, so indicator sensitivity is medium.	?	Extent of facilities to be constructed, capacity of local medical facilities, proximity of residents and other receptors to activities.
MT - LT	Operation of existing and 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	Transport of waste from existing stores into new stores would result in pollutant emissions compared to the baseline. Such emissions are anticipated to be small and continually monitored and mitigated, so any difference is unlikely to result in a significant impact	?	Number of intra-site transports.
MT	Closure of existing facilities	0	As the existing facilities will require closing in the future anyway, implementation of this option would simply bring forward health impacts	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
	<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. 		associated with air quality, but would not significantly affect their magnitude.		
LT	<p>Closure of new 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>General health statistics for residents in the Copeland are slightly poorer than the health statistics for the UK as a whole, so indicator sensitivity is medium.</p>	?	Extent to which recreation and amenity areas would be impacted and how the local population would respond, 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>(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"> 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>	??	Extent of the construction works required, location of the new facilities, types of equipment and plant used, number of transport movements and timescale over which they occur.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
MT – LT	Operation of existing and new facilities <ul style="list-style-type: none"> Potential increased noise and vibration from operation of stores. 	0 <p>Any noise and vibration impacts associated with 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, there are unlikely to be any significant health impacts associated with noise and vibration during operation over and above what would be expected in the baseline scenario.</p>	?	Number of intra-site transports.
MT	Closure of existing facilities <ul style="list-style-type: none"> Noise and vibration levels can increase as a result of demolition, and have negative impacts on health. 	0 <p>As the existing facilities will require closing in the future anyway, implementation of this option would simply bring forward health impacts associated with noise and vibration, but would not significantly affect their magnitude.</p>	✓	
LT	Closure of new facilities <ul style="list-style-type: none"> Noise and vibration levels can increase as a result of demolition, and have negative impacts on health. 	– <p>Noise and vibration impacts from decommissioning activities can be mitigated through standard demolition good practice. Any associated health 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 and general health statistics for residents in the Copeland are slightly poorer than the health statistics for the UK as a whole, indicator sensitivity is medium. It is likely this would need to be verified through further assessment.</p>	??	Extent of demolition required, equipment and plant used, number of transport movements.
Effects on physical activity and obesity 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				

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
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. (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	Construction 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. 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
MT-LT	Operation of existing and 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	✓	
MT	Closure of existing 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. 	0	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
LT	<p>Closure of new 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 and 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.</p>	?	Proximity of existing and new facilities to recreational and amenity areas, number of transport movements required (linked to amount of generated waste).
<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>–</p> <p>There may be 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>	?	Number and timing of transport movements (linked to number of facilities constructed), cumulative developments, changes in local transport network and travel patterns.
MT - LT	<p>Operation of existing and 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 the conditioned wastes to a GDF will be covered in assessments elsewhere).</p>	✓	Number and timing of transport movements.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
			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.		
MT	Closure of existing facilities <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. 	0	As the existing facilities will require closing in the future anyway, implementation of this option would simply bring forward any impacts from road traffic changes but would not significantly affect their magnitude.	✓	
LT	Closure of new facilities <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. 	-	Impacts on the local road network from transport whilst decommissioning and demolition of new stores is undertaken. 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.	?	Number and timing of transport movements (linked to number of facilities constructed), cumulative developments, changes in local transport network and travel patterns.
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. 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. 	-	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.	?	Dewatering required as part of construction, piling requirements and depths of excavations

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
	<ul style="list-style-type: none"> Likely to require an increase in water consumption which may put strain on water resources. 		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.		(could impact groundwater), type of contaminants and how long lasting they are.
MT - LT	Operation of existing and new facilities <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. 	0	<p>There is a small risk of effects on water quality during operation, and such effects would also be expected for the baseline. In addition, any reduction in requirements for water abstraction from implementation of this option are not deemed to have a significant health effect compared to the baseline. Overall, no significant impact is expected in either case.</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>	✓	
MT	Closure of existing 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 any recreational users of these features. 	0	As the existing facilities will require closing in the future anyway, implementation of this option would simply bring forward any impacts on the water environment but would not significantly affect their magnitude.	✓	
LT	Closure of new 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 any recreational users of these features. 	-	<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
Radiological safety related health effects					

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
<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. (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 existing and new facilities, and closure of existing facilities</p> <ul style="list-style-type: none"> Radiological risks associated with the storage and intra-site transport of the spent oxide fuels inventory. 	<p>0</p> <p>A new store would be constructed to modern standards, and therefore offer a higher level of radiological protection than the existing stores. However, movement of the spent oxide fuels inventory introduces additional risks that would not be encountered under the baseline scenario.</p> <p>Due to the use of extensive controls (including adherence to the principles of ALARA and BAT), the actual radiological health risk represented by the spent oxide fuels inventory, and movement of the inventory, is considered low. In addition, sensitivity to changes is also considered to be low.</p> <p>Overall, the effect of building new stores on radiological safety is considered to be neutral.</p>	✓	
<p>Mental health and Wellbeing effects</p> <p>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	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Likely to create employment opportunities, which studies have shown can positively influence mental health and wellbeing. 	<p>+</p> <p>Building new facilities 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.</p>	??	<p>Number of jobs created, duration of the construction works.</p>
	<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 	<p>-</p> <p>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</p>	??	<p>Extent of environmental impacts, duration of the construction works.</p>

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
	experienced by the local population. Such health effects might include annoyance, anxiety or stress		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.		
ST – MT	Operation of existing and new facilities <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. 	0	No significant impacts are expected on mental health and wellbeing compared to the baseline option.	✓	
MT	Closure of existing facilities <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. 	0	As the existing facilities will require closing in the future anyway, implementation of this option would simply bring forward any impacts on the water environment but would not significantly affect their magnitude.	✓	
LT	Closure of new facilities <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. 	0	The closure of new facilities would generate some additional employment during decommissioning. 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.	??	Number of jobs created, how many jobs lost or transferred, timescales for closures. Nature and extent of environmental impacts.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
	<ul style="list-style-type: none"> • 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>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 neutral effect on mental health and wellbeing associated with closing facilities.</p>		

3.2 Spent Magnox Fuels

3.2.1 Stop reprocessing – Description of Option

Option	Stop reprocessing of suitable Spent Magnox fuel early and interim store the remaining material pending treatment and packaging prior to disposal to a GDF (Stop)	
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 Spent Magnox fuels, but the facilities for this are ageing and may close before reprocessing of the irradiated inventory has been completed.</p> <p>Under the baseline option, unprocessed Spent Magnox fuels will be placed in self-shielded boxes and placed in an interim store pending treatment, conditioning and packaging prior to disposal to a GDF. In the stop reprocessing early option, an additional volume of unprocessed Spent Magnox fuels will require storage in the same manner. 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 2076). 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 and availability of the GDF.</p> <p>For the purpose of the assessment it has been assumed that conditioning involves placing the Spent Magnox fuels into appropriate self-shielded boxes.</p>	
Details/ Activities	<p>Construction of new facilities Given the additional Spent Magnox fuel that may need to be conditioned and stored for this option, there may be a need to build another interim storage facility over and above that required for the baseline. In this assessment, we assume that a single additional facility is required above that need for the baseline.</p> <p>Operation of new facilities For this option, there is assumed to be an additional interim store required compared to the baseline.</p>	<p>Closure of existing facilities As the Magnox reprocessing plant is scheduled to be closed in late 2021, implementation of this option would bring the closure programme for the finishing and waste treatment plants forward. However, the fuel handling plants would still be required to place the remaining spent fuel into containers. As such, this option would bring forward closure programmes for some plant by a few months, but would not lead to closure of existing facilities directly.</p> <p>Avoid need to maintain existing facilities Scheduled closure of the Magnox reprocessing plant around late 2021 means that implementation of this option would avoid the need to maintain the Magnox reprocessing and downstream plant for a period of about a few months. However, the Fuel Handling Plant, where unprocessed fuel would be kept would still need to be maintained so that unprocessed fuel can be placed in self-shielded boxes.</p>

3.2.2 Stop reprocessing – 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.	–	Magnitude may be low in the short-term, because vehicle movements are likely to be spread out over a sufficient period of time for the effect upon local air quality to be low. Standard construction good practice and additional mitigation measures can reduce the generation of dust (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.	? Number of facilities requiring construction, the timing of construction (including seasonal works which may influence the dispersal of pollutant emissions).
ST - LT	Operation of existing and new facilities <ul style="list-style-type: none"> • Emissions of pollutants through use of equipment and plant to move Spent Magnox fuels inventory into new facilities, and operation of new storage facilities. 	+	The new storage facilities would be associated with operational emission of pollutants, although this negative impact is likely to be small because of the controls that would be in place to manage these emissions. However, implementation of this option would cease operational emissions associated with the Magnox reprocessing facility and downstream plant early, which would lead to a small positive impact on air quality. This positive impact is likely to be greater than the negative impact associated with the operation of new stores, because of the scale and age of the Magnox reprocessing facilities. Existing air quality at the site is well within national Air Quality Objectives so indicator sensitivity is low.	? Length by which operation of existing facilities shortened.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
MT	Closure of existing facilities <ul style="list-style-type: none"> Pollutant-emitting activities such as demolition and transport movements. 	0	As the existing facilities will require closing in the future anyway, implementation of this option would bring forward impacts on air quality but would not significantly affect their magnitude.	✓	Length by which operation of existing facilities shortened.
LT	Closure of new 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 these new facilities would eventually require decommissioning there would be a minor negative impact on air quality for implementation of this option at some point in the future. The impact would be small because controls can be applied during decommissioning to mitigate impacts on air quality. Air quality at the site is not anticipated to significantly worsen in the long-term, so indicator sensitivity would remain low.	✓	Number 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	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, 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.	??	Number and scale of facilities requiring construction, characteristics of nearby sites of value for nature conservation (both designated and non-designated) and other ecological receptors, number of transport movements involved and the time over which they occur.
ST - LT	Operation of existing and 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 storage facilities 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	✓	

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
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 in late 2021 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 new 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 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).
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. The impact of increased CO ₂ emissions may continue beyond the end of construction.	-	Considering the size, nature and likely activities associated with construction of new facilities, which are not needed in the baseline option, the magnitude of impact in terms of CO ₂ emissions generated may be medium 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, defined as 'emissions from industry except for those associated with fuel combustion (for example, emissions from cement manufacture)' [3]. Given the overall steady decline in CO ₂ emissions in the industrial process sector between 1990 and 2018, and the relatively modest contribution of the sector to UK emissions, indicator sensitivity is considered low.	?	Embodied carbon of materials used, complexity and number of facilities (may affect construction programmes) Contribution of the facility to industrial process sector CO ₂ emissions, changes in sector targets. Ability to adapt to avoid, mitigate and offset carbon emissions.
ST - LT	Operation of existing and new facilities <ul style="list-style-type: none"> Impacts on climate change and energy use from use of plant and equipment. 	+	There would be energy usage associated with the operation of new facilities. However, the energy usage benefits of early cessation of reprocessing operations are likely to mean implementation of this option implies a small	?	Contribution of facilities to industrial process sector CO ₂ emissions,

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
			decrease in the extent of energy use and carbon emissions generated, 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.		changes in sector targets, duration of operation of existing facilities. Ability to adapt to avoid, mitigate and offset carbon emissions.
MT	Closure of existing facilities • CO ₂ emission-generating activities such as demolition and transport of plant, equipment and waste.	0	As the existing facilities will require closing in the future anyway, implementation of this option would bring forward impacts on climate change and energy use but would not significantly affect their magnitude.	✓	
LT	Closure of new facilities • CO ₂ emission-generating activities such as demolition. • Would require energy use.	-	Considering the size, nature and likely activities associated with decommissioning of new facilities, which are not needed in the baseline option, the magnitude of impact in terms of CO ₂ emissions generated may be low in the long-term, when the new storage facilities are decommissioned. In the future, international and national carbon emission targets are likely to be stricter. Indicator sensitivity may therefore increase to medium.	??	Changes in CO ₂ targets or legislation and technology, volume of waste generated and whether this can be reused or recycled. Ability to adapt to avoid, mitigate and offset carbon emissions.
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 • 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	-	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. The vast majority of the Sellafield site is located in Flood Zone 1, defined as having less than a 1 in 1000 chance of flooding occurring each year. The site	?	The extent of coastal erosion and sea level rise, any changes to existing coastal defences.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
	man-made) and may provide opportunities to further protect coastlines from erosion.		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 - LT	Operation of existing and new facilities	0	There are unlikely to be any significant effects in terms of coastal change and flood risk from operation of newly-built stores or from operation of existing facilities.	✓	
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 by a few months will have a significant impact on flood risk. There is unlikely to be significant coastal change over this timeframe.	✓	
LT	Closure of new facilities • 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.	0	Given the likelihood that any construction works would be confined within the site boundary, there are unlikely to be any significant effects upon cultural heritage.	✓	
ST - MT	Operation of existing and new facilities • Could affect cultural heritage features through changes in noise and other environmental effects.	0	Aside from potential movements associated with transporting the 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. Despite the small increase in Spent Magnox fuels inventory being managed under this option, residual impacts	✓	

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
			are unlikely to be significant assuming monitoring is undertaken if required and appropriate mitigation is used to manage impacts from noise.		
ST	<p>Closure of existing 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. 	0	As the Magnox reprocessing plant is scheduled for closure in late 2021, disposal would bring forward potential impacts on cultural heritage by a few months, but would not significantly affect the magnitude of such impacts.	✓	
LT	<p>Closure of new 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. 	0	As most decommissioning works would likely be confined within the site boundary, there are unlikely to be any significant effects upon cultural heritage features.	✓	
<p>Geology and Soils (Potential Receptors: Geodiversity, designated geological sites, high quality land such as that used for agriculture).</p>					

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
ST - MT	Construction 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. 	<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 required to build new facilities, the impact magnitude would likely be low.</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.</p>	✓	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 excavation activities. 	<p>– Given the likely extent of construction activities required to build interim stores, the magnitude of the impact 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 reduced to low.</p> <p>– 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.</p>	✓	
ST - MT	Operation of existing and new facilities	<p>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.</p>	✓	
ST	Closure of existing facilities <ul style="list-style-type: none"> Activities such as demolition have the potential to result in ground contamination. 	<p>0 As the Magnox reprocessing plant is scheduled for closure in late 2021, implementation of stopping reprocessing early would bring forward impacts on geology and soils by a few months, but would not significantly affect the magnitude of such impacts.</p>	✓	
LT	Closure of new facilities	<p>– Implementation of this option is assumed to lead to a new facility requiring decommissioning. The effect on the geology and soils both at the site and at the sites where waste arisings are managed would likely be minor. The use</p>	??	Extent of decommissioning activity required (including

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
	<ul style="list-style-type: none"> Decommissioning plant and interim storage facilities could impact soil quality and land contamination at the site. 	<p>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>		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, flora and fauna, tourists and other visitors to the area). (Indicators: The local landscape).</p>				
ST	<p>Construction 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 would likely have a low magnitude effect upon the landscape and may adversely affect views from nearby locations.</p> <p>Although Sellafield is located near a National Park, the industrial nature of the site and its prominence in the local landscape means 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 were to extend beyond the existing site boundary this could have increased visual impacts.
ST - LT	<p>Operation of existing and new facilities</p> <ul style="list-style-type: none"> Facilities are a constant feature of the landscape for many years. Ongoing transport movements from transporting the waste products to a disposal facility. 	<p>0</p> <p>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). However, the small increase in unprocessed Spent Magnox fuels inventory being managed under this option are unlikely to be significant in this context.</p>	✓	
ST	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> Could create some landscape and visual opportunities. 	<p>0</p> <p>As the Magnox reprocessing plant is scheduled for closure in late 2021 under the baseline, stopping reprocessing early would bring forward positive landscape and visual impacts, but given the relatively short timeframes involved, the effect of this is unlikely to be significant.</p>	✓	

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
LT	Closure of new 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.	?	Size of storage facility constructed. Duration of operational phase of Magnox reprocessing.
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"> • Construction of new facilities would require substantial volumes of material. Some of this material may be sourced from reusable material already on-site and some may be imported from primary sources. 	--	Construction works to build new stores would involve materials such as concrete and steel, which could have an additional medium 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 a large amount of new material would need to be imported.	?	Ability to reuse existing materials from site.
ST - LT	Operation of existing and new facilities <ul style="list-style-type: none"> • Disposing of the inventory of Spent Magnox fuels carries environmental risks. Implementation of the disposal for a greater portion of the inventory would avoid generation of HAL (Highly Active Liquor), a highly radioactive liquid waste stream which requires careful management, thereby offering an opportunity. 	-	Compared to the baseline of reprocessing the Spent Magnox fuels inventory through existing facilities, stopping Magnox reprocessing earlier would require classifying additional unprocessed material as waste. Given the current stage of reprocessing operations, this volume would be small. This option therefore generates a small volume of packaged waste during operation, constituting a negative impact of low magnitude. In the baseline, HAL is produced as a liquid waste stream as a result of reprocessing activities. Whilst disposal of additional unprocessed material would generate waste requiring disposal, which would increase in volume following conditioning and packaging, the nature of this waste could make it easier to manage compared to the liquors produced under the baseline scenario. 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.	✓	

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
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. 	0	As the Magnox reprocessing plant is scheduled for closure in late 2021 under the baseline scenario, implementation of stopping reprocessing early would bring forward impacts on materials and wastes from closure of existing facilities by a few months, but not significantly affect their magnitude.	✓	
LT	Closure of new 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>Any new stores would lead to an additional volume of waste being generated above the baseline, some of which may be radioactive. Overall, this would likely result in a medium magnitude negative impact.</p> <p>Taking into account the success of the UK Strategy for the management of radioactive wastes, considerable progress has been made in diverting LLW and VLLW from disposal at the LLWR and similar facilities through reuse, recycling and decontamination. Consequently, any LLW or VLLW generated from the closure of new facilities is likely to have a suitable waste management route available. Sensitivity is therefore considered low.</p>	?	Capacity of the LLWR and other disposal facilities, the nature of the waste (i.e. radioactive or non-radioactive), the programme.
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. 	–	<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>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>	??	The location and extent of construction works, number of transport movements and the timescale over which they occur.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST - MT	<p>Operation of existing and new facilities</p> <ul style="list-style-type: none"> Potential noise and vibration impacts associated with the processes used to condition and package the Spent Magnox fuels. Noise from intra-site transport from existing stores to the facilities, and potential off-site transport to a GDF. 	0	<p>Any noise and vibration impacts associated with 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. 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 of the new facilities.</p> <p>Given that similar effects would likely manifest in the baseline scenario, or even be slightly reduced, the impact of ceasing Magnox reprocessing operations early is deemed to be insignificant compared to baseline.</p>	?	Number of intra-site transports.
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. 	0	As the Magnox reprocessing plant is scheduled for closure in late 2021 under the baseline scenario, stopping reprocessing early would bring forward noise and vibration impacts by a few months but would not significantly affect their magnitude.	✓	
LT	<p>Closure of new 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>Noise and vibration impacts from decommissioning activities can be mitigated through standard 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.
<p>Radiological Discharges (Potential Receptors: The environment, people, flora and fauna). (Indicators: Discharge rates at the site, extent of controls and existing mitigation in place).</p>					

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
ST - LT	Operation of existing and 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>+</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, placing in self-shielded boxes is a relatively low risk process because there is no production of any hazardous by-products. Disposing of the small volume of additional unprocessed material 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 (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 final conditioning and packaging plant could mean the Spent Magnox fuels 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 facilities <ul style="list-style-type: none"> Decommissioning activities such as demolition of facilities have the potential to result in discharges of radioactivity. 	<p>0</p> <p>As the existing facilities will require closing in the future anyway, implementation of this option would simply bring forward impacts on radiological discharges but would not significantly affect their magnitude.</p>	✓	
LT	Closure of new facilities <ul style="list-style-type: none"> Decommissioning activities such as demolition of facilities have the potential to result in discharges of radioactivity. 	<p>-</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 new facilities are likely to be low. Discharge rates for the site as a whole are likely to decrease in the long-term, so receptor sensitivity is considered medium.</p>	?	Future site discharge rates
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	<p>-</p> <p>Construction would likely take place within the existing site boundary, with appropriate management procedures in place to keep pollutant discharges to</p>	?	The extent of construction activities would affect the volume

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
	<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>a minimum. Given the likely extent of construction works required to build new stores, impacts upon water resources and quality would 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 to be medium.</p> <p>The very large volumes of water currently abstracted by the site suggest that sensitivity to further water consumption (likely during construction) may be high.</p>		of water that needs to be abstracted, changes in volume of water abstracted as site activities change, proportion of water volume new construction activity uses.
ST - MT	<p>Operation of existing and new facilities</p> <ul style="list-style-type: none"> • Potential requirement for water abstraction. 	<p>+</p> <p>Compared to the baseline where a number of aqueous processes used during reprocessing produce liquid waste streams, ceasing reprocessing early 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 the Magnox reprocessing plant is scheduled for closure in late 2021 under the baseline scenario, this option would bring forward impacts on water resources and quality by a few months, but would not significantly affect the magnitude of such impacts.</p>	✓	
LT	<p>Closure of new facilities</p> <ul style="list-style-type: none"> • Requirements for water abstraction and an increased risk of discharges to nearby waterbodies from decommissioning activities. 	<p>-</p> <p>Building a new storage facility will lead to an increase in decommissioning activities required compared to the baseline, but the magnitude of these impacts in terms of contamination and water abstraction compared to the baseline is likely 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.</p> <p>Water abstraction involved in closing the new facilities may place further burden on water resources at the site. Water consumption is currently very</p>	??	<p>Changes in water abstraction and consumption at the site, (linked to timescales for decommissioning activities).</p> <p>Changes in Water Framework Directive classifications.</p>

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
		high and this may continue into the long-term. Sensitivity to increased water abstraction may therefore also be considered medium.		
SOCIO-ECONOMICS				
Employment (Potential Receptors: Regional and national employment). (Indicators: Employment created or sustained, contribution to employment markets).				
ST	Construction of new facilities <ul style="list-style-type: none"> Construction of encapsulation plant and interim stores would create a full range of employment, from construction to highly-skilled and managerial jobs. 	<p>+</p> <p>There would be new jobs associated with the construction of a new storage facility compared to the baseline. It is likely that construction of a new store would lead to between about 50 and 100 jobs for a number of years.</p> <p>Construction is assumed to occur at Sellafield, which is within the Copeland district. About 9.2% (3,030 people) of the local population works in construction [4], suggesting it is an important contributor to local employment markets. Sensitivity is therefore considered medium.</p> <p>The potential increase in construction capacity of about 3% would constitute a low magnitude impact.</p>	?	Type of facilities constructed, construction duration period, number of jobs associated with construction.
ST - MT	Operation of existing and new facilities <ul style="list-style-type: none"> Would create some employment opportunities. 	<p>--</p> <p>The Magnox reprocessing facility currently employees about 450 people, with about another 500 people employed in downstream plants.</p> <p>Under this option, operation of the Magnox reprocessing facility and supporting plants would stop early. As such, there would be a reduction in the number of jobs associated with continued operation of existing facilities compared to the baseline. As the Magnox reprocessing facilities are scheduled for closure in late 2021 in the baseline, this would be a very short-term impact and is deemed to be of low magnitude.</p> <p>The operation of a new storage facility would create a very small number of jobs. This effect is likely to be insignificant compared to the baseline.</p> <p>The contribution of the “manufacturing” sector (which includes most decommissioning and fuel reprocessing work) to the local employment market</p>	?	Proportion of jobs transferred to other activities (e.g., conditioning, packaging and decommissioning activities). How early Magnox reprocessing stops.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
			in terms of jobs is roughly 6,578 [4]. Sensitivity is therefore considered high based on the importance of manufacturing jobs to the local labour market.		
ST	Closure of existing facilities <ul style="list-style-type: none"> Disposal of the unprocessed Spent Magnox fuels 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. 	0	As the Magnox reprocessing plant is scheduled for closure in late 2021 under the baseline scenario, this option would bring forward impacts on employment by a few months, but would not significantly affect the magnitude of such impacts.	✓	
LT	Closure of new facilities <ul style="list-style-type: none"> Decommissioning of new facilities could result in job losses. 	++	<p>Decommissioning of a new store would lead to a number of jobs being created compared to the baseline scenario. However, given extant decommissioning activities on site, the magnitude of this impact is likely to be low.</p> <p>The contribution of the “manufacturing” sector (which includes most decommissioning and fuel reprocessing work) to the local employment market in terms of jobs is roughly 6,578 [4]. Sensitivity is therefore considered high based on the importance of manufacturing jobs to the local labour market.</p>	?	Potential for new facility to be modified to manage other waste streams. Proportion of jobs created as new 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"> Would draw heavily on the local and regional supply of construction, engineering and civils workers. 	0	<p>To build a new storage facility, there would be some additional employment generated, including construction, highly-skilled and managerial jobs. It is anticipated a greater proportion of these jobs would be of a relatively lower skill requirement.</p> <p>In addition, storage facilities for unprocessed Spent Magnox fuels would still be required under the baseline scenario, so any impact on skills from ceasing reprocessing early is unlikely to be insignificant.</p>	?	Specific skills required and the availability of such skills in the local or regional area.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST - LT	<p>Operation of existing and new facilities</p> <ul style="list-style-type: none"> • Could create opportunities to develop or enhance knowledge and skills. 	0	<p>Employment supported by the Magnox reprocessing plant and downstream facilities may be lost, leading to early degradation of knowledge and skills. As the facilities are scheduled for closure in late 2021, the impact of this early loss of skills and knowledge would be very short-term and minor.</p> <p>However, storing increased volumes of spent Magnox fuels in SSBs will provide the opportunity for improved knowledge and skills related to the storage of Magnox alloy in a dry environment. Again, this impact is likely to be very small and minor.</p> <p>Overall, these two effects are deemed to cancel out, and the resulting impact is deemed insignificant.</p>	?	Degree to which skills that have been lost are required for other activities, increased volume of stored spent Magnox fuel.
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. 	0	As the existing facilities will require closing in the future anyway, implementation of this option would simply bring forward impacts on knowledge and skills, but would not significantly affect their magnitude.	✓	
LT	<p>Closure of new facilities</p> <ul style="list-style-type: none"> • Once disposal operations are completed and the Spent Magnox fuels inventory has been fully managed, knowledge and skills would be lost. 	0	Once any new facilities were closed, there would be an associated loss of knowledge and skills. However, such loss would also be expected for the baseline scenario, and so any impacts associated with the implementation of this option would be insignificant.	✓	
<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>	0	There are unlikely to be any education and training benefits from building and operating an additional storage facility over those achieved under the baseline.	✓	

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
	<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. 				
ST - MT	Closure of existing facilities	0	As the existing facilities will require closing in the future anyway, implementation of this option would simply bring forward impacts on education and training, but would not significantly affect their magnitude.	✓	
LT	Closure of new facilities	0	It is unlikely that closure of new facilities used to reprocess the Spent Magnox fuels 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 or 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 early cessation of Spent Magnox fuels reprocessing 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 can be multiplied by employment estimates to estimate total GVA contributions for this option. The value for West Cumbria is £22,030 per employee [5] ³ . Assuming the majority of employment is either sourced or based locally, and construction employs between 50 and 100 workers this results in a total construction GVA of between £1 million and £2 million per year, or a construction sector increase of around 1% a year. This would constitute a low magnitude impact. The construction GVA of West Cumbria in 2018 was £279 million, which equated to about 5% of total GVA for West Cumbria. This suggests the sector	?	Number of workers required and construction timescales.

³ Value is for 2018, which is provisional. The value for 2017 is £21,430 suggesting numbers reported here will be insensitive to finalisation of this 2018 value.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
			is of medium sensitivity based on its importance to the regional economy, giving an overall minor positive impact.		
ST - MT	<p>Operation of existing and 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 £22,030 per employee [5]³. Assuming the majority of employment is either sourced or based locally, the result of implementation of this option is estimated to have between a £9 million and £22 million per year detriment, equating to a manufacturing sector decrease of approximately 1%. This would constitute a low magnitude impact.</p> <p>The manufacturing GVA of West Cumbria in 2018 was £1,627 million (about 32% of total GVA for West Cumbria), suggesting the sector is of high sensitivity based on its importance to the regional economy.</p>	?	Proportion of jobs transferred to other activities (e.g., conditioning, packaging and decommissioning activities). How early Magnox reprocessing stops.
ST	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> • Could lead to changes in the supply chain involved in reprocessing Spent Magnox fuels. • Decommissioning may require nuclear civils, construction and engineering experience, which could lead to economic investment. 	0	As the Magnox reprocessing plant is scheduled for closure in late 2021 under the baseline scenario, this option would bring forward impacts on employment by a few months, but would not significantly affect the magnitude of such impacts.	✓	

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
	<ul style="list-style-type: none"> Could reduce economic contributions to the local and regional economy due to loss of employment. 				
LT	<p>Closure of new facilities</p> <ul style="list-style-type: none"> Decommissioning may require nuclear civils, construction and engineering experience, which could lead to economic investment. 	++	<p>Closure of new storage facilities is likely to lead to a low magnitude positive impact on jobs compared to the baseline. This would have a corresponding low magnitude impact on GVA.</p> <p>The manufacturing GVA of West Cumbria in 2018 was £1,627 million (about 32% of total GVA for West Cumbria), suggesting the sector is of high sensitivity based on its importance to the regional economy. Thus, implementation of this option is deemed to have an overall positive moderate impact compared to the baseline.</p>	?	<p>Potential for new store to be used for alternative waste streams.</p> <p>Proportion of jobs created as new jobs.</p>
<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 change local travel patterns and may reduce 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 disposal on local assets can be considered neutral.</p> <p>The area around the Sellafield site (Copeland) is ranked the 215th most-deprived Local Authority District out of 317 in England in relation to “Barriers to housing and services”. The receptor therefore has low sensitivity to changes.⁴</p>	?	<p>Potential changes to site access routes would be highly dependent on the location of treatment and storage facilities and the estimated number of vehicle movements involved.</p>

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, road distance to a Post Office or sub post office, measures of household overcrowding, homelessness and housing affordability.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST - LT	Development of new facilities <ul style="list-style-type: none"> At a national scale, development of storage facilities may provide opportunities for the management of other waste streams. 	+	Opportunities may exist as part of storing the unprocessed Spent Magnox fuels to develop and maintain a national asset(s), which could be useful for other waste streams. This would constitute a positive impact of low magnitude.	✓	
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 in late 2021 anyway and no new Magnox power stations are proposed, this impact is not considered significant	✓	
LT	Closure of new facilities	0	No significant impact on existing local and national assets is expected as a result of the closure of new 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 from emissions of pollutants such as NO_x, SO₂ and Particulate Matter. 	-	Magnitude may be low in the short-term, because vehicle movements are likely to be spread out over a sufficient period of time for the effect upon local air quality to be low. General health statistics for residents in the Copeland are slightly poorer than the health statistics for the UK as a whole, so indicator sensitivity is medium.	?	Extent of facilities to be constructed, capacity of local medical facilities, proximity of residents and other receptors to activities.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST - MT	<p>Operation of existing and 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 operation of a new store would likely be of very low magnitude and continually monitored and mitigated. Implementation of this option would cease operational emissions associated with the Magnox reprocessing facility and downstream plant early, which would lead to a small positive impact on air quality.</p> <p>Overall, the magnitude of health impacts to the public would therefore be positive, but 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 operational phase of existing facilities.
ST-MT	<p>Closure of existing 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. 	0	<p>As the existing facilities will require closing in the future anyway, implementation of this option would simply bring forward health impacts associated with air quality, but would not significantly affect their magnitude.</p>	✓	
LT	<p>Closure of new 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>General health statistics for residents in the Copeland are slightly poorer than the health statistics for the UK as a whole, so indicator sensitivity is medium.</p>	✓	Extent to which recreation and amenity areas would be impacted and how the local population would respond, and the availability of other amenity and recreation areas in the local area.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
<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 style="text-align: center;">-</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>As a number of residential properties are located within a few hundred metres of the site and site access road and general health statistics for residents in the Copeland are slightly poorer than the health statistics for the UK as a whole, indicator sensitivity is medium. It is likely this would need to be verified through further assessment.</p>	??	Extent of the construction works required, location of the new facilities, types of equipment and plant used, number of transport movements and timescale over which they occur.
ST - MT	<p>Operation of existing and new facilities</p> <ul style="list-style-type: none"> • Noise and vibration from operation of plant and stores. 	<p style="text-align: center;">0</p> <p>Any noise and vibration impacts associated with 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. 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 of the new facilities.</p> <p>Given that similar effects would likely manifest in the baseline scenario, or even be slightly reduced, the impact of ceasing Magnox reprocessing operations early is deemed to be insignificant compared to baseline</p>	?	Number of intra-site transports.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST-MT	Closure of existing facilities <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 existing facilities will require closing in the future anyway, implementation of this option would simply bring forward health impacts associated with noise and vibration, but would not significantly affect their magnitude.	✓	
ST and LT	Closure of new facilities <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>Noise and vibration impacts from decommissioning activities can be mitigated through standard demolition good practice. Any associated health 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 and general health statistics for residents in the Copeland are slightly poorer than the health statistics for the UK as a whole, indicator sensitivity is medium. It is likely this would need to be verified through further assessment.</p>	??	Extent of demolition required, equipment and plant used, number of transport movements.
Effects on physical activity and obesity 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 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).					
ST	Construction 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. 	-	<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>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

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST - MT	<p>Operation of existing and 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	Due to the relatively minor environmental effects anticipated to arise from ceasing operation of Magnox reprocessing early, impacts on local recreational and amenity areas (and subsequently levels of physical activity) are unlikely to be significant.	✓	
ST	<p>Closure of existing 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. 	0	As the existing facilities will require closing in the future anyway, implementation of this option would simply bring forward impacts on local recreational and amenity areas, but would not significantly affect their magnitude.	✓	
LT	<p>Closure of new 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>Decommissioning activities are likely to be confined mainly within the site boundary, but will require careful management through construction and 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 existing and new facilities to recreational and amenity areas, number 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.

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).

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
(Indicators: Accident statistics).				
ST	Construction of new facilities <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>-</p> <p>There may be impacts on the local road network from transport in the short-term until a new facility is 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>	?	Number and timing of transport movements (linked to number of facilities constructed), cumulative developments, changes in local transport network and travel patterns.
ST - MT	Operation of existing facilities <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 the conditioned wastes to a GDF will be covered in assessments elsewhere).</p> <p>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	Closure of existing facilities <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>0</p> <p>As the existing facilities will require closing in the future anyway, implementation of this option would simply bring forward health impacts arising from road traffic, but would not significantly affect their magnitude.</p>	✓	
LT	Closure of new facilities <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>Impacts on the local road network from transport whilst decommissioning and demolition of a new store is undertaken. 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>	?	Number and timing of transport movements (linked to number of facilities constructed), cumulative developments, changes

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
				in local transport network and travel patterns.
<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>-</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 existing and 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 that produce liquid waste streams, disposal of additional unprocessed Spent Magnox fuels fuel 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>?</p> <p>Duration of the operational phase</p>
ST	<p>Closure of existing facilities</p> <p>Decommissioning has the potential to result in contamination of local water</p>	<p>0</p>	<p>As the Magnox reprocessing plant is scheduled for closure in late 2021 under the baseline scenario, stopping reprocessing early would bring forward any</p>	<p>✓</p>

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
	bodies. This could lead to health effects upon the local population and any recreational users of these features.		impacts on the water environment but would not significantly affect their magnitude.		
LT	Closure of new 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 any recreational users of these features. 	-	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. 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.	?	Changes in water quality at the site over time.
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	Operation of existing and new facilities <ul style="list-style-type: none"> Ceasing reprocessing early could offer radiological opportunities in terms of avoiding the production of Highly Active Liquor (HAL), a high risk by-product of spent fuel reprocessing. 	+	Storage in self-shielded boxes is a relatively low risk process from a radiological perspective, and ceasing reprocessing early would avoid the production of HAL. Overall, there is considered to be a low magnitude positive impact compared to the baseline from ceasing operations early. Due to the use of extensive controls (including adherence to the principles of ALARA and BAT), the actual radiological health risk of reprocessing the Spent Magnox fuels 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 early cessation of reprocessing.	?	Duration of operational phase.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST-MT	Closure of existing facilities <ul style="list-style-type: none"> Decommissioning activities such as demolition of facilities have the potential to result in discharges of radioactivity with associated health effects. 	0	As the Magnox reprocessing plant is scheduled for closure in late 2021 under the baseline scenario, stopping reprocessing early would bring forward any radiological impacts by a few months but would not significantly affect their magnitude.	✓	
LT	Closure of new facilities <ul style="list-style-type: none"> Decommissioning activities such as demolition of facilities have the potential to result in discharges of radioactivity with associated health effects. 	-	Implementation of this option would lead to an additional store to be decommissioned. However, extensive procedures and controls would be in place to minimise radiological health impacts, including adherence to ALARA and BAT principles. Thus, any impacts associated with closure of new facilities are likely to be low. Radiological risks from the site as a whole are likely to decrease in the long-term, so receptor sensitivity is considered medium.	?	Future site discharge rates.
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. 	+	Building a new store would lead to 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.	??	Number of jobs created, duration of the construction works.
	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. 	-	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	??	Extent of environmental impacts, duration of the construction works.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact		Uncertainty	Factors affecting uncertainty
	Such health effects might include annoyance, anxiety or stress.		proximity to the site, and would be of low magnitude once mitigation measures were applied.		
ST - MT	<p>Operation of existing and 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. 	0	<p>Effects on the environment (including through changes in air and water quality, and the local landscape etc.) are likely to be very small, but positive, compared to the baseline as a result of the early closure of the Magnox reprocessing plant and downstream facilities. Early loss of jobs is likely to lead to a negative effect on mental health.</p> <p>Overall, the net effect upon the mental health and wellbeing of the local population compared to baseline is considered to be insignificant, particularly given the closure of Magnox reprocessing plant in the near future under the baseline option</p>	?	Socio-economic opportunities available, whether these are made available to local population.
ST	<p>Closure of existing 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. 	0	As the Magnox reprocessing plant is scheduled for closure in late 2021 under the baseline scenario, stopping reprocessing early would bring forward any impacts on mental health and wellbeing by a few months but would not significantly affect their magnitude.	✓	
ST and LT	<p>Closure of new 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. 	0	The closure of new facilities would generate some additional employment during decommissioning. 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.	??	Number of jobs created, how many jobs lost or transferred, timescales for closures. Nature and extent of environmental impacts.

Timescale	Risk / Opportunity for Potential Impacts	Significance of Impact	Uncertainty	Factors affecting uncertainty
	<ul style="list-style-type: none"> 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>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 neutral effect on mental health and wellbeing associated with closing facilities.</p>		

3.2.3 Extend Reprocessing – Description of Option

Option	Extend reprocessing operations to ensure all suitable Spent Magnox fuels is reprocessed and interim store Spent Magnox fuels not suitable for reprocessing pending treatment and packaging prior to disposal to a GDF (Extend Reprocessing)
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 Spent Magnox fuels, but the facilities for this are ageing and may close before reprocessing of the irradiated inventory has been completed.</p> <p>In the extend reprocessing option, all suitable Spent Magnox fuels is reprocessed, which would involve maintaining the reprocessing facility and the supporting plant beyond the projected end date of Magnox reprocessing operations in late 2021. Throughput of the reprocessing plant may also decrease because of the need to handle more-heavily corroded spent fuel. Even pursuing this option, there would be some spent fuel that is not reprocessed, which would be stored in self-shielded boxes in facilities that would be available under the baseline option, before being conditioned, packaged and disposed 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 2076). 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 and availability of the GDF.</p> <p>For the purpose of the assessment it has been assumed that conditioning involves placing the Spent Magnox fuels into appropriate self-shielded boxes.</p>

Option	Extend reprocessing operations to ensure all suitable Spent Magnox fuels is reprocessed and interim store Spent Magnox fuels not suitable for reprocessing pending treatment and packaging prior to disposal to a GDF (Extend Reprocessing)	
Details/ Activities	<p>Construction of new facilities This option would involve maintaining existing reprocessing facilities and supporting plant, but no new construction.</p> <p>Operation of new facilities Under the baseline, Magnox reprocessing will continue until late 2021. In order to reprocess more-heavily corroded Spent Magnox fuels, reprocessing would need to continue for several years. In addition, if aging support plant failed whilst there was remaining liquors to be processed, these plant would need fixing because the liquors contain radionuclides in a highly-mobile form that is not suitable for disposal.</p>	<p>Closure of existing and new facilities As Magnox reprocessing is scheduled to be completed in late 2021, implementation of this option would delay the closure programme of the Magnox reprocessing facility and supporting plant potentially by a number of years.</p> <p>Maintenance of existing facilities Under this option, there would be a requirement to maintain existing facilities and supporting plant until reprocessing of all suitable inventory has been completed.</p>

3.2.4 Extend Reprocessing – Assessment

Timescale	Risk / Opportunity for Impact	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. This can be directly through the use of plant or indirectly through the transport of materials and waste.	0	For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the impacts on air quality from implementation of this option are considered to be insignificant.	✓
ST – MT	Operation of existing 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, the magnitude of the effect of extending reprocessing can be considered to be low. Existing air quality at the site is well within Air Quality Objectives so indicator sensitivity is low.	?
ST-LT	Closure of existing 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. 	0	The effect of closing of existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the impacts on air quality from implementation of this option are considered to be neutral.	✓

Timescale	Risk / Opportunity for Impact	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, or declines in populations of species. Effects on ecological receptors from disturbance or pollution-generating activities (air, noise, water etc.) 	0 For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the impacts on biodiversity, flora and fauna from implementation of this option are considered to be insignificant.	✓	
ST - MT	Operation of existing 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.	✓	
ST - LT	Closure of existing facilities <ul style="list-style-type: none"> Possible effects on ecological receptors from disturbance, pollutant-generating activities such as demolition and transport. 	0 The effect of closing existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the impacts on biodiversity, flora and fauna from implementation of this option are considered to be insignificant.	✓	

Timescale	Risk / Opportunity for Impact	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	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. • The impact of increased CO₂ emissions may continue beyond the end of construction. 	0	For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the impacts on climate change and energy from implementation of this option are considered to be insignificant.	✓	
ST - MT	Operation of existing facilities <ul style="list-style-type: none"> • Impacts on climate change and energy use from use of plant and equipment. 	--	<p>The existing facilities may use substantial amounts of energy and generate CO₂ emissions over a period of several years, making the potential impact of extending reprocessing high magnitude.</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)' [3].</p> <p>Given the overall steady decline in CO₂ emissions in the industrial process sector between 1990 and 2018, and the relatively modest contribution of the sector to UK emissions, indicator sensitivity is considered low.</p>	?	Contribution of the facilities to industrial process sector CO ₂ emissions, changes in sector targets. Ability to adapt to avoid, mitigate and offset carbon emissions.
ST-LT	Closure of existing 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. 	0	The effect of closing of existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the impacts on climate change and energy from implementation of this option are considered to be insignificant.	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
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. 	0	For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the impacts on coastal change and flood risk from implementation of this option are considered to be insignificant.	✓
ST - MT	Operation of existing facilities	0	There is unlikely to be any significant effects in terms of coastal change and flood risk from the extended operation of the reprocessing plant and supporting infrastructure.	✓
ST-LT	Closure of existing facilities <ul style="list-style-type: none"> Decommissioning may create opportunities to reduce flood risk. 	0	The effect of closing existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the impacts on coastal change and flood risk from implementation of this option are considered to be insignificant.	✓
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. 	0	For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the impacts on cultural heritage from implementation of this option are considered to be insignificant.	✓

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST - MT	Operation of existing facilities <ul style="list-style-type: none"> • Could affect cultural heritage features through changes in noise and other environmental effects. 	0	Activities arising from extending reprocessing operations would be restricted to within the site boundary, and any residual impacts are unlikely to be significant assuming monitoring is undertaken if required and appropriate mitigation is used to manage impacts from noise.	✓	
ST-LT	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. 	0	The effect of closing existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the impacts on cultural heritage from implementation of this option are considered to be insignificant.	✓	
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 • Potential for non-radioactive releases to the ground, leading to land contamination within the site boundary. • Soil resources would likely be used up during construction and excavation activities. 	0	For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the impacts on geology and soils from implementation of this option are considered to be insignificant.	✓	
ST - MT	Operation of existing 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.	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST-LT	Closure of existing facilities <ul style="list-style-type: none"> Decommissioning the reprocessing plant and supporting facilities could impact soil quality and land contamination at the site. 	0	The effect of closing existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the impacts on geology and soils from implementation of this option are considered to be insignificant.		
Landscape and Visual (Potential Receptors: The local population, cyclists, pedestrians and equestrians using local routes, flora and 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 industrial facilities. 	0	For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the impacts on geology and soils from implementation of this option are considered to be insignificant.	✓	
ST - MT	Operation of existing facilities <ul style="list-style-type: none"> The existing facilities would remain a constant feature of the landscape for several years. 	-	Extending reprocessing operations may lead to adverse landscape and visual effects associated with the continued presence of the facilities themselves. The magnitude of this impact is considered low. Although Sellafield is located near a National Park, the industrial nature of the site and its prominence in the local landscape means sensitivity of the surrounding landscape to further adverse changes can be considered low.	✓	Duration of extended operational phase.
ST-LT	Closure of existing facilities <ul style="list-style-type: none"> May create landscape and visual impact opportunities Could lead to improved views from nearby locations. 	0	The effect of closing existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the landscape and visual impacts from implementation of this option are considered to be insignificant.	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty	
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"> Materials used and waste generated during building construction. 	0	For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the material and waste impacts of this option are considered to be insignificant.	✓	
ST - MT	Operation of existing 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). Whilst plutonium and uranium are not currently considered wastes, the HAL would require careful treatment and management. 	---	<p>Compared to the baseline, in which part of the Spent Magnox fuels inventory would be reprocessed through existing facilities and part would be disposed of as waste, under this option a much smaller volume of the inventory would be classified as waste (about 500 tonnes). However, HAL would also be produced in considerable volumes. On balance, given the high-risk nature of HAL, this option may result in a high magnitude negative impact from a materials and waste perspective.</p> <p>Due to the fact that the established management route to manage HAL is reliant on aging plant, sensitivity to impacts from generating liquor is considered medium.</p>	✓	Duration of extension. Availability of supporting plant.
ST-LT	Closure of existing 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. 	0	The effect of closing existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the material and waste impacts from implementation of this option are considered to be insignificant.	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
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. 	0	For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the impacts from noise as a result of implementation of this option are considered to be insignificant.	✓
ST - MT	Operation of existing 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	Any noise and vibration impacts associated with extended operation of existing facilities and operation of the new facilities would likely be confined within the site boundary. 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.	✓
ST-LT	Closure of existing 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. 	0	The effect of closing existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the impacts from noise as a result of implementation of this option are considered to be insignificant.	✓

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty	
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 existing facilities <ul style="list-style-type: none"> Reprocessing converts Spent Magnox 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. 	-- 0	Under this option all suitable Spent Magnox fuels 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 medium magnitude negative impact in terms of radiological discharges. Due to existing mitigation and controls in place to manage the risk of radiological effects, including the use of ALARA and BAT principles, sensitivity is considered low.	?	Volumes of suitable Spent Magnox fuels inventory.
ST-LT	Closure of existing facilities <ul style="list-style-type: none"> Decommissioning activities such as demolition of facilities have the potential to result in discharges of radioactivity. 	0	The effect of closing existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the impacts on radiological discharges from implementation of this option are considered to be insignificant.	✓	
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. 	0	For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the impacts on water resources and quality from implementation of this option are considered to be insignificant.	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST – MT	Operation of existing facilities <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, whereas current high volumes of water abstraction imply sensitivity to impacts on water resources may be high.</p>	?	<p>Extent of direct water abstraction needed for reprocessing and indirect water abstraction needed to support workers etc.</p> <p>Duration of extended operations.</p>
ST-LT	Closure of existing 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. 	0	<p>The effect of closing existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the impacts on water resources and quality from implementation of this option are considered to be insignificant.</p>	✓	
SOCIO-ECONOMICS					
Employment (Potential Receptors: Regional and national employment). (Indicators: Employment created or sustained, contribution to employment markets).					
ST	Construction of new facilities <ul style="list-style-type: none"> Construction could create a full range of employment generated, from construction to highly-skilled and managerial jobs. 	0	<p>For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the impacts on employment from implementation of this option are considered to be insignificant.</p>	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST - MT	<p>Operation of existing facilities</p> <ul style="list-style-type: none"> Would create a range of employment opportunities. 	+++	<p>The Magnox reprocessing facility currently employees about 450 people, with about another 500 people employed in downstream plants.</p> <p>Under this option, operation of the Magnox reprocessing facility and supporting plants would be extended for a number of years. As such, jobs associated with continued operation of existing facilities would be maintained. Although, this extension would be is a short-term impact, the number of jobs maintained, means the overall magnitude of the impact would likely be medium.</p> <p>The contribution of the “manufacturing” sector (which includes most decommissioning and fuel reprocessing work) to the local employment market in terms of jobs is roughly 6,578 [4]. Sensitivity is therefore considered high based on the importance of manufacturing jobs to the local labour market.</p>	?	Duration of extension of operational phase.
ST-LT	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> Decommissioning of new facilities could result in job losses. 	0	<p>The effect of closing existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the impacts on employment from implementation of this option are considered to be insignificant.</p>	✓	
<p>Knowledge and Skills</p> <p>(Potential Receptors: National skill base).</p> <p>(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. 	0	<p>For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the impacts on knowledge and skills employment from implementation of this option are considered to be insignificant.</p>	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST - MT	<p>Operation of existing facilities</p> <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, uranium and plutonium. 	+	<p>Extended reprocessing would help maintain existing skills, which would be used during operation of the plant and supporting infrastructure, In addition, the requirement under this option to reprocess more-heavily corroded fuels may lead to the 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>	?	<p>Skill development may be time limited. Skills and knowledge opportunities may be transferable to other waste management technologies or waste types.</p>
ST-LT	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> Once reprocessing operations are completed, knowledge and skills would be lost. 	0	<p>The effect of closing existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the impacts on knowledge and skills from implementation of this option are considered to be insignificant.</p>	✓	
<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> <ul style="list-style-type: none"> Building new facilities would mean some education and training may be required. This could create opportunities at regional and national spatial scales. 	0	<p>For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the impacts on education and training from implementation of this option are considered to be insignificant.</p>	✓	
ST - MT	<p>Operation of existing facilities</p> <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. 	+	<p>If reprocessing operations are extended there may be some limited education and training opportunities created in the short-term, with benefits reducing with time. Overall there may be a minor positive impact from extending the reprocessing the Spent Magnox fuels inventory.</p>	✓	<p>Duration of extended operation phase. Retention of existing workers during extended operation.</p>

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST-LT	Closure of existing facilities	0	The effect of closing existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the impacts on education and training from implementation of this option are considered to be insignificant.	✓	
Economy (Potential Receptors: Local and Regional economy). (Indicators: £ Gross Value Added).					
ST	Construction of new facilities <ul style="list-style-type: none"> Expenditure on additional facilities 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. 	0	For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the impacts on employment from implementation of this option are considered to be insignificant.	✓	
ST - MT	Operation of existing facilities <ul style="list-style-type: none"> Could lead to ongoing economic contributions to the local and regional economy. 	++	GVA per employee data can be multiplied by the expected FTE (jobs supported) per year of operation. The value for West Cumbria is £22,030 per employee [5] ⁵ . Assuming the majority of employment is either sourced or based locally, the result for operational GVA is between £9 million and £21 million per year for the duration of the operation period, equating to a manufacturing sector increase of about 1%. This would constitute a low magnitude impact. The manufacturing GVA of West Cumbria in 2018 was £1,627 million, (about 32% of total GVA for West Cumbria), suggesting the sector is of high sensitivity based on its importance to the regional economy.	?	Duration of operational phase

⁵ Value is for 2018, which is provisional. The value for 2017 is £21,430 suggesting numbers reported here will be insensitive to finalisation of this 2018 value.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST-LT	Closure of existing facilities <ul style="list-style-type: none"> • Could reduce economic contributions to the local and regional economy due to loss of employment. 	0	The effect of closing existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the impacts on the economy from implementation of this option are considered to be insignificant.	✓	
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	For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, there would be no creation of local or national assets.	✓	
ST - MT	Operation of existing 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 or radioactive materials. 	+	There is currently thought to be little opportunity to reuse the Magnox reprocessing plant for processing of other materials, such as exotic spent fuels. However, as the Magnox reprocessing plant is scheduled for closure in late 2021, implementation of this option would maintain a national asset for a number of additional years, constituting a low magnitude positive impact. Given the UK's current spent Magnox fuel inventory, indicator sensitivity is considered low, making the overall impact of minor significance.	✓	The suitability of facilities to manage other spent fuel arisings.
ST-LT	Closure of existing facilities	0	No significant impact on existing local and national assets is expected as a result of the closure of existing facilities.	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
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	<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>0</p> <p>For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the health impacts arising from changes in air quality from implementation of this option are considered to be insignificant.</p>	✓	
ST - MT	<p>Operation of existing 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-term need to be considered.</p>	?	Length of the operation phase.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST-LT	<p>Closure of existing 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. 	0	The effect of closing of existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the health impacts arising from changes in air quality from implementation of this option are considered to be neutral.	✓	
<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. 	0	For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the health impacts associated with changes in noise levels as a result of implementation of this option are considered to be insignificant.	✓	
ST - MT	<p>Operation of existing facilities</p> <ul style="list-style-type: none"> Potential for increased noise and vibration from operation of facilities. 	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.	✓	
ST-LT	<p>Closure of existing 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. 	0	The effect of closing existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the health impacts associated with changes in noise levels as a result of implementation of this option are considered to be insignificant.	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
<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. • This can lead to changes in levels of physical activity undertaken by the local population. 	<p>0</p> <p>For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, impacts on local recreational and amenity areas (and subsequently levels of physical activity) as a result of implementation of this option are considered to be insignificant.</p>	✓	
ST – MT	<p>Operation of existing 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>As most of the environmental effects anticipated to arise from operation of any new facilities and supporting plant 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>	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST-LT	<p>Closure of existing 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. 	0	As the existing facilities will require closing in the future anyway, implementation of this option would simply bring forward impacts on local recreational and amenity areas, but would not significantly affect their magnitude.	✓	
<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. 	0	For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the impacts on road traffic as a result of implementation of this option are considered to be insignificant.	✓	
ST - MT	<p>Operation of existing facilities</p> <ul style="list-style-type: none"> There may be a requirement for ongoing transport movements. 	0	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.	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST-LT	Closure of existing facilities <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. 	0	The effect of closing existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the impacts on road traffic as a result of implementation of this option are considered to be insignificant.	✓	
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. 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. 	0	For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the health impacts related to the water environment as a result of implementation of this option are considered to be insignificant.	✓	
ST - MT	Operation of existing facilities <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 risks associated with aqueous processes in the baseline. 	-	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. 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.	?	Duration of extended operations.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST-LT	<p>Closure of existing 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. 	0	The effect of closing existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the health impacts related to the water environment as a result of implementation of this option are considered to be insignificant.	✓	
<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> <p>(Indicators: Discharge rates at the site, RIFE total reported dosages to the public).</p>					
ST-MT	<p>Operation of existing facilities</p> <ul style="list-style-type: none"> Extended reprocessing to manage the Spent Magnox fuels inventory could lead to radiological risks in terms of the production of Highly Active Liquor (HAL), a by-product of spent fuel reprocessing. 	–	<p>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 a greater volume of the Spent Magnox fuels inventory would be disposed of, it can be considered to have a medium magnitude negative impact from a radiological safety perspective.</p> <p>Due to the use of extensive controls (including adherence to ALARA and BAT), the actual radiological health risk of extending reprocessing of the Spent Magnox fuels inventory is considered low. Sensitivity to changes is therefore also considered to be low, giving an overall minor negative impact from extended reprocessing.</p>	?	Duration of operational phase.
ST-LT	<p>Closure of existing facilities</p> <ul style="list-style-type: none"> Decommissioning activities such as demolition of facilities have the potential to result in discharges of radioactivity with associated health effects. 	0	The effect of closing existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the impacts on radiological safety from implementation of this option are considered to be insignificant.	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
<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	<p>Construction of any new facilities</p> <ul style="list-style-type: none"> Likely to create employment opportunities, which studies have shown can influence mental health and wellbeing. 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. 	<p>0</p> <p>For implementation of this option, there is not expected to be the need to build any additional new facilities over and above that required for the baseline. As such, the mental health impacts as a result of implementation of this option are considered to be insignificant.</p>	✓	
ST - MT	<p>Operation of existing 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>0</p> <p>Effects on the environment (including through changes in air and water quality, and the local landscape etc.) are likely to be very small, but negative, compared to the baseline as a result of the extended operations of the Spent Magnox fuels reprocessing plant and downstream facilities. Maintenance of jobs is likely to lead to a positive effect on mental health.</p> <p>Overall, the net effect upon the mental health and wellbeing of the local population compared to baseline is considered to be insignificant.</p>	??	Socio-economic opportunities available, whether these are made available to local population.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
ST-LT	<p>Closure of existing 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. 	0	The effect of closing existing facilities would be delayed, but the magnitude of this effect would not be changed compared to the baseline. As such, the mental health impacts from implementation of this option are considered to be insignificant.	✓	

4.0 Nuclear Materials

4.1 Plutonium

4.1.1 Reuse – Description of Option

Option	Build facilities to make fuel to enable use in a third-party reactor prior to storage and disposal 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 of plutonium. Reuse would likely 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 possibly 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 all of the inventory, then some material may be managed as a waste for disposal. However, this material may be processed through the PFFF, so we assume no additional conditioning and treatment facilities would be required for this unreuseable material.</p>	
Details/ Activities	<p>Construction of new facilities Implementation of the reuse option to manage the plutonium inventory may require, but not necessarily be limited to, construction of a 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 fuel source for nuclear power generation.</p>	<p>Closure of existing and new facilities Implementation of reuse 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 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 continuously replace existing stores and repackage the plutonium, which would be required under the baseline scenario. Repackaging of the current package inventory is planned after 50 years or so, but into new designs of cans with increased design lives. Modern stores are built to a design life, some up to 100 years, but may require regular maintenance works.</p>

4.1.2 Reuse – Assessment

Timescale	Risk / Opportunity for Impact	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. 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.	?	Number 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. 	- Given the nature of nuclear fuel fabrication technologies and controls in place 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.	✓	Fuel fabrication technology, duration of the operational phase.
MT - LT	Closure of existing and new 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).

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
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 on a continuous basis, with the plutonium repackaged periodically. 	+	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.	?	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, 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>	??	Number and scale of facilities requiring construction, characteristics of nearby sites of value for nature conservation (both designated and non-designated) and other ecological receptors, number of transport movements involved and the time over which they occur.
MT	<p>Operation of new facilities</p> <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, number of transport movements required to transport materials and workers, duration of the operational phase.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
MT – LT	Closure of existing and new facilities <ul style="list-style-type: none"> Possible effects on ecological receptors from disturbance, pollutant-generating activities such as demolition and transport. 	<p>–</p> <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).
MT – LT	Avoid maintaining existing facilities	<p>+</p> <p>As repackaging activities and works to replace stores takes place infrequently over a number of years, any effects from avoiding the need to maintain existing stores is likely to be of a low magnitude, but positive.</p>	?	Extent of activities required to maintain existing stores.
Climate Change and Energy (Potential Receptors: The atmosphere, the oceans, flora and fauna, soils, people). (Indicators: Industrial process 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>	<p>--</p> <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 CO₂ emissions 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)' [3].</p> <p>Given the overall steady decline in CO₂ emissions in the industrial process sector between 1990 and 2018, and the relatively modest contribution of the sector to UK emissions, indicator sensitivity is considered low.</p>	?	Embodied carbon of materials used, complexity and number of facilities (may affect construction programmes).
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>–</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>	?	Technology used, contribution of the facilities to industrial process sector CO ₂ emissions, changes in

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
				sector targets. Ability to adapt to avoid, mitigate and offset carbon emissions.
MT – LT	Closure of existing and new 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>– –</p> <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>	?	Changes in CO ₂ targets or legislation and technology, volume of waste generated and whether this can be reused or recycled. Ability to adapt to avoid, mitigate and offset carbon emissions.
MT – LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> Maintaining stores and repackaging plutonium continuously under the baseline scenario could generate CO₂ emissions and require energy use. 	<p>++</p> <p>The activities involved in maintaining existing facilities would generate some emissions of CO₂, and the recurring but infrequent nature of the work, would make the impact magnitude medium. Avoiding these impacts may therefore have a moderate positive effect in the medium to long-term.</p>	?	The extent of activities required to repackage plutonium and replace stores.
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>–</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>The vast majority of the Sellafield site 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 between 5 m and 50 m above sea level and is generally protected from coastal flooding by cliffs, a shingle spit and a railway</p>	?	The extent of coastal erosion and sea level rise, any changes to existing coastal defences.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
	opportunities to further protect coastlines from erosion.		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.		
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	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 is unlikely to be significant coastal change over this timeframe.	✓	
LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> Disposition of the plutonium inventory via reuse could reduce the risk associated with continuing to store the material in facilities which may be at risk of flooding and coastal change. 	+	<p>As the reuse option would involve processing 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.</p> <p>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 continue to be stored safely and securely in its current form. 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.</p>	?	See construction of new facilities (above).
LT	Closure of new facilities <ul style="list-style-type: none"> Decommissioning may create opportunities to reduce flood risk. 	0	Given that the vast majority of 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, extent of coastal change.
Cultural Heritage (Potential Receptors: Listed buildings, Scheduled Ancient Monuments, Registered Parks and Gardens, Conservation Areas).					

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	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 or 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 location-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 would 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 new 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 or 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>	??	See construction of new facilities (above).

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
LT	Avoid maintaining existing facilities	+		
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. 	-		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 excavation activities. 	-		
MT	Operation of new facilities	0		

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
MT	Closure of existing facilities <ul style="list-style-type: none"> Activities such as demolition have the potential to result in ground contamination. 	<p>-</p> <p>As the stores and packages used to contain plutonium may have 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 are considered to have low magnitude, especially as modern best practice design has reduced contamination. 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 required (including transport of wastes off-site), potential use of remediation techniques to clean-up the land.
LT	Avoid maintaining existing facilities	<p>+</p> <p>Maintaining the stores and repackaging the plutonium would require minor construction works on brownfield land within the existing site avoiding these activities is unlikely to have any significant effects upon geology and soils. However, avoiding construction of stores on a recurring basis is likely to have a low magnitude positive impact. As for construction of new facilities, the overall significance of this impact is considered minor.</p>	?	Nature of repackaging activities, risk of contamination and discharges e.g. from plutonium decay.
LT	Closure of new facilities <ul style="list-style-type: none"> Decommissioning the plutonium fuel fabrication facility and any pre-treatment or storage facilities could impact soil quality and land contamination at the site. 	<p>-</p> <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, 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, which is currently considered to be low.</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, flora and fauna, tourists and other visitors to the area). (Indicators: The local landscape).				

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
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>Although Sellafield is located near a National Park, the industrial nature of the site and its prominence in the local landscape means sensitivity of the surrounding landscape to further adverse changes can be considered low. Cumulative effects need to be considered</p>	✓	Reuse of waste materials would reduce transport movements. If construction of facilities and stores were 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. Ongoing transport movements associated with transporting the plutonium fuel to the reactors. 	-	<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>Although Sellafield is located near a National Park, the industrial nature of the site and its prominence in the local landscape means sensitivity of the surrounding landscape to further adverse changes can be considered low.</p>	?	Decommissioning of other facilities at the site could increase the prominence of the plutonium fuel fabrication facility. Location of facilities and stores.
MT - LT	Closure of existing and new 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 impact on the local landscape.</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 number and scale of facilities removed and other facilities on the site.
LT	Avoid maintaining existing facilities	+	<p>Due to the extensive industrial nature of the site, landscape and visual effects associated with avoiding activities to replace stores and repackage the plutonium are likely to be minor, but positive.</p>	✓	
Materials and Waste (Potential Receptors: Local, regional and national waste management facilities, local landfills, the Low Level Waste Repository).					

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
ST	<p>Construction of new facilities</p> <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>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.</p>	?	Complexity and design of the fuel fabrication and storage facilities (likely to alter material requirements). Distances over which material need to be imported, and whether material on-site can be reused.
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 vast majority of the 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 continues to be stored 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. 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 and forecast in future (in 2019 there was estimated to be 1,390, 148,000 and 453,000 cubic metres of HLW, ILW and LLW (excluding VLLW) respectively), the generation of waste in the volumes that might be expected from closing existing facilities is relatively small. Sensitivity could therefore be considered</p>	?	The volume and nature of waste generated, the extent to which waste materials can be reused.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
		low. Cumulative impacts need to be considered, as does the capacity of facilities to receive any LLW or VLLW arisings.		
LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> Maintaining stores and repackaging the plutonium on a continuous basis requires materials and produce waste. 	++ <p>Although the timescale before existing facilities need replacing is relatively long, undertaking such maintenance activities on a continuous basis would have a substantial material requirement and waste generation potential. Avoiding this may therefore be considered a high magnitude positive impact. 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.
LT	Closure of new 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>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 LLW, 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 new 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 disposal facilities, the nature of the waste (i.e. radioactive or non-radioactive), the programme, availability of capacity 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. 	- <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. 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, number of transport movements and the timescale over which they occur.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	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>		
ST-LT	<p>Operation of existing and 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 material from existing stores to the facilities, and potential off-site transport to reactors. 	<p>0</p> <p>Any noise and vibration impacts associated with operation of existing and 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 transporting new fuel to reactors will be covered in assessments elsewhere), there are unlikely to be any significant noise and vibration impacts during operation.</p>	✓	
MT-LT	<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 considerable decommissioning activities may be required, noise and vibration impacts from such activities can be mitigated through standard construction and 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	<p>Avoid maintaining existing facilities</p> <ul style="list-style-type: none"> Replacing stores and repackaging may generate noise and vibration. 	<p>+</p> <p>Avoiding construction of stores on a recurring basis is likely to have a low magnitude positive impact. As for construction of new facilities, the overall significance of this impact is considered minor.</p>	??	The location and extent of construction works, number of transport movements and the timescale over which they occur.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
LT	Closure of new 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>–</p> <p>Noise and vibration impacts from decommissioning activities can be mitigated through standard construction and 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. This needs 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.
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>++</p> <p>Converting the plutonium into fuel would reduce the risk associated with continuously storing it in its existing powdered form. Plutonium decay in storage gives rise to alpha, 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 new facilities <ul style="list-style-type: none"> Decommissioning activities such as demolition of facilities have the potential to result in discharges of radioactivity. 	<p>–</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 and new facilities are likely to be low. Discharge rates for the site as a whole are likely to decrease in the long-term, so receptor sensitivity is considered medium.</p>	?	Future site discharge rates
LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> Replacing stores and repackaging is associated with radiological discharges. 	<p>+</p> <p>Although the timescale before existing facilities need replacing is relatively long, undertaking such maintenance activities on a continuous basis would be associated with a level of radiological discharges. Avoiding replacement and</p>	?	The potential build-up of plutonium daughter products via radioactive

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
		<p>repackaging of plutonium may therefore be considered a low magnitude positive impact.</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>		decay, future site discharge rates.
<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).</p>				
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 (millions of 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, changes in volume of water abstracted as site activities change, proportion of water volume new construction activity uses.
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 are not thought to be required in the plutonium pre-treatment process, so we assume no liquid waste streams will be produced. Thus, the magnitude of impacts can be considered low.</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.</p>	?	Whether there is a requirement for chemical pre-treatment processes, the proportion of the plutonium inventory that may require pre-treatment, the extent of indirect water abstraction and consumption needed to support workers etc.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	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>++</p> <p>In the baseline, construction of replacement stores is required. Construction of new stores 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. Reuse of plutonium would avoid the need to construct these stores, therefore avoid this impact.</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 (millions of cubic metres) suggest that sensitivity to further water consumption (likely during construction) may be high.</p>	?	Water requirements during store replacement and repackaging, changes in volume of water abstracted as site activities change, proportion of water volume new construction activity uses.
LT	<p>Closure of new 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</p>	??	Changes in water abstraction and consumption at the site, (linked to timescales for decommissioning activities). Changes in

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
			<p>long-term, and may improve once operations such as reprocessing are complete.</p> <p>Requirements for water abstraction involved in closing new 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>		Water Framework Directive classifications.
SOCIO-ECONOMICS					
Employment					
(Potential Receptors: Regional and national employment).					
(Indicators: Employment created or sustained, contribution to local labour market).					
ST	<p>Development of new facilities</p> <ul style="list-style-type: none"> • Would create a full range of employment, from construction to highly-skilled and managerial jobs. 	+++	<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. ⁶ 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. About 9.2% (3,030 people) of the local population are estimated to work in construction [4], 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	<p>Operation of new facilities</p> <ul style="list-style-type: none"> • Would create a range of employment opportunities. 	++	<p>Estimates suggest a fuel fabrication facility could generate in the region of several hundred jobs. ⁶ There may also be additional jobs associated with plutonium pre-treatment, transport and management of reactor sites.</p> <p>The contribution of the “manufacturing” sector (which includes most decommissioning and fuel reprocessing work) to the local employment market in terms of jobs is estimated to be 6, 578 [4]. Sensitivity is therefore</p>	??	Proportion of jobs created as new jobs, and the number transferred from other activities in the industry. For example, those involved

⁶ 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 Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
			<p>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 to medium magnitude impact based on knowledge of facilities of a similar nature.</p>		in continued safe and secure storage of plutonium.
MT	<p>Closure of existing facilities</p> <p>Decommissioning has the potential to create employment opportunities.</p>	0	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 new employment opportunities to constitute a significant impact.	✓	<p>The complexity involved in decommissioning the facilities.</p> <p>The availability of relevant expertise.</p>
LT	<p>Avoid maintaining existing facilities</p> <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. 	--	<p>Whilst some employment from management of the current stores may be lost, this number is relatively small. As there is likely to be a high level of transferability of these roles to the new facilities, the overall impact is unlikely to be significant.</p> <p>However, replacement stores would need to be constructed under the baseline option, which would likely have a medium magnitude impact on employment.</p> <p>Construction is assumed to occur at Sellafield, which is within the Copeland district. About 9.2% (3,030 people) of the local population are estimated to work in construction [4], suggesting it is an important contributor to local employment markets. Sensitivity is therefore considered medium.</p>	?	Number of jobs supported by existing stores, the transferability of existing jobs to new facilities.
LT	<p>Closure of new facilities</p> <ul style="list-style-type: none"> Decommissioning of new facilities could result in job losses. 	++	<p>Decommissioning of the new facilities would lead to a number of jobs being created compared to the baseline scenario. However, given extant decommissioning activities on site, the magnitude of this impact is likely to be low.</p> <p>The contribution of the “manufacturing” sector (which includes most decommissioning and fuel reprocessing work) to the local employment market in terms of jobs is roughly 6,578 [4]. Sensitivity is therefore considered high based on the importance of manufacturing jobs to the local labour market.</p>	?	Potential for facilities to be repurposed. Opportunities to retain or transfer jobs.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
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. 	++ A full range of employment, knowledge and skills would be generated by reuse, from construction to highly skilled and managerial jobs. This would constitute a high magnitude positive impact. Given the anticipated demand for nuclear engineering, civil and construction workers over the coming decade to work on the UK's new nuclear projects, reuse of the plutonium inventory could also have a negative impact through increasing pressure on the national skill base. However, this impact would likely be mitigated by the transfer of workers from the national workforce to nuclear roles. Overall, this option is deemed to have a medium magnitude positive impact on knowledge and skills compared to the baseline, and sensitivity is considered low.	?	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. 	+++ Although plutonium reuse in fuel is an established technology globally, it is not currently done within the UK. It is therefore likely that reuse would both maintain existing skills and facilitate the development of new skills and improved knowledge, as fuel fabrication, plutonium pre-treatment and storage techniques may be required during the operational period. Such skills and knowledge may also be transferable to other areas of the nuclear industry. The magnitude of impact may therefore be high. Due to the importance of this field (nuclear power generation) to the region and nationally, sensitivity is considered medium.	?	Skill development may be time limited. Skills and knowledge opportunities may be transferable to other areas of the nuclear industry.
MT	Closure of existing facilities <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.	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
LT	Avoid maintaining existing facilities <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	Closure of new facilities <ul style="list-style-type: none"> Could create opportunities to enhance or maintain decommissioning skills and expertise. 	+	Requirements for decommissioning associated with closure of the new facilities 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.	?	Complexity of decommissioning project, and availability of decommissioning skills.
Education and Training (Potential Receptors: National Skill Base). (Indicators: Likely future skill requirements and contribution to improving the UK skill base).					
ST – LT	Development and operation of new facilities <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. 	++	Development of plutonium fuel fabrication and pre-treatment technologies may create education and training opportunities compared to the baseline of continued storage. This would likely occur in the short to medium-term during construction and operation, with benefits reducing following this period. 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.	?	Fuel fabrication and reactor technology implemented.
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 new 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.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
Economy (Potential Receptors: Local and Regional economy). (Indicators: £ Gross Value Added).				
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Expenditure on plutonium reuse 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>++</p> <p>Average Gross Value Added (GVA) per employee data for UK regions can be multiplied by employment estimates for fuel fabrication in order to estimate total GVA contributions for the reuse option.</p> <p>The value for West Cumbria is £22,030 per employee [5]⁷. 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 £330 million, or a construction sector increase of 4% - 24% a year. This would constitute a low to high magnitude impact.</p> <p>The construction GVA of West Cumbria in 2018 was £279 million, which is equated to about 5 % 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>	??	Skill development may be time limited. Skills and knowledge opportunities may be transferable to other areas of the nuclear industry.
		<p>N / A</p> <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>++</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 £22,030 per employee [5]⁷. Assuming the majority of employment is either sourced or based locally, the result for operational GVA (depending on the scale of facilities) is between about £7 million and £11 million per year for the duration of the operation period,</p>	?	Fuel fabrication and reactor technology implemented, potential transferability to other areas of the nuclear industry, future arisings

⁷ Value is for 2018, which is provisional. The value for 2017 is £21,430 suggesting numbers reported here will be insensitive to finalisation of this 2018 value.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
			equating to a manufacturing sector increase of approximately 1%. This would constitute a low magnitude impact. The manufacturing GVA of West Cumbria in 2018 was £1,627 million, (about 32 % of total GVA for West Cumbria), suggesting the sector is of high sensitivity based on its importance to the regional economy.		of plutonium requiring management.
MT	Closure of existing facilities • Decommissioning may require economic investment.	0	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 new facilities to close.	?	Decommissioning programmes at other sites, availability of personnel and expertise.
LT	Avoid maintaining existing facilities • Could lead to changes in the supply chain involved in continuing to store the plutonium.	0	Deviation from the continued safe and secure storage baseline could mean a loss of economic opportunities for some businesses but gains for others. This should be assessed at a local level. There would be a move from a small ongoing opportunity, to a larger, but time-limited opportunity. Overall, this change is deemed insignificant.	??	Opportunities for existing supply chain to be maintained, resilience of existing suppliers to adapt.
LT	Closure of new facilities • Could reduce economic contributions to the local and regional economy due to loss of employment. • Decommissioning may require nuclear civils, construction and engineering experience, which could lead to economic investment.	+	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. However, closure of new storage facilities is likely to lead to a low magnitude positive impact on jobs compared to the baseline. This would have a corresponding low magnitude impact on GVA. The manufacturing GVA of West Cumbria in 2018 was £1,627 million (about 32% of total GVA for West Cumbria), suggesting the sector is of high sensitivity based on its importance to the regional economy. Thus, implementation of this option is deemed to have an overall positive minor impact compared to the baseline.	??	The site decommissioning programme Cumulative effects of other facilities closing. Potential for facilities to be repurposed. Proportion of jobs created as new jobs
Local and National Assets (Potential Receptors: local, regional and national community).					

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
(Indicators: Indices of Multiple Deprivation (IMD) ranking for barriers to housing and services, the existence of alternative facilities)				
ST - LT	<p>Construction and operation of new facilities</p> <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. 	<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 reuse on local assets can be considered neutral.</p> <p>The area around the Sellafield site (Copeland) is ranked the 215th most-deprived Local Authority District out of 317 in England in relation to “Barriers to housing and services”. The receptor therefore has low sensitivity to changes.⁸</p>	??	Potential changes to site access routes would be highly dependent on the location of any facilities and the estimated number of vehicle movements involved.
MT - LT	<p>Development of new facilities</p> <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>+</p> <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	<p>Closure of existing facilities and avoiding need to maintain them</p>	<p>0</p> <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>	✓	

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, road distance to a Post Office or sub post office, measures of household overcrowding, homelessness and housing affordability.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
LT	Closure of new facilities	0	No significant impact on existing local and national assets is expected as a result of the closure of new 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	Construction of new facilities <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. 	-	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. 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. General health statistics for residents in the Copeland are slightly poorer than the health statistics for the UK as a whole, so indicator sensitivity is medium.	?	Number of vehicle movements and the timescales over which they occur, number of facilities to be constructed, capacity of local medical facilities, proximity of residents and other receptors to activities.
MT - LT	Operation of new facilities <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. 	-	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. 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.	?	Length of the operation phase and the fuel fabrication technology used, number of transport movements.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
MT - LT	<p>Closure of existing and new 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).</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>–</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, number of transport movements and timescale over which they occur.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
MT	Operation of new facilities <ul style="list-style-type: none"> Increased noise and vibration from operation of plant and facilities. 	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	Closure of existing and new facilities <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. 	-	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.	?	Demolition required, types of equipment and plant used, number of transport movements (linked to the proportion of waste material that can be reused on-site).
LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> Reuse would avoid the noise and vibration-generating works needed to replace and maintain existing stores. 	+	Avoiding construction of stores on a recurring basis is likely to have a low magnitude positive impact. As for construction of new facilities, the overall significance of this impact is considered minor.	??	Extent of the construction works required, location of the new facilities, types of equipment and plant used, number of transport movements and timescale over which they occur.
Effects on physical activity and obesity 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. (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	Construction of new facilities <ul style="list-style-type: none"> Can potentially reduce the attractiveness and usage of recreation 	-	As the majority of environmental effects which could influence use of recreational areas and local amenities would be confined within or close to	??	Extent of the construction required, location of the new facilities, types of

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
	<p>and amenity areas through visual disturbance from plant and vehicles, and through changes in traffic volumes and patterns on the local road network.</p> <ul style="list-style-type: none"> This can lead to changes in levels of physical activity undertaken by the local population. 	<p>the site boundary, the magnitude of impacts from a health perspective is likely to be low.</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>		equipment and plant required
MT	<p>Operation of new facilities</p> <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. 	<p>–</p> <p>Following construction and extending into the long-term there may continue to be adverse environmental effects associated with the presence of the facilities themselves and the ongoing transport of conditioned wastes, firstly to an interim store and then to a disposal facility (this will be covered in assessments elsewhere). Impacts on local recreational and amenity areas (and subsequently levels of physical activity) from these effects is considered to be low.</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 and stores.
MT - LT	<p>Closure of existing and new 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 and 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 existing stores to recreational and amenity areas, number of transport movements required.
LT	<p>Avoid maintaining existing facilities</p> <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. 	<p>+</p> <p>In the medium and long-term there could be positive 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>	??	Extent of maintenance and repackaging activities required, changes to the health baseline of the local

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
		Taking into account the health profile of Copeland, sensitivity is considered medium.		population (may become more or less sensitive).
<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>	?	Number and timing of transport movements (linked to number 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). 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> <p>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, number and timing of transport movements.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
MT - LT	<p>Closure of existing and new 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.</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>	?	See construction of new facilities (above).
LT	<p>Avoid maintaining existing facilities</p>	<p>+</p> <p>In the medium and long-term there could be positive effects from avoiding activities to repack the plutonium, maintain existing facilities and build replacement stores. 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>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>-</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.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
MT - LT	<p>Operation of new facilities</p> <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. 	-	<p>Processes that may be used in the plutonium pre-treatment process are not thought to produce any low level radioactive liquid waste streams, and radioactive and non-radioactive discharges to water from the fuel fabrication process are likely to be very small. Thus, the magnitude of the impact of this option on health effects related to changes in the water environment are considered 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>	?	Technology used and the use of any aqueous processes.
MT - LT	<p>Closure of existing and new 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 recreational users of these features. 	-	<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 waterbodies 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.
LT	<p>Avoid maintaining existing facilities</p>	+	<p>In the baseline, construction of replacement stores is required. Construction of new stores would likely take place within the existing site boundary and be controlled through construction good practice and monitoring; any residual impacts are likely to be of low magnitude, but any such impact under implementation of this option would be positive because it is avoided.</p> <p>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.</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>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>					

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
(Indicators: Discharge rates at the site, RIFE total reported dosages to the public).				
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>++</p> <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 continue to be stored 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 continuing to store the plutonium in its current form is considered low. Sensitivity to changes is therefore low.</p>	✓	
<p>Mental health and Wellbeing effects</p> <p>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.</p> <p>(Potential Receptors: Mental health statistics for local population, visitors, regional population).</p>				
ST	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Likely to create employment opportunities, which studies have shown can positively influence mental health and wellbeing. 	<p>+</p> <p>Under the reuse 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.</p>	??	Number of jobs created, duration of the construction works, where employment is sourced from.
	<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. 	<p>-</p> <p>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</p>	??	Extent of environmental impacts, duration of the construction works.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
	Such health effects might include annoyance, anxiety or stress.	close proximity to the site, and would be of low magnitude once mitigation measures were applied.		
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. 	+	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 - LT	<p>Closure of existing and new 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. 	0	<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 and jobs can be transferred, then these impacts may be mitigated. Employment opportunities created to carry out the decommissioning activities would be short-term and there would be long-term job losses compared to the baseline option of continual replacement of stores.</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 not considered to be a significant effect on mental health and wellbeing associated with closing facilities.</p>	?? Number of jobs created, how many jobs lost or transferred, timescales for closures. Nature and extent of environmental impacts.

4.1.3 Condition and treat – Description of Option

Option	Build facilities to condition and treat plutonium prior to storage and disposal to a geological disposal facility (GDF) (Condition and treat)	
Site	Sellafield	
Description	<p>All plutonium options ultimately end in disposal, but this option considers the most direct path to disposal, via conditioning and treatment. 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 and treatment would take place at Sellafield. The material would then need to be placed in interim storage pending transfer to a GDF.</p> <p>The four conditioning technologies used to inform this assessment (Cementation, Vitrification, Hot Isostatic Press and Disposal 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 would likely be a single treatment plant and one or more interim stores.</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. Cementation is a relatively simple process, whereas Vitrification and Hot Isostatic Press are more complex.</p>	<p>Closure of existing and new facilities This conditioning and treatment option 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 disposed of to a GDF.</p> <p>Avoid need to maintain existing facilities Disposal at the earliest opportunity would avoid the need to continuously replace existing stores and repackage the plutonium, which would be required under the baseline scenario. Repackaging is needed periodically, depending on the type of plutonium and if the original container has already been replaced, whilst the stores are built to up to a 100-year design life but may require regular maintenance works.</p>

4.1.4 Condition and treat – Assessment

Timescale	Risk / Opportunity for Impact	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. 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.	? Number 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.
MT - LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> • In the baseline existing facilities used to store plutonium would be maintained on a continuous basis, with the plutonium repackaged periodically. 	+	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 that 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.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
LT	Closure of existing and new 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. 	<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).
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, 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.</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>	??	Number and scale of facilities requiring construction, characteristics of nearby sites of value for nature conservation (both designated and non-designated) and other ecological receptors, number of transport movements 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. 	<p>0</p> <p>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.</p>	?	Technology used, number of transport movements required to transport materials and workers, duration of the operational phase.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
MT	Closure of existing and new facilities <ul style="list-style-type: none"> • Could involve pollutant-emitting activities such as demolition and transport movements, which could affect ecological receptors. 	-	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. 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	+	As repackaging activities and works to replace stores takes place infrequently over a number of years, any effects from avoiding the need to maintain existing stores is likely to be of a low magnitude, but positive.	?	Extent of activities required to maintain existing stores.
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. The impact of increased CO ₂ emissions may continue beyond the end of construction.	--	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 in terms of CO ₂ emissions 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, defined as 'emissions from industry except for those associated with fuel combustion (for example, emissions from cement manufacture)' [3]. Given the overall steady decline in CO ₂ emissions in the industrial process sector between 1990 and 2018, and the relatively modest contribution of the sector to UK emissions, indicator sensitivity is considered low.	?	Embodied carbon of materials used, complexity and number of facilities (may affect construction programmes)
MT - LT	Operation of new facilities <ul style="list-style-type: none"> • Impacts on climate change and energy use from use of plant and equipment. 	-	The facilities may be operational and using substantial amounts of energy and generating CO ₂ 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.	??	Contribution of the facilities to sector CO ₂ emissions, changes in targets, extent to which waste packages need to

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
				be infilled. Ability to adapt to avoid, mitigate and offset carbon emissions.
MT-LT	Closure of existing and new facilities <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>	?	If international and national carbon emission targets become stricter in the medium to long-term, indicator sensitivity may increase. Ability to adapt to avoid, mitigate and offset carbon emissions.
MT-LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> Maintaining stores and repackaging plutonium on a continuous basis under the baseline scenario could generate CO₂ emissions and require energy use. 	<p>++</p> <p>The activities involved in maintaining existing facilities would generate some emissions of CO₂, and the recurring nature of the work, would make the impact magnitude medium. Avoiding these impacts may therefore have a moderate positive effect in the medium to long-term.</p>	?	The extent of activities required to repackage plutonium and replace stores.
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>-</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>The vast majority of the Sellafield site 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 between 5 m and 50 m 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</p>	?	The extent of coastal erosion and sea level rise, any changes to existing coastal defences.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
	opportunities to further protect coastlines from erosion.	0	which protect the site from coastal erosion, sensitivity in the short to medium-term is low.	
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 continuing to store the material in facilities that may be at risk of flooding and coastal change. 	+	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. 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 continue to be stored in its current form. 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 new facilities <ul style="list-style-type: none"> Decommissioning may create opportunities to reduce flood risk. 	0	Given that the vast majority of 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.	?
Cultural Heritage (Potential Receptors: Listed buildings, Scheduled Ancient Monuments, Registered Parks and Gardens, Conservation Areas).				
ST	Construction of new facilities	-	Construction works likely to be confined within the site boundary. Direct impacts through damage or degradation of buildings or structures would	??
				This is a very site-specific

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
	<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>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>		<p>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.</p>
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. 	0	<p>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.</p>	✓	
MT-LT	<p>Closure of existing and new 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>Decommissioning works would likely be confined within the site boundary, making direct impacts through damage or degradation of buildings and 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>	??	<p>See construction of new facilities (above).</p>

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty	
LT	Avoid maintaining existing facilities	+	However, given the presence of many other industrial facilities at the site, such impacts are unlikely to be significant.	✓	
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 on soil quality at the site. Potential for non-radioactive releases to the ground, leading to land contamination within the site boundary. 	-	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. 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.	✓	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 excavation activities. <p>This may vary depending on the conditioning technology used but would be substantial compared to the baseline.</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. 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.	?	Extent of material reuse.
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.	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
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>–</p> <p>As the stores and packages used to contain plutonium may have 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 are considered to have low 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>	<p>+</p> <p>Maintaining the stores and repackaging the plutonium would require 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> <p>However, avoiding construction of stores on a recurring basis is likely to have a low magnitude positive impact. As for construction of new facilities, the overall significance of this impact is considered minor.</p>	?	Nature of repackaging activities, risk of contamination or discharges e.g. from plutonium decay.
LT	<p>Closure of new 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>–</p> <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 of impacts 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, which is currently considered to be low.</p>	??	See closure of existing facilities (above).
<p>Landscape and Visual</p> <p>(Potential Receptors: The local population, cyclists, pedestrians and equestrians using local routes, flora and fauna, tourists and other visitors to the area).</p> <p>(Indicators: The local landscape).</p>				

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
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. Although Sellafield is located near a National Park, the industrial nature of the site and its prominence in the local landscape means 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. Although Sellafield is located near a National Park, the industrial nature of the site and its prominence in the local landscape means sensitivity of the surrounding landscape to further adverse changes can be considered low.	?	Decommissioning of other facilities at the site could increase the prominence of the plutonium treatment and storage. Location of facilities and stores.
MT - LT	Closure of existing and new 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 number and scale of facilities removed and other facilities on the site.
LT	Avoid maintaining existing facilities	+	Due to the extensive industrial nature of the site, landscape and visual effects associated with avoiding activities to replace stores and repackage the plutonium are likely to be minor, but positive.	✓	
Materials and Waste (Potential Receptors: Local, regional and national waste management facilities, local landfills, the Low Level Waste Repository).					
ST	Construction of new facilities	---	Material requirements may differ depending on the conditioning technology used, but would involve substantial volumes of construction materials such as	?	Complexity and design of the treatment and

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
	<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>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 continued safe and secure storage.</p> <p>Although there may be some opportunities to reuse existing material on the site, it is likely that some would need to be imported given the volumes of material required. 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>		<p>storage facilities (likely to alter material requirements). Distances over which material need to be imported, and whether material on-site can be reused.</p>
MT	<p>Operation of new facilities</p> <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>-----</p> <p>Compared to the baseline of continued safe and secure storage the plutonium as a nil value asset, conditioning and treatment prior to disposal may require classifying some or 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>	✓	<p>Potential for extended storage of waste due to GDF programme delays.</p>
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. 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 the Sellafield site and forecast in future (in 2019 this was estimated to be over 1,390, 148,000 and 453,000 cubic metres of HLW, ILW and LLW (excluding VLLW) respectively), the generation of waste in the volumes that might be expected from closing existing facilities is relatively small. Sensitivity could therefore be</p>	?	<p>The volume and nature of waste generated, the extent to which waste materials can be reused.</p>

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
		considered low. Cumulative impacts need to be considered, as does the capacity of facilities to receive any LLW or VLLW arisings.		
LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> Maintaining stores and repackaging the plutonium on a continuous basis requires materials and produce waste. 	<p>++</p> <p>Although the timescale before existing facilities need replacing is relatively long, undertaking such maintenance activities continuously 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.
LT	Closure of new 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 new 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 of capacity 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, number of transport movements and the timescale over which they occur.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	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>		
ST-LT	<p>Operation of existing and 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 existing and 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>	✓	
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 considerable decommissioning activities may be required, noise and vibration impacts from such activities can be mitigated through standard construction and 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	<p>Avoid maintaining existing facilities</p> <ul style="list-style-type: none"> Replacing stores and repackaging the plutonium may generate noise and vibration. 	<p>+</p> <p>Avoiding construction of stores on a recurring basis is likely to have a low magnitude positive impact. As for construction of new facilities, the overall significance of this impact is considered minor.</p>	??	The location and extent of construction works, number of transport movements and the timescale over which they occur.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
LT	Closure of new 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>–</p> <p>Noise and vibration impacts from decommissioning activities can be mitigated through standard construction and 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. This needs 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.
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>++</p> <p>Conditioning the plutonium would reduce the risk associated with continuously storing it in its existing form. Plutonium decay in storage gives rise to alpha, 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.</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 low.</p>	?	The potential build-up of plutonium daughter products via radioactive decay.
MT - LT	Closure of existing and new facilities <ul style="list-style-type: none"> Decommissioning activities such as demolition of facilities have the potential to result in discharges of radioactivity. 	<p>–</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 and new facilities are likely to be low. Discharge rates for the site as a whole are likely to decrease in the long-term, so receptor sensitivity is considered medium.</p>	?	Future site discharge rates
LT	Avoid maintaining existing facilities <ul style="list-style-type: none"> Replacing stores and repackaging is associated with radiological discharges. 	<p>+</p> <p>Although the timescale before existing facilities need replacing is relatively long, undertaking such maintenance activities on a continuous basis would be associated with a level of radiological discharges. Avoiding replacement and</p>	?	The potential build-up of plutonium daughter products via radioactive

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
			repackaging of plutonium may therefore be considered a low magnitude positive impact. 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.		decay, future site discharge rates.
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 considered to be good in accordance with the Water Framework Directive, sensitivity to contamination is considered to be medium. The very large volumes of water currently abstracted by the site (millions of 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, changes in volume of water abstracted as site activities change, proportion of water volume new construction activity uses.
MT	Operation of new facilities <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. 	-	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. 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.	?	Extent of indirect water abstraction and consumption needed to support workers etc.
MT	Closure of existing facilities	-	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	??	Water requirements during decommissioning.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
	<ul style="list-style-type: none"> • Could require increased water abstraction. • May increase the risk of pollutant discharges to water receptors. 	<p>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>		
LT	Avoid maintaining existing facilities	<p>++</p> <p>In the baseline, construction of replacement stores is required. Construction of new stores 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. Reuse or immobilisation of plutonium would avoid the need to construct these stores, therefore avoid this impact.</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 (millions of cubic metres) suggest that sensitivity to further water consumption (likely during construction) may be high, although predictions of site water utilisation over the next few decades are not currently available and are technology dependant.</p>	?	Water requirements during store replacement and repackaging, changes in volume of water abstracted as site activities change, proportion of water volume new construction activity uses.
LT	Closure of new facilities	<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 improve once operations such as reprocessing are complete.</p> <p>Water abstraction involved in closing new facilities may place an additional burden on water resources at the site. Water consumption is currently very</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

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
		high and this may continue into the long-term. Sensitivity to increased water abstraction may therefore be considered medium.		Framework Directive classifications.
SOCIO-ECONOMICS				
Employment (Potential Receptors: Regional and national employment). (Indicators: Employment created or 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. 	<p>Estimates for jobs associated with conditioning options range from 200 to 2,000 FTE per year for a construction period of at least 5 years.⁹ The low end of the range is based on construction of a small vitrification plant, while the upper end is based on construction of a cementation plant.</p> <p>Construction is assumed to occur at Sellafield, which is within the Copeland district. About 9.2% (3,030 people) of the local population are estimated to work in construction [4], 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 7% and 66% per year would constitute a medium to high magnitude impact.</p>	??	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. 	<p>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 disposal MOx may result in around 300-500 jobs per year.⁹</p> <p>The contribution of the “manufacturing” sector (which includes most decommissioning and fuel reprocessing work) to the local employment market in terms of jobs is estimated to be 6, 578 [4]. Sensitivity is therefore considered high based on the importance of manufacturing jobs to the local labour market.</p>	?	Proportion of jobs created as new jobs, and the number transferred from other activities in the industry. For example, those involved in continued safe and secure storage of plutonium.

⁹ 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 Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
			The increase in employment in this sector would be between 5% and 15 %, which would constitute a low to medium magnitude impact, but could also bring skills export potential of unknown value.		
MT	Closure of existing facilities <ul style="list-style-type: none"> Decommissioning has the potential to create employment opportunities. 	0	Nuclear civil, construction, engineering and waste management expertise may be required to decommission the existing facilities used to store the plutonium inventory. However, this requirement is unlikely to generate enough new employment opportunities to constitute a significant impact.	✓	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. 	--	<p>Whilst some employment from management of the current stores may be lost, this number is relatively small. As there is likely to be a high level of transferability of these roles to the new facilities, the overall impact is unlikely to be significant.</p> <p>However, replacement stores would need to be constructed under the baseline option, which would likely have a medium magnitude impact on employment.</p> <p>Construction is assumed to occur at Sellafield, which is within the Copeland district. About 9.2% (3,030 people) of the local population are estimated to work in construction [4], suggesting it is an important contributor to local employment markets. Sensitivity is therefore considered medium.</p>	?	Number of jobs supported by existing stores, the transferability of existing jobs to new facilities.
LT	Closure of new facilities <ul style="list-style-type: none"> Decommissioning of new facilities could result in job losses. 	++	<p>Decommissioning of the new facilities would lead to a number of jobs being created compared to the baseline scenario. However, given extant decommissioning activities on site, the magnitude of this impact is likely to be low.</p> <p>The contribution of the “manufacturing” sector (which includes most decommissioning and fuel reprocessing work) to the local employment market in terms of jobs is roughly 6,578 [4]. Sensitivity is therefore considered high based on the importance of manufacturing jobs to the local labour market.</p>	?	Potential for facilities to be repurposed. Opportunities to retain or transfer jobs.
Knowledge and Skills (Potential Receptors: National skill base).					

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
(Indicators: Existence and degree of maintenance of skills, anticipated demand for nuclear skills, national nuclear knowledge and capabilities).				
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>++</p> <p>Regardless of the conditioning technology used, there would be a full range of employment generated by disposal, from construction to highly skilled and managerial jobs. In particular, cementation would require a greater number of jobs of a relatively lower skill requirement. This would constitute a high magnitude positive impact.</p> <p>Given the anticipated demand for nuclear engineering, civil and construction workers over the next decade to work on the UK's new nuclear projects, conditioning and treatment of the plutonium inventory could have a negative impact through increasing pressure on the national skill base. However, this impact would likely be mitigated by the transfer of workers from the national workforce to nuclear roles.</p> <p>Overall, this option is deemed to have a medium magnitude positive impact on knowledge and skills compared to the baseline, and sensitivity is considered low.</p>	?	Specific skills required and the availability of such skills in the local or regional area.
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 disposal MOx options as both technologies are relatively immature and would likely require R&D. 	<p>+++</p> <p>It is likely that conditioning and treatment would both maintain existing skills and facilitate the development of new skills and knowledge 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. 	<p>0</p> <p>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.</p>	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
LT	Avoid maintaining existing facilities <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	Closure of new facilities <ul style="list-style-type: none"> Could create opportunities to enhance or maintain decommissioning skills and expertise. 	+	Requirements for decommissioning associated with closure of the new facilities 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.	?	Complexity of decommissioning project, and availability of decommissioning skills.
Education and Training (Potential Receptors: National Skill Base). (Indicators: Likely future skill requirements and contribution to improving the UK skill base).					
ST – LT	Development and operation of new facilities <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. 	++	HIP and disposal MOx conditioning technologies in particular would create education and training opportunities as these are the least technically mature options. If disposal via cement or vitrification is implemented, there would still be some education and training opportunities created compared to the baseline of continued safe and secure 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.	?	Conditioning technology implemented.
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.	✓	

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
LT	Closure of new facilities	0	Following completion of disposal, there will likely be a requirement for additional decommissioning personnel 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 or 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 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.	++	Average Gross Value Added (GVA) per employee data for UK regions can be multiplied by employment estimates for conditioning to estimate total GVA contributions for the disposal option. The value for West Cumbria is £22,030 per employee [5] ¹⁰ . Assuming the majority of employment is either sourced or based locally, this results in a 5 year total of construction GVA of between £22 million to £220 million, or a construction sector increase of approximately 2% to 16% per year. This would constitute a low to medium magnitude impact. The construction GVA of West Cumbria in 2018 was £279 million, which equated to about 5% 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.	?	Skill development may be time limited. Skills and 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 assessed in an independent assessment elsewhere.	N/A	

¹⁰ Value is for 2018, which is provisional. The value for 2017 is £21,430 suggesting numbers reported here will be insensitive to finalisation of this 2018 value.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
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. The value for West Cumbria is £22,030 per employee [5]¹¹. Assuming the majority of employment is either sourced or based locally, the result for operational GVA is between £7 million and £22 million per year for the duration of the operation period, equating to a manufacturing sector increase of about 1%. This would constitute a low magnitude impact.</p> <p>The manufacturing GVA of West Cumbria in 2018 was £1,627 million, (about 32% of total GVA for West Cumbria), suggesting the sector is of high sensitivity based on its importance to the regional economy, and the potential for international skills export</p>	??	Conditioning technology implemented, potential transferability to other areas of the nuclear industry, future arisings of plutonium requiring management.
MT	<p>Closure of existing facilities</p> <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 new facilities to close.</p>	?	Decommissioning programmes at other sites, availability of personnel and expertise.
LT	<p>Avoid maintaining existing facilities</p> <ul style="list-style-type: none"> • Could lead to changes in the supply chain involved in storing the plutonium. 	<p>0</p> <p>Deviation from the continued storage baseline could mean a loss of economic opportunities for some businesses but gains for others. This should be assessed at a local level. There would be a move from a small ongoing opportunity, to a larger, but time-limited opportunity. Overall, this change is deemed insignificant.</p>	??	Opportunities for existing supply chain to be maintained, resilience of existing suppliers to adapt.
LT	<p>Closure of new facilities</p> <ul style="list-style-type: none"> • Could reduce economic contributions to the local and regional economy due to loss of employment. • Decommissioning may require nuclear civils, construction and engineering experience, which could lead to economic investment. 	<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. The disposition plant will be one of the last facilities at Sellafield so proportionately there will be a bigger impact on the site total at the time.</p>	??	The site decommissioning programme. Cumulative effects of other facilities closing. Potential for facilities to be repurposed.

¹¹ Value is for 2018, which is provisional. The value for 2017 is £21,430 suggesting numbers reported here will be insensitive to finalisation of this 2018 value.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
			<p>However, closure of new storage facilities is likely to lead to a low magnitude positive impact on jobs compared to the baseline. This would have a corresponding low magnitude impact on GVA.</p> <p>The manufacturing GVA of West Cumbria in 2018 was £1,627 million (about 32% of total GVA for West Cumbria), suggesting the sector is of high sensitivity based on its importance to the regional economy. Thus, implementation of this option is deemed to have an overall positive minor impact compared to the baseline.</p>		Proportion of jobs created as new jobs.
<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 - LT	<p>Construction and operation of new facilities</p> <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 disposal on local assets can be considered neutral.</p> <p>The area around the Sellafield site (Copeland) is ranked the 215th most-deprived Local Authority District out of 317 in England in relation to “Barriers to housing and services”. The receptor therefore has low sensitivity to changes.¹²</p>	??	Potential changes to site access routes would be highly dependent on the location of facilities and the estimated number of vehicle movements involved.
MT - LT	<p>Development of new facilities</p> <ul style="list-style-type: none"> At a national scale, development of one or more conditioning and storage 	+	Vitrification and cementation are common methods for conditioning radioactive waste, and emerging technologies (such as Hot Isostatic Pressing, HIP) are considered more appropriate for conditioning plutonium.	✓	The suitability of any developed facilities to manage future arisings,

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, road distance to a Post Office or sub post office, measures of household overcrowding, homelessness and housing affordability.

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
	facilities may provide opportunities for the management of other waste streams.		<p>Opportunities may therefore exist as part of this option to develop and maintain a national asset or assets. This would constitute a medium to long-term positive impact of medium magnitude.</p> <p>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 condition and treat option is implemented, receptor sensitivity can be considered low.</p>		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 new facilities	0	No significant impact on existing local and national assets is expected as a result of the closure of new facilities.	?	
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	Construction of new facilities	-	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	?	Number of vehicle movements and the timescales over which

Timescale	Risk / Opportunity for Impact	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>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>General health statistics for residents in the Copeland are slightly poorer than the health statistics for the UK as a whole, so indicator sensitivity is medium.</p>		they occur, number 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>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, number of transport movements.
MT - LT	<p>Closure of existing and new 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>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 amenity and recreations 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>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>+</p>	??	Activities required to maintain existing stores and repackage the plutonium, changes to the health baseline of the local population (may

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
			Taking into account the health profile of Copeland, sensitivity is considered medium.		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, number 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 new 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, number of transport movements.
LT	<p>Avoid maintaining existing facilities</p>	+	Avoiding construction of stores on a recurring basis is likely to have a low magnitude positive impact. As for construction of new facilities, the overall significance of this impact is considered minor.	??	Extent of the construction works required, location of the new facilities, types of equipment and

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
	<ul style="list-style-type: none"> Reuse would avoid the noise and vibration-generating works needed to replace and maintain existing stores. 				plant used, number of transport movements and timescale over which they occur.
<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 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>Construction 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>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>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
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>Following construction and extending into the long-term there may continue to be adverse environmental 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). Impacts on local recreational and amenity areas (and subsequently levels of physical activity) from these effects is considered to be low.</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>	?	Decommissioning of other facilities at the site could increase the prominence of the conditioning and treatment facilities. Location of facilities and stores.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
MT - LT	<p>Closure of existing and new 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 and 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.</p>	?	Proximity of existing stores to recreational and amenity areas, number of transport movements required.
MT-LT	<p>Avoid maintaining existing facilities</p> <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. 	<p>+</p> <p>In the medium and long-term there could be positive 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. 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>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 	<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>	?	Number and timing of transport movements (linked to number of facilities constructed), cumulative developments, changes

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
	exacerbate physical and mental health conditions.			in local transport network and travel patterns.
MT	Operation of new facilities • There may be a requirement for ongoing transport movements.	0 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 significant impacts on users of the local transport network.	??	Number and timing of transport movements.
MT - LT	Closure of existing and new facilities • 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.	- 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.	?	The number and timing of transport movements, changes in the local transport network and travel patterns.
LT	Avoid maintaining existing facilities	+ In the medium and long-term there could be positive effects from avoiding activities to repackaging the plutonium, maintain existing facilities and build replacement stores. 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. Taking into account the health profile of Copeland, sensitivity is considered medium.	??	Extent of maintenance and repackaging activities required, changes to the health baseline of the local population (may become more or less sensitive).
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. 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	- Short-term changes to the water environment from construction activities could have health implications if they affect drinking supplies or recreational	?	Dewatering required as part of construction,

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
	<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>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>		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>–</p> <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 new 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 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 freshwater 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
LT	<p>Avoid maintaining existing facilities</p>	<p>+</p> <p>In the baseline, construction of replacement stores is required. Construction of new stores would likely take place within the existing site boundary and be controlled through construction good practice and monitoring; any residual impacts are likely to be of low magnitude, but any such impact under implementation of this option would be positive because it is avoided.</p> <p>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.</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.

Timescale	Risk / Opportunity for Impact	Significance of Impact	Uncertainty	Factors affecting uncertainty
<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"> 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. 	<p style="text-align: center;">++</p> <p>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.</p> <p>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 continue to be stored 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 continuing to store plutonium in its current form is considered low. Sensitivity to changes is therefore low, giving an overall moderate positive impact.</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	<p>Construction of new facilities</p> <ul style="list-style-type: none"> Likely to create employment opportunities, which studies have shown can positively influence mental health and wellbeing. 	<p style="text-align: center;">+</p> <p>Under this condition and treat 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.</p>	??	<p>Number of jobs created, duration of the construction works, where employment is sourced from.</p>

Timescale	Risk / Opportunity for Impact	Significance of Impact		Uncertainty	Factors affecting uncertainty
	<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. 	-	<p>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.</p>	??	<p>Extent of environmental impacts, duration of the construction works.</p>
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. 	+	<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>	??	<p>Socio-economic opportunities available, whether these are made available to local population, environmental impacts and whether they can be mitigated.</p>
ST - LT	<p>Closure of existing and new 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. 	0	<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 and jobs can be transferred, then these impacts may be mitigated. Employment opportunities created to carry out the decommissioning activities would be short-term and there would be long-term job losses compared to the baseline option of continual replacement of stores.</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 not considered to be a significant effect on mental health and wellbeing associated with closing facilities.</p>	??	<p>Number of jobs created, how many jobs lost or transferred, timescales for closures. Nature and extent of environmental impacts.</p>

5.0 References

- 1 DECC; The Scottish Government; Welsh Government; DOE, *UK Strategy for the Management of Solid Low Level Waste from the Nuclear Industry*, February 2016.
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- 3 Department for Business, Energy and Industrial Strategy, *2018 UK Greenhouse Gas Emissions, Provisional Figures*, 28th March 2019.
- 4 Office for National Statistics, *Copeland Local Authority: Local Area Report*, NOMIS Official Labour Market Statistics. Available at <https://www.nomisweb.co.uk/reports/localarea?compare=E07000029>. Accessed 1st May 2020.
- 5 Office for National Statistics, *Regional Gross Value Added (Balanced) per Head and Income Components*, GVA(B) Dataset, 19th December 2019