The NDA group
Draft Strategy

Integrated Impact Assessment Report
Volume 2: Assessment Report
July 2025

Glossary

AGR	Advanced Gas-Cooled Reactor
ALARA	As low as reasonably achievable
ALARP	As low as reasonably practicable
AMR	Advanced Modular Reactor
BAT	Best Available Technique
BPM	Best Practicable Means
C&M	Care and Maintenance
CO_2	Carbon Dioxide
BEIS	Department for Business, Energy & Industrial Strategy
DESNZ	Department for Energy Security & Net Zero
DNO	Defence Nuclear Organisation
EIA	Environmental Impact Assessment
GDF	Geological Disposal Facility
GVA	Gross Value Added
HIA	Health Impact Assessment
IIA	Integrated Impact Assessment
ILW	Intermediate Level Waste
LLW	Low Level Waste
LLWR	Low Level Waste Repository Ltd
NDA	Nuclear Decommissioning Authority
NLF	Nuclear Liability Fund
NO_x	Oxides of nitrogen
NPS	National Policy Statement
NSD	Near Surface Disposal
NSIP	Nationally Significant Infrastructure Project
NTS	Nuclear Transport Solutions
NWS	Nuclear Waste Services
POCO	Post Operational Clean Out
PM	Particulate Matter
RIFE	Radioactivity in Food and the Environment
SDG	Sustainable Development Goal
SDP	Submarine Dismantling Project
SDR	Site Decommissioning and Remediation
SEA	Strategic Environmental Assessment
SeIA	Socio-Economic Impact Assessment
SLC	Site Licence Company
SMR	Small Modular Reactor
SO_2	Sulphur dioxide
TMF	Tails Management Facility
UF_6	Uranium Hexafluoride
UK	United Kingdom

Contents

1. Introduction

This Volume (Volume 2) of the Integrated Impact Assessment (IIA) contains the detailed assessment of the Nuclear Decommissioning Authority's (NDA's) Strategy 5 (2026) [19]. The Strategy is split into four themes with accompanying Critical Enablers. In collaboration with the NDA, credible options have been determined for each theme and for the Transport Critical Enabler. These credible options are described in further detail in Volume 1 of the IIA. Environmental, socio-economic and health baseline information for regional, local and NDA sites, where available, is presented in Volume 3 of the IIA. This information has been applied in the assessment where relevant.

The assessment combines a Strategic Environmental Assessment (SEA), Health Impact Assessment (HIA) and Socio-Economic Impact Assessment (SeIA). An IIA should meet the requirements of the Strategic Environmental Assessment (SEA) Directive and transposing United Kingdom (UK) regulations. Health and socio-economic impacts are not statutory requirements, but a health impact assessment is recommended within the SEA Directive, and a socio-economic impact assessment demonstrates good practice.

This Volume presents the methodology for the assessment, the results of the assessment and a discussion of cumulative effects of the Strategy, as well as conclusions drawn from the assessment.

2. Methodology

2.1 Assessment Methodology

The assessment will be carried out using the following methodology.

1. Identify the risks of adverse, or opportunities for beneficial effects, of the credible options identified in the Strategy, and how they might occur.
2. Identify any existing legislative requirements and forms of mitigation which may already address the risks.
3. Where the risk of, or opportunity for an effect remains, assess the potential significance (based on the magnitude of the effect and the sensitivity of receptors), where possible considering uncertainties and factors which may cause the significance to vary.
4. Recommend further mitigation and enhancement measures.
5. Recommend monitoring and response mechanisms.

2.1.1 Significance

The significance of an impact is established by determining the potential magnitude of the impact and the sensitivity of potential receptors, as shown in Figure 1.

Figure 1: Impact Significance Matrix

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

The magnitude of impact is based on the following elements:

- Nature of the impact – e.g., can it destroy a feature or remove it, or will it reduce its health, performance or status?

- Degree, intensity and extent of losses or gains - could destruction of a feature or extinction of a local population of a species occur, or a reduction in emissions to air and water?
- Spatial scale - i.e. what is the geographical area over which the effect would be perceived or experienced?

The sensitivity of a receptor considers the vulnerability of the receptor to change, whether the receptor can recover from change and how important the receptor is. For some topics, a change to the receptor can be measured (for example, change in a species' population, change in water quality). However, where change to a receptor cannot be directly measured, an indicator can be used.

An indicator is a parameter than can represent change to a receptor, for example when the concentration of nitrous oxide (indicator) changes, people (receptor) may be impacted. The sensitivity of an indicator can represent the sensitivity of the receptor, which can then be used to determine the impact significance.

Receptors and corresponding indicators for some environmental topics discussed in Volume I and II are shown in Table 1.

Table 1: Topics for which the indicators have been used

Topic	Receptors	Indicator
Environment		
Air quality	People, flora and fauna	Local air quality (concentrations of relevant pollutants: oxides of nitrogen [NO_x], Particulate Matter [PM10] and sulphur dioxide [SO_2])
Climate change	Atmosphere, oceans, flora and fauna, people	Energy sector emissions and nuclear contribution to total emissions
Coastal change and flood risk	People, flora and fauna and infrastructure	Flood Risk Maps
Landscape and visual impact	People, floral and fauna	Landscape designations
Radiological emissions and discharges	People, flora and fauna, atmosphere, water bodies	Emissions/discharge rates at the site Radioactivity in Food and the Environment (RIFE) total reported doses to the public
Water resources and quality	People, flora and fauna	Local water quality

2.1.2 Uncertainty

Uncertainty of the assessment is categorised as follows.

??	Result is considered highly uncertain and will almost certainly require further detailed assessment at a later stage, for example as part of a detailed Environmental Impact Assessment (EIA) at a project level.
?	Result is considered uncertain and may require further detailed assessment at a later stage.
ü	Result is considered fairly certain and is unlikely to vary enough to require further assessment.

The uncertainty is based on the reliability of the baseline information, the confidence of the magnitude and sensitivity identified in the assessment and the potential for the strategy to change in the future.

2.2 Generic Activities

The credible options for the four strategy themes, Site Decommissioning and Remediation, Spent Fuels, Nuclear Materials, and Integrated Waste Management, and the Critical Enabler of Transport, are described in detail in Volume 1 of the IIA. The majority of these credible options require generic, or common activities to implement them. In order to remove repetition, assessments have been carried out for these generic activities, presented in Section 3, Table 3 to Table 8. Significant impacts for each credible option are then discussed separately in Section 4. Where a credible option may require additional activities, the impacts of these are also discussed. Reasons for not discussing a credible option are provided in Volume 1 of the IIA.

The four generic activities are:

- Land – either an increase or decrease in land utilised by NDA for mission progress
- Construction
- Operation and maintenance
- Transport – either an increase or decrease in transport of NDA assets or liabilities

The generic activities that are applicable to each credible option are listed in Table 2 below.

Table 2: Generic activities and applicable credible options

Key: Short-term (ST), Long-term (LT), Applicable ( ), Not applicable (-)

Strategic theme	Topic	Credible Options	Land	Construction	Operation and Maintenance	Transport
Site Decommissioning and Remediation	Safe Stewardship	Utilise existing assets to manage and maintain the estate.	-	-	ü	-
		Develop/construct new assets to manage and maintain the estate.	Increase	ü	ü	-
	Decommissioning	Immediate dismantling – either accelerated, parallel or sequential.	ST – increase LT – decrease	ü	-	-
		Deferred dismantling – Minimal interventions during Care and Maintenance (C&M).	ST – decrease LT – increase/ decrease*	-	ü	-
		Deferred dismantling – Planned interventions during C&M.	ST – decrease LT – increase/ decrease*	-	ü	-
		Combined strategy including interim state(s).	Not assessed because this option is a combination of the above options.			
	Site end-states	Leave the hazard where it is and prevent use.	-	-	ü	-
		Make land suitable for next planned use.	Decrease	ü	ü	Increase

Strategic theme	Topic	Credible Options	Land	Construction	Operation and Maintenance	Transport
		Remove the hazard completely so that the risk does not need to be controlled.	Decrease	ü	-	Increase
	Operational Estate use	Retain land as an NDA asset or liability.	-	-	ü	-
		Divest the land (leasehold) for social, environmental or economic benefit.	-	-	ü	-
		Divest the land (freehold) for social, environmental or economic benefit.	Decrease	-	-	-
*Due to the timeframes of deferred dismantling, a short-term decrease in land use for other benefits may occur, followed by a short period of an increase in land use during dismantling, leading to a long-term release of the land following accomplishment of end state.						
Spent Fuel	Consolidation	Current baseline: Continue to consolidate spent fuels from Advanced Gas-Cooled Reactor (AGR) stations and Dounreay at Sellafield.	Current baseline not assessed.			
		Only consolidate AGR spent fuels at Sellafield and store spent fuels from Dounreay at Dounreay until a disposition option becomes available.	Increase	ü	ü	Decrease
		Stop all consolidation activities and leave spent fuels on reactor sites until a disposition option becomes available.	Increase	ü	ü	Decrease

Strategic theme	Topic	Credible Options	Land	Construction	Operation and Maintenance	Transport
	Interim Storage	Current baseline: Existing assets are used where they are appropriate and new storage solutions are developed for smaller inventories.	Current baseline not assessed.			
		Treat and package all spent fuels now ready for disposal in a Geological Disposal Facility (GDF), including drying spent oxide fuels and storing in disposal containers.	Increase	ü	ü	-
		Minimise new storage solutions and use existing packages and facilities for all fuels.	-	ü	ü	-
	Disposition	Current baseline: Store fuels pending a decision to declare them as waste for disposal in a GDF. For planning purposes assume GDF disposal.	Current baseline not assessed.			
		Declare all fuels as waste today.	-	-	-	-
		Store fuels indefinitely.	-	ü	ü	-
Nuclear Materials	Plutonium	Current baseline: Continued safe and secure storage, renovating and replacing stores as required.	Current baseline not assessed.			
		Build facilities to condition and treat plutonium prior to storage and disposal to a GDF.	Increase	ü	ü	-

Strategic theme	Topic	Credible Options	Land	Construction	Operation and Maintenance	Transport
	Uranium	Current baseline: Continued safe and secure storage pending sale for reuse, where economically and/or technically practicable.	Current baseline not assessed.			
		Continued safe and secure storage pending disposal.	-	-	ü	-
		Continued safe and secure storage pending conditioning to an appropriate form for disposal.	Increase	ü	ü	ü
Integrated Waste Management	Treatment and package	Treatment at local (on or near site) facilities.	Increase	ü	ü	-
		Treatment at regional facilities.	Increase	ü	ü	ü
		Treatment at national facilities.	Increase	ü	ü	ü
	Storage	Storage at local (on or near site) facilities.	Increase	ü	ü	-
		Storage at regional facilities.	Increase	ü	ü	ü
		Storage at national facilities.	Increase	ü	ü	ü
	Disposal	Current baseline: Disposal to currently open appropriate facilities.	Current baseline not assessed.			
		On-site or in situ disposal at additional sites.	Increase	ü	ü	Decrease
		Disposal to Near Surface Disposal (NSD) at Low Level Waste Repository (LLWR) subject to permitting and planning.	-	ü	ü	Increase

Strategic theme	Topic	Credible Options	Land	Construction	Operation and Maintenance	Transport
		Disposal to GDF subject to ongoing consultation and investigation.	Not assessed. Significant assessment undertaken outside of this IIA.			
Critical Enablers	Transport	Increased use of rail transportation.	-	ü	ü	Increase

3. Assessment

3.1 Overarching Requirements for Credible Options

3.1.1 Land

Some credible options may either result in an increase or decrease in land utilised by NDA for mission progress, as detailed in Table 2. The impact of the increase or decrease of land utilised is assessed in Table 3 and Table 4, respectively.

It is assumed in the assessment that an increase in land use is not currently utilised by the NDA and is open land. This would either comprise vegetation or hardstanding (e.g., concrete or asphalt) but may not require redevelopment as part of the credible option.

Table 3: Assessment of Increase in Land Utilised

Assessment of Increase in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
Environment	Air quality	The requirement for land will not directly present a risk or opportunity for impact on air quality. Air quality could be impacted by other activities by an increase in land utilised.		0	0	The direct impact on air quality will be insignificant.		N/A

Assessment of Increase in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Biodiversity	If there was an increase in land utilised for operations, there could be direct impacts through destruction of habitats or separation of adjacent habitats. This could lead to declines in populations of species.	Assessment of biodiversity and sensitivity prior to acquisition. No acquisition of adjacent sensitive designated or non-designated sites. Relocation of sensitive species, if appropriate.	0	-	The significance depends on the biodiversity of the land and surrounding land prior to the execution of the credible option. Considering the mitigation, the magnitude of impacts would likely be low even if the receptor was of medium sensitivity.	? ?	Characteristics of land that could be utilised are unknown.
	Climate change	The land could be developed and underlying soils excavated, leading to release of stored carbon into the atmosphere. Climate change could also indirectly be impacted by other activities once the additional land has been developed.		0	-	The significance depends on the nature and amount of carbon stored within the land and how the land will be used once utilised. The magnitude is likely to be low and the sensitivity would not be greater than medium.	? ?	Characteristics of land that could be utilised are unknown.

Assessment of Increase in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Coastal change and flood risk	An increase in land utilisation in coastal regions could impact existing coastal defences (natural and man-made). This could present a risk and lead to increases in coastal change or provide an opportunity to protect coastlines from erosion. Utilising and subsequently developing additional land could increase surface water runoff to adjacent land and decrease filtration rates through soil leading to a risk of surface water flooding.	Flood and coastal risk assessments would be required prior to acquisition and development of land.	+	-	The designated flood zone, coastal features and coastal defences will affect the magnitude to which the land and surrounding land would be impacted. The sensitivity will be affected by the proposed and surrounding land use. Several sites are situated on the coast and adjacent to rivers. These would be more sensitive to impacts than those not. However, is anticipated to be low on current decommissioning timescales.	? ?	Characteristics of land that could be utilised are unknown.

Assessment of Increase in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Cultural heritage	Working on land not previously developed could impact cultural heritage receptors through changing the setting or other environmental effects such as flood risk. These could be on site or off-site. This impact could be positive, by preserving the setting of a receptor, or negative, for example by development adjacent to a receptor.	Appropriate assessments prior to acquisition.	+	-	There is both risk and opportunity to impact cultural heritage. However, these are likely to be of low magnitude and the receptor will be of low sensitivity.	? ?	Location-specific consideration.
	Geology and soils	Possible adverse effects upon soil quality of the additional land. Potential for negative environmental impacts to soil and underlying geology once land is in use. However, contamination may be present requiring and providing opportunity for remediation prior to use.	Potential future releases would be minimised by controls and legislation.	+	-	The magnitude of impact for any activity is likely to be low. Receptor sensitivity is generally considered to be low within the site boundaries.	? ?	Characteristics of land unknown.

Assessment of Increase in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Landscape and visual impacts	Risk of negatively impacting the landscape and people using the land. If current land use was unsightly there is an opportunity to improve the landscape and people's view.	Appropriate assessment prior to land acquisition.	+	-	Magnitude could be medium if land was utilised for something other than its current use, however, this could present an opportunity as well as a risk. Sensitivity would be dependent on the setting of the land, being less sensitive where already in an industrial setting.	?	Characteristics of land unknown.
	Materials and waste	In utilising and developing the land, both materials and waste could be produced. Material may be suitable for re-use which removes the requirement for import of new material. Waste would likely be produced to make the land suitable. This would have to be processed and likely removed to a suitable waste facility.	Use of protocols and codes of practice to decrease the volume of material being treated as waste.	0	-	Magnitude could be medium depending on the volume of waste produced. If material is re-used, then the magnitude of impact is lower. The sensitivity of receptors (for example waste management facilities) is low.	? ?	Characteristics of land unknown.

Assessment of Increase in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Noise and vibration	The act of utilising land will not impact on noise and vibration. However, they could be impacted by other activities once the land has been utilised or developed.		0	0	The direct impact on noise and vibration will be insignificant.		N/A
	Radiological emissions and discharges	The act of utilising land will not impact on radiological emissions and discharges. However, these could be impacted by other activities once the land has been utilised or developed.		0	0	The direct impact on radiological emissions and discharges will be insignificant.		N/A
	Water resources and quality	Changing the usage of the land could impact water resources on site, for example by redirecting water courses, and off-site, through increased surface water run-off. Water quality could be impacted by other activities once the land has been utilised or developed.	Appropriate assessments prior to land acquisition.	0	-	Magnitude of impact is affected by the nature of the water resource and its location relevant to the land. Sensitivity is also affected by the nature and classification of the water resource.	? ?	Characteristics of land unknown.

Assessment of Increase in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
Health	General Health	It is assumed that the increase in land utilised is within the site boundary. However, if off-site land is required there are risks that could impact the general health of the nearby population. Additional land may have public rights of way or areas of recreational land that can no longer be used, impacting the physical activity of the local population. There is a risk of indirect impacts associated with environmental impacts from subsequent use of the land.	Ensure local population has access to recreational land by maintaining access or relocation.	0	-	The magnitude of the impact is likely to be low. The sensitivity of the receptor could be medium considering that areas for physical activity are generally local.	? ?	Location of land unknown.
	Life Expectancy	It is unlikely acquisition of land would directly impact life expectancy. However, subsequent activities could create risks and opportunities for impact.		0	0	The direct impact on life expectancy will be insignificant.		N/A

Assessment of Increase in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Mental Health	It is likely that the land utilised is within the site boundary. However, if off-site land is required there are risks that could impact the mental health of the nearby population. Additional land may have public rights of way that can no longer be used, impacting the physical activity which in turn can impact the mental health of the local population. However, if the economy of the area was positively impacted by the new land use, this could positively impact the mental health of the local population or even wider. Indirect impacts could occur associated with environmental impacts.	Ensure local population has access to recreational land by maintaining access or relocation.	+	-	The magnitude of the impact is likely to be low. The sensitivity is dependent on the mental health of local people but is anticipated to be low.	? ?	Location of land unknown.
	Radioactivity	It is unlikely acquisition of land would directly impact radioactivity that could affect health.		0	0	The direct impact on radioactivity will be insignificant.		N/A

Assessment of Increase in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Respiratory Disease	It is unlikely acquisition of land would directly impact radioactivity that could affect health. However, subsequent activities could present a risk from environmental impacts.		0	0	The direct impact on respiratory disease will be insignificant.		N/A
Socio-economic	Diversity	It is unlikely acquisition of land would directly impact diversity. However, subsequent activities could create additional employment opportunities and impact diversity.		0	0	The direct impact on diversity will be insignificant.		N/A
	Employment	It is unlikely acquisition of land would directly impact employment. However, subsequent activities could create additional employment opportunities.		0	0	The direct impact on employment will be insignificant.		N/A

Assessment of Increase in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Economy	Additional expenditure of utilising land may present a risk. Proposed activities may have to comply with policy and legislation which will further increase expenditure. However, utilising land that is not currently utilised and carrying out activities that provide a cost benefit to the economy will provide an opportunity.	Cost benefit and further assessment to identify if economy would or would not benefit.	++	- -	The magnitude has the potential to be high depending on the future activity. The sensitivity of the receptor will depend on the local and national Gross Value Added (GVA) at the time.	? ?	Land value and potential to add value is currently unknown.
	Local and National Assets	It is unlikely acquisition of land would directly impact local or national assets. However, subsequent activities could create additional opportunities.		0	0	The direct impact on local and national assets will be insignificant.		N/A

Assessment of Increase in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Population	Utilising additional land for activities may dissuade people from moving to the immediate area; however, additional jobs may promote relocation to the area. It may also influence the current population to relocate away from the area of new activity.	Assessment on impact to local population.	+	-	The magnitude would depend on the population in the vicinity of the land acquisition and the subsequent activities. However, it is likely to be low. The sensitivity of the receptor is also likely to be low, considering the current population reside in the area and likely have some knowledge of the sites.	?	Location and population of land.

Table 4: Assessment of Decrease in Land Utilised

Assessment of Decrease in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
Environment	Air quality	Where there is a decrease in land utilised, and is no longer used for industrial purpose, there is likely to be an improvement in air quality.		+	0	The magnitude is low, as other industrial processes are likely to still occur in the vicinity, at least in the short term. The sensitivity is also low as the air quality across the sites is within legal limits and generally improving [1].	?	Future land use
	Biodiversity	Where land is released from operations, there could be direct impacts through creation of habitats or the joining of adjacent habitats. This could lead to an increase in populations of species. However, this would depend on the next use of the land.	Appropriate environmental assessment prior to works.	++	0	The significance depends on the biodiversity of the land and surrounding land prior to the execution of the credible option. Considering the current land use, the magnitude of impacts would likely be medium, and the receptor is likely to be of medium sensitivity.	?	Future land use
	Climate change	Land released could be rewilded, creating a natural carbon store.		++	-	The significance depends on the future use of the land.	? ?	Future use of land not currently known.

Assessment of Decrease in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
		Climate change could indirectly be impacted by other activities once the land has been released.				Where land is rewilded there may be significant positive impacts due to a medium magnitude and medium sensitivity. The significance of the risk due to more impactful activities following release is less, with a likely low magnitude.		
	Coastal change and flood risk	Given the industrial nature of the NDA sites, and the presence of numerous other structures and facilities, it is unlikely that decreasing the land utilised would have a significant impact in terms of reducing flood risk. However, the land could be rewilded giving opportunities for natural flood storage and improved surface water drainage.		+	-	The significance depends on the current and future use of the land. The magnitude is likely to be low. The sensitivity would depend on the current and future flood risk and coastal change predictions; however, is anticipated to be low on current decommissioning timescales.	? ?	Current and future use of land and designated flood risk and predicated coastal change not currently known.

Assessment of Decrease in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
		Decreasing land utilised could remove the requirement for coastal defences in some areas and coastal change may occur faster.						

Assessment of Decrease in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Cultural heritage	Removal of facilities from the landscape could improve the setting of heritage features.	Appropriate assessments prior to future use.	+	0	If receptors were determined to be of medium sensitivity, assuming appropriate mitigation is in place, the overall impact would likely be of minor significance.	? ?	This is a very 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.
	Geology and soils	Decreasing land utilised could allow for remediation of any contaminated land to take place.		+	0	The magnitude is likely to be low given the anticipated slow release of land.	?	Potential use of remediation techniques to ensure land is suitable for its intended use.

Assessment of Decrease in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
						Given the existing quality of land and soil at sites, which is often of low value, sensitivity to remediation can be considered medium. Cumulative effects need to be considered.		
	Landscape and visual impacts	Releasing land from use on NDA sites may create landscape and visual impact opportunities. This could lead to improved views from nearby locations.		+	0	The removal of industrial facilities could have a positive impact on the local landscape. Given the number of other facilities on the sites and their prominence in the local landscape, the sensitivity of the indicator to minor improvements is considered low.	?	The number and scale of facilities removed and other facilities on the site.
	Materials and waste	A decrease in land utilisation is not likely to directly impact materials use and waste production. However, the future use of the land, for development, rewilding or flood retention may produce materials and/or waste.		0	0	The direct impact on materials and waste will be insignificant.		N/A

Assessment of Decrease in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Noise and vibration	Noise and vibration issues associated with operations previously on the land would be removed.		+	0	The removal of industrial facilities could have a positive impact on the noise and vibration in the immediate vicinity. However, given the number of other facilities on the sites the sensitivity of the indicator to minor improvements is considered low.	?	The number and scale of facilities removed and other facilities on the site.
	Radiological emissions and discharges	Potential emissions and discharges associated with operations on the land would be removed.		+	0	The significance will be low considering the low levels of release from currently operating sites [2].		N/A
	Water resources and quality	Risks associated with operation of the land will be removed including surface water run-off. Water usage is likely to decrease once operations have ceased.	Existing pollution prevention controls and good practice during operation.	++	0	Magnitude of impact considered to be low with respect to water quality but could be medium due to a decrease in water usage. Sensitivity is dependent on the water resource but could be high in some areas.	? ?	Water usage change and water resource.

Assessment of Decrease in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
Health	General Health	General health impacts associated with operation of sites would be removed in the long term.		+	0	The magnitude may be low to medium dependent on the decrease of land utilised over shorter times periods. Considering the proximity of residential properties to most sites, receptor sensitivity may be low.	?	Area of land and speed of decrease.
	Life Expectancy	It is unlikely a decrease in land utilisation would directly impact life expectancy. However, opportunities to improve environmental impacts could improve health in local areas.		0	0	The direct impact on life expectancy will be insignificant.		N/A
	Mental Health	Negative socio-economic effects from possible job losses may impact mental health and wellbeing. However, an improvement in environmental effects could indirectly improve mental health.	Transfer within the NDA group.	+	-	The NDA's aim is to release land from operation in the long term. This is likely to mean a low magnitude. The sensitivity is also likely to be low but is dependent on the mental health of local people.	?	Number of jobs created or lost, timescales for closures, nature and extent of environmental impacts and future land use

Assessment of Decrease in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
		Depending on future land use there may be long term opportunities from improved biodiversity or recreational activities.						
	Radioactivity	The risk of emissions and discharges associated with operations would be removed. Legacy radioactivity may be remediated, providing an opportunity to improve health issues related to radioactivity.	Controls during remediation.	+	0	The significance will be low considering the low levels of release from currently operating sites [2].		N/A

Assessment of Decrease in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Respiratory Disease	Emissions associated with operation would be removed in the long term. This would present an opportunity to potentially improve the respiratory health of the local population.	Effects of closure and demolition are likely to be confined within the site boundary and may be mitigated with good construction and demolition practice. The magnitude of potential health impacts would therefore likely be low.	+	0	The magnitude of potential health impacts would likely be low considering previous mitigation measures. The sensitivity would depend on the health profile of the local population but would also likely be low.	? ?	Future land use
Socio-economic	Diversity	Land no longer being utilised in the nuclear sector could lead to fewer employment opportunities and reduced diversity.	Transfer within the NDA group.	0	-	It is likely that the magnitude would be low as the NDA would mitigate the loss of jobs. The sensitivity would likely be medium in areas of employment.	? ?	Extent that diversity is dependent on available workforce.

Assessment of Decrease in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Economy	Land no longer being utilised in the nuclear sector could reduce economic contributions to the local and regional economy due to loss of employment. However, land could be released for other uses and provide an opportunity to increase economic contributions by diversifying.		+	-	Magnitude of impact would depend on the scale of the closure. Sensitivity would depend on the percentage contribution to the local economy. These are likely to be low as land is likely to be released over a long period of time.	?	Timeframes
	Employment	The decommissioning of facilities would result in job losses in the long term. However, there are opportunities for the land to be used for other industries, sustaining jobs in the area.	Transfer within the NDA group.	+	-	The magnitude is likely to be low considering land is likely to be released over a long period of time. The long-term loss of employment may have a medium sensitivity due to the reliance on NDA sites for employment in surrounding areas. However, the NDA would see transfer within the Operating Companies which would reduce the magnitude.	?	Potential for facilities to be repurposed. Opportunities to retain or transfer jobs.

Assessment of Decrease in Land Utilised								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Local and National Assets	If the local economy is not being supported by the utilisation of the land, investment in local assets is likely to decrease. However, if the economy is sustained by other uses, this would negate the impact.		0	-	The magnitude is likely to be low considering land is likely to be released over a long period of time. The sensitivity would depend how much the local economy and hence assets are supported by the current use of the land.	? ?	Timeframes
	Population	Releasing land from NDA activities may influence the current population to relocate away from the area in search of work. However, it may also encourage people to move to the immediate area if the land is utilised for different industry.	Assessment on impact to local population.	+	-	The magnitude would depend on the population in the vicinity of the land released and the subsequent activities. However, it is likely to be low due to the timescale of the release of land. The sensitivity of the receptor is likely to be medium due to high reliance on NDA sites for employment in local areas.	? ?	Timescale and NDA employment.

3.1.2 Construction

Construction activities will be required for some credible options, as shown in Table 2: Generic activities and applicable credible options. This may include, but is not limited to, the construction of facilities or infrastructure, or the construction of mitigation infrastructure for remediation purposes. For the purposes of the assessment, construction includes all materials, workforce and transport, but does not include disposal of waste or the operation of the constructed facilities etc.

Table 5: Assessment of Construction

Assessment of construction								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
Environment	Air quality	Generation of dust. Emissions of pollutants such as NO_x, SO_2 and PM. This can be directly through the use of plant or indirectly through the transport of materials and waste.	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.	0	-	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. The sensitivity is low as the air quality across the sites is within legal limits and generally improving [1].	?	Number of facilities requiring construction, the timing of construction (including seasonal works which may influence the dispersal of pollutant emissions).

Assessment of construction								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Biodiversity	Possible construction on designated or non-designated sites of value for biodiversity. 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, water, noise etc.).	Assessment of biodiversity and sensitivity prior to commencement of works. Relocation of sensitive species, if appropriate.	0	-	The significance depends on the biodiversity of the land and surrounding land prior to the execution of the credible option. Considering the mitigation, 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 and other ecological receptors, time over which construction occurs.
	Climate change	Generation of carbon dioxide (CO_2) emissions. Use of energy and materials, which could have further implications in terms of embodied carbon.		0	- -	Considering the size and likely activities associated with construction of new facilities, the magnitude of impact in terms of CO_2 emissions generated may be high in the short-term.	?	Embodied carbon of materials used, complexity and number of facilities (may affect construction programmes).

Assessment of construction								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
		Impacts on climate change and energy use from use of plant and equipment. The impact of increased CO_2 emissions may continue beyond the end of construction.				Indicator sensitivity is regarded as low due to the industrial process sector's generally consistent decrease in CO_2 emissions between 1990 and 2022 and its comparatively small contribution to UK emissions [3].		
	Coastal change and flood risk	Construction works could increase flood risk at the site by increasing the presence of hard surfaces. This can increase surface water runoff and restrict drainage. Construction in coastal regions can affect existing coastal defences (natural and man-made) but may provide opportunities to further protect coastlines from erosion.	The risks of increased surface water run-off and restricted drainage would be designed-out in line with standard practice.	0	-	The magnitude of the residual impact on flood risk can be considered low. Given the existing defences which protect the sites from coastal erosion, sensitivity in the short to medium-term can be considered low.	?	The extent of coastal erosion and sea level rise, any changes to existing coastal defences.

Assessment of construction								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Cultural heritage	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 construction works would be confined within the site boundary, the magnitude and sensitivity can be considered low due to the sporadic instances of cultural heritage sites within the NDA estate.	?	Depending on the location of the cultural heritage site.
	Geology and soils	Possible adverse effects upon soil quality at the site. Potential for releases to the ground, leading to land contamination within the site boundary. Opportunity to improve soil contamination if there was a change in use of the land.	The use of ALARP (as low as reasonably practicable) and BAT principles and other institutional controls would minimise releases.	+	-	Impacts of construction on geology and soils would likely be confined within the site boundary. Given the extent of construction works required to build new facilities, the magnitude would likely be medium. Considering the industrial nature of sites, impacts to soil and ground quality are likely to be minor. Receptor sensitivity is therefore considered low.	?	The extent of construction activities and proximity to areas of existing contamination.

Assessment of construction								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Landscape and visual impacts	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.		0	-	Such activities could have a medium magnitude effect upon the landscape and may adversely affect views from nearby locations. Sensitivity depends on the site's location, topography and surrounding landscape.	?	If construction of facilities were to extend beyond the existing site boundary this could have increased visual impacts.
	Materials and waste	Construction would require substantial volumes of material and is likely to create waste. Some of the material may be sourced from reusable material already on-site and some may be imported from primary sources. Additional transport movements likely required.	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.	+	- - -	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. Even with the ability to reuse existing materials, due to the probable high demand of imported materials, sensitivity to positive impacts of reusing materials is considered low.	?	Ability to reuse existing materials from site.

Assessment of construction								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Noise and vibration	Potential for increased noise and vibration, particularly from activities such as excavation and piling, and through the transport of plant and construction materials.	Construction management procedures and design measures could be used to minimise noise and vibration levels. Impacts would be confined within the site boundary or along site access roads, provided that no piling activities are required.	0	-	Considering mitigation, residual impacts would be of low magnitude. 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. Depending on the location of the site and the distance from residential properties and wildlife, receptor sensitivity can be considered from low to medium. Further assessment will be needed for individual locations to assess specific sensitivity.	? ?	The location and extent of construction works, number of transport movements, and the timescale over which they occur.
	Radiological emissions and discharges	Not likely to produce radiological emissions or discharges during construction.		0	0	Not likely to be any impact due to construction.	ü	

Assessment of construction								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Water resources and quality	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. Infrastructure or foundations could create new pathways to water resources for contaminants.	Appropriate management procedures in place to keep pollutant discharges to a minimum.	0	- -	Given the likely extent of construction works required to build new stores, impacts upon water resources and quality would be of medium magnitude. Sensitivity will be dependent on the water quality and volume of water abstracted but likely to be medium considering the baseline information for the sites.	?	Volume of abstracted water required, changes in volume of water abstracted as site activities change, proportion of water volume new construction activity uses.
Health	General Health	Construction can affect health negatively in many ways such as respiratory diseases, health effects associated with noise level changes, road traffic changes and changes in the water environment in the short term but any impacts will be removed in the long term.	Monitoring and use of good practice during construction activities would minimise impacts upon general health.	0	-	The magnitude may be low to medium dependent on the location of the site over shorter times periods. Taking into account the proximity of residential properties to most sites, receptor sensitivity may be low.	?	Location of the site/area of construction.

Assessment of construction								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Respiratory Disease	Construction works can negatively affect health through changes in air quality from emissions of pollutants such as NO_x, SO_2 and PM.	Monitoring and use of good practice during construction activities would minimise impacts upon respiratory diseases.	0	-	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. Sensitivity will depend on the health statistics of the residents in the areas that the sites are located so further assessment is required for each specific case.	?	Extent of facilities to be constructed, proximity of residents and other receptors to activities.
	Radioactivity	Construction could present a risk for impact to construction workers through exposure to radionuclides within soil and groundwater.	Appropriate mitigation measures during construction activities preventing exposure to workers.	0	0	The health risk from radioactivity of construction for workers is considered low due to mitigation measures. Therefore, the impact is likely to be insignificant.	ü	
	Life Expectancy	Construction can present a risk for impact to life expectancy through the increased risk to construction workers.	Appropriate mitigation measures during construction activities reducing incidents.	+	- -	The construction industry is the leading industry for work-place fatalities and accidents in the UK [4], hence the magnitude for risk is medium.	?	Extent and duration of construction works.

Assessment of construction								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
		Opportunities provided to the local community (employment, economic) may positively improve health and in turn life expectancy for the surrounding population.				The sensitivity of construction workers is likely to be medium, considering the life expectancy across the UK is 81 [5] compared to the average age of a construction worker of 44 [6]. The magnitude and sensitivity of the opportunities for the surrounding population are likely to be low, dependent on the extent and duration of the construction works.		
	Mental Health	Likely to create employment opportunities, which studies have shown can positively influence mental health and wellbeing. May lead to negative impacts on mental health and wellbeing due to the range and extent of environmental effects during construction.		+	-	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.	? ?	Number of jobs created and duration of the construction works. Extent of environmental impacts, duration of the construction works.

Assessment of construction								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
Socio-economic	Diversity	Construction of facilities will create and maintain employment opportunities and offer the opportunity to increase diversity.	NDA Group Inclusion Strategy [7].	++	0	The construction of facilities will require a larger workforce from the wider supply chain, leading to an increasingly diverse workforce in line with the NDA Group Inclusion Strategy [7]. The magnitude and sensitivity would likely be low considering the current diversity of the workforce.	? ?	Extent that diversity is dependent on available skilled workforce.
	Employment	Additional construction activities are likely to require additional employment, from construction to highly skilled and managerial jobs.		++	0	The magnitude would be dependent on the extent of the construction proposed. The sensitivity would be dependent on the percentage of people in the construction sector in the local area. Both are assumed to be medium based on baseline information.	? ?	Extent of construction, duration period, number of jobs associated with construction.

Assessment of construction								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Economy	Expenditure on construction could have negative 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	The magnitude is dependent on the extent of construction proposed. The sensitivity of the receptor will depend on the local and national Gross Value Added (GVA) at the time.	?	Number of workers required and construction timescales. Extent of construction.
	Local and National Assets	An increase in employment could result in an increase in local population and may lead to an over-subscribed community facilities and services.	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 in the long term.	0	0	Construction is likely to be spread out over a long period of time, in which case the overall on local assets can be considered neutral.	? ?	Construction timescales.

Assessment of construction								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Population	Employment opportunities may persuade people to move to the immediate area. Ongoing industrial activities in the local area may encourage some people to leave the area.		+	-	The magnitude is likely to be low; however, this depends on the employment opportunities. The sensitivity of the receptor would be dependent on the reliance on the NDA site for employment in the local area.	? ?	Extent of impact of NDA activities on local population.

3.1.3 Operation and Maintenance

There is a requirement for operation and maintenance of existing or new buildings and facilities for a number of credible options, as detailed in Table 2: Generic activities and applicable credible options. The impact of the operation and maintenance of buildings and facilities is detailed in Table 6. It is generally assumed that maintenance is required for any structure for the full duration of its operational lifespan. This is assumed to involve existing programmes, techniques and best practices.

Table 6: Assessment of Operation and Maintenance

Assessment of Operation and Maintenance								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
Environment	Air quality	Emissions of pollutants through use of equipment and plant to maintain existing and new structures.	Requirement to apply BAT and (for radioactivity) as low as reasonably achievable (ALARA).	0	-	New and existing facilities would likely produce operational emission of pollutants; however, the magnitude is likely to be low because of the controls that would be in place to manage these emissions. The sensitivity is low as the air quality across the UK is within legal limits and generally improving [1].	ü	
	Biodiversity	Operation and maintenance would not directly impact biodiversity.		0	0	The impact on biodiversity will be insignificant.		N/A

Assessment of Operation and Maintenance								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
		Biodiversity could be impacted through other routes, such as a change in air quality.						
	Climate change	There is a risk of impacts on climate change through energy use of operational transport, plant and equipment.	Current good practice in use of low energy transport, plant and equipment.	0	-	The magnitude would be low in the context of the industrial sector emissions as a whole. Sensitivity of the indicator is also considered low.	?	Number of potential new facilities that require maintenance.
	Coastal change and flood risk	No risks or opportunities are foreseen from the operation and maintenance of new or existing facilities.		0	0	There are unlikely to be any significant impacts on coastal change and flood risk from the operation and maintenance of new or existing facilities.		N/A
	Cultural heritage	Risk of impact on cultural heritage features through potential increases in noise and other environmental effects.	Compliance with regulations.	0	-	Activities involved in operation and maintenance would be intra-site, meaning it is unlikely there would be direct impacts upon cultural heritage features and as such impacts are unlikely to be significant	?	Proximity of heritage features

Assessment of Operation and Maintenance								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Geology and soils	No risks or opportunities are foreseen from the operation and maintenance of existing or new facilities.	Use of current good practice in the operation and maintenance of existing facilities.	0	0	There are unlikely to be any releases to ground which could lead to significant effects on geology and soil through maintenance activities.		N/A
	Landscape and visual impacts	Increased operational and maintenance activities may lead to an increased impact through greater presence of vehicles and personnel.	Use of current good practice in the operation and maintenance of facilities.	0	-	The magnitude and sensitivity are likely to be low considering that operation and maintenance are an ongoing constant feature at NDA sites.	?	Extent of activities
	Materials and waste	Risk of material requirements and generation of waste through operational and maintenance activities.	Requirement to apply BAT and ALARP. Implementation of the waste hierarchy.	0	-	Waste generated and materials required through operation and maintenance is likely to be minimal compared to other processes on site, and there are many processes in place to manage waste and source materials, so significance is considered low.	? ?	Extent and nature of waste generated, and materials required during wide range of maintenance activities.

Assessment of Operation and Maintenance								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Noise and vibration	Potential noise and vibration impacts associated with operational and maintenance processes.	Compliance with regulations.	0	-	Magnitude is likely to be low considering mitigation measures. Any noise and vibration impacts associated with operation and maintenance of the facilities would likely be confined to within the site boundary and like other on-site operations. Sensitivity is considered to be low.	?	Extent of activities.
	Radiological emissions and discharges	Potential emissions and discharges associated with operations and maintenance.	Requirement to apply BAT and ALARA.	0	0	Considering the mitigation measures required and permit restrictions during operations and maintenance, the impact will be insignificant.	ü	
	Water resources and quality	Potential requirement for water abstraction and discharge during operation and maintenance activities.	Requirement to apply BAT and (for radioactivity) ALARA. Existing controls in place to monitor water use and minimise discharges to waterbodies on NDA sites.	0	-	During operation and maintenance, requirements for water abstraction and risks of effects on water quality may constitute a medium magnitude.	??	Extent of requirement of water abstraction or discharge during maintenance.

Assessment of Operation and Maintenance								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
						Given the existing status of water quality and resources at the sites, sensitivity to impacts is low.		
Health	General Health	Emissions to the environment associated with ongoing industrial activities.	Requirement to apply BAT and (for radioactivity) ALARA and comply with regulations to minimise environmental impacts.	0	0	Mitigation measures would remove any significant impact.		N/A
	Respiratory Disease	Dust and emissions of pollutants through use of equipment and plant to operate and maintain existing and new structures can reduce air quality and have a negative impact on respiratory health.	Requirement to apply BAT and (for radioactivity) ALARA and comply with regulations to minimise environmental impacts.	0	0	Air quality changes during operation and maintenance would likely be of low magnitude and continually monitored and mitigated. Therefore, the impact is likely to be insignificant.		N/A
	Radioactivity	There is a risk that operation and maintenance of storage facilities may cause releases of radioactivity.	Extensive procedures and controls exist to minimise radiological health impacts, including adherence to ALARA and BAT principles.	0	0	Due to mitigation in place for operations and legacy radioactivity, the direct impact on radioactivity affecting health will likely be insignificant.		N/A

Assessment of Operation and Maintenance								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Life Expectancy	It is unlikely the operation and maintenance of new and existing facilities would directly impact life expectancy. However, environmental impacts could cause indirect impact.	Requirement to apply BAT and (for radioactivity) ALARA and comply with regulations to minimise environmental impacts.	0	0	The direct impact on life expectancy will be insignificant.		N/A
	Mental Health	Operation and maintenance of sites and facilities has the potential to offer socio-economic opportunities which may have positive effects for the mental health of those employed.		+	0	The magnitude is likely to be low as the increase in jobs is not likely to be significant. The sensitivity is also likely to be low but is dependent on the mental health of local people.	?	The extent of socio-economic opportunities available and whether these are made available to local population.

Assessment of Operation and Maintenance								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
Socio-economic	Diversity	Operation and maintenance of NDA facilities will create and maintain employment opportunities and offer an opportunity for increased diversity.	NDA Group Inclusion Strategy [7].	++	0	The ongoing operation and maintenance of facilities may require a larger workforce from the wider supply chain, leading to an increasingly diverse workforce in line with the NDA Group Inclusion Strategy [7]. The magnitude and sensitivity would likely be low considering the current diversity of the workforce.	? ?	Extent that diversity is dependent on available workforce.
	Economy	Continued operation and maintenance of NDA facilities would lead to continued or increased economic contributions to the local and regional economy.		++	0	The magnitude and sensitivity depend on the scale of the facility and the current baseline. The magnitude could be medium and the sensitivity also medium depending on the timescale of the operation.	? ?	Timescale and contribution to the economy the facilities make.

Assessment of Operation and Maintenance								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Employment	The operation and maintenance of new NDA facilities has the potential to create employment opportunities. It is likely that there would be a need for continued investment in new skills to enable the facilities to be operated and maintained.		+	0	The long-term maintenance or increase in employment is likely to have a low magnitude due to the timescales of new facilities. The sensitivity may be medium due to the reliance on NDA sites for employment in surrounding areas.	? ?	Location and number of employment opportunities new facilities would create.
	Local and National Assets	Local assets may be developed or existing assets enhanced to improve access for continued operation and maintenance. National assets, such as rail infrastructure could also be developed or enhanced.		+	0	Magnitude would be dependent on the timescale but likely to be low. Sensitivity would also be likely to be low, as assets would be maintained in line with operation of the facilities.	? ?	Scale of operations/maintenance.

Assessment of Operation and Maintenance								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Population	Employment opportunities may persuade people to move to the immediate area. Ongoing industrial activities in the local area may encourage some people to leave the area.		+	-	The magnitude is likely to be low; however, this depends on the employment opportunities. The sensitivity of the receptor would be dependent on the reliance on the NDA site for employment in the local area.	? ?	Extent of impact of NDA activities on local population.

3.1.4 Transport

The NDA regularly transport assets and liabilities across the transport network of the UK. Some credible options will result in an increase of transportation, for example removing hazards from NRS sites to appropriate waste facilities rather than remaining on site. However, some credible options will result in a decrease of transport, for example leaving spent fuel at Dounreay rather than transporting it to Sellafield.

The NDA Strategy for Transport, a Critical Enabler, has a preferred option of rail transport over road. This has been considered in the mitigation of the significance of the impacts. The Strategy for Transport will also be discussed in Section 4.5.1 in further detail. Based on this strategy, it is assumed for the purposes of this assessment that no new roads are to be constructed, however, rail links may be improved and updated.

Table 7: Assessment of Transport Increase

Assessment of transport increase								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
Environment	Air quality	An increase in transportation could increase the risk of negative impacts on air quality. This could include the generation of dust and emissions of air pollutants such as NO_x, SO_2 and PM.	The NDA's preferred mode of transport is rail. Rail has a greater capacity per journey than road, which will cause less of an impact on air quality than road.	0	-	The magnitude is likely to be low or medium depending on the amount of transport increase across the country. The sensitivity is low as the air quality across the UK is within legal limits and generally improving [1].	? ?	The number of journeys required to enable the credible options are unknown.
	Biodiversity	An increase in transport would not directly impact biodiversity, assuming that no new transport routes are constructed.		0	0	The impact on biodiversity will be insignificant.		N/A

Assessment of transport increase								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
		Biodiversity could be impacted through other routes, such as a detriment of air quality.						
	Climate change	Transportation produces greenhouse gases such as CO_2, CH_4 and NO_x. It will also use additional fossil fuels, assuming that traditional methods of transportation are used and not clean fuels, e.g. hydrogen, electric. An increase in transport would increase the risk of negatively impacting climate change.	The NDA's preferred mode of transport is rail. Rail has a greater capacity per journey than road, which will create less of an impact on climate change than road.	0	-	The magnitude is likely to be low or medium depending on the amount and type of transport to increase. The sensitivity is likely to be medium as Nuclear Transport Solutions (NTS) are the second highest carbon contributor within the NDA group and their carbon emissions have not reduced from 2019/2020 to 2023/2024 (data provided by the NDA).	? ?	The number of journeys required to enable the credible options are unknown. The type of transport is unknown.
	Coastal change and flood risk	Rail line improvements to accommodate additional loads along coasts may impact coastal change, for example to Sellafield. This is likely to provide the opportunity to improve these rail lines.		+	0	The magnitude of the impact is likely to be low considering there may be long timescales to see improvements. The sensitivity of the receptor is likely to be low to medium considering the predicted likelihood of coastal change (regression) across the UK.	? ?	Location of transport improvements.

Assessment of transport increase								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
		It is unlikely to impact flood risk.						
	Cultural heritage	An increase in transport would not directly impact cultural heritage.		0	0	The impact on cultural heritage will be insignificant.		N/A
	Geology and soils	An increase in transport could impact soils through spillages and leakages along transport routes.	Run-off should pass through drains and interceptors and not directly into soils.	0	-	The magnitude is likely to be low considering mitigation and the likely timescales of increases in transport. The sensitivity would be dependent on the soil quality along the transport route, but also likely to be low as transport will already run on the routes.	?	The number of journeys required to enable the credible options are unknown.
	Landscape and visual impacts	Increased transport may lead to a negative impact through greater presence of vehicles.		0	-	The magnitude and sensitivity are likely to be low considering that transport will already run on the routes.	?	The number of journeys required to enable the credible options are currently unknown.
	Materials and waste	An increase in transport may require materials and produce waste if updating transport links was to occur.	Use of current good practice, such as implementation of waste hierarchy.	0	-	The magnitude is dependent on the nature of the update. The sensitivity would be low, considering the mitigation measures.	? ?	Nature of transport improvements.

Assessment of transport increase								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Noise and vibration	Noise and vibration would likely increase with an increase in transport.		0	-	Vehicle movements would likely be spread out over a considerable length of time, making the magnitude of impact low. The sensitivity of the receptor (people, wildlife) is likely to be low to medium depending on the distance from the transport route.	? ?	The number of journeys required to enable the credible options are unknown.
	Radiological emissions and discharges	An increase in transportation of radiologically active materials could increase emissions and discharges along transport routes.	Transportation of NDA assets and liabilities follow strict legislation and protocols regarding the packaging and movement. Requirement to apply BAT and (for radioactivity) ALARA.	0	0	Considering the mitigation measures required during transportation of any radiologically active material, the impact will be insignificant.	ü	
	Water resources and quality	Increased transport could increase contaminated run-off on roads and railways.	Run-off should pass through drains and interceptors and not directly into water courses.	0	-	Vehicle movements would likely be spread out over a considerable length of time, making the magnitude of impact low.	? ?	The number of journeys required to enable the credible options are currently unknown.

Assessment of transport increase								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
						The sensitivity of the receptor depends on the current water quality, and as transport is likely to already run on the route the sensitivity is likely to be low.		
Health	General Health	An increase in noise and vibration can affect a person's general health over time. If these are in recreation areas, then the risk of impact becomes greater. Hearing and sleep can be impacted the most, which can lead to other health conditions.	Assessment undertaken for increased transport routes considering the impacts to human health.	0	-	Vehicle movements would likely be spread out over a considerable length of time, making the magnitude of impact low. However, the sensitivity could be medium depending on the location of the increased transport.	? ?	The number of journeys required to enable the credible options are currently unknown.

Assessment of transport increase								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Respiratory Disease	Increased transport can worsen air pollution in the vicinity of the travel route. Air pollution will increase the risk of respiratory disease within people.	Assessment undertaken for increased transport routes considering the impacts to human health.	0	-	Vehicle movements would likely be spread out over a considerable length of time, making the magnitude of impact low. However, the sensitivity could be medium depending on the location of the increased transport. Road transport will impact the likelihood of respiratory conditions more than rail transport.	? ?	The number of journeys required to enable the credible options are currently unknown.
	Radioactivity	There is a risk that an increase in transport of radioactive materials may cause releases of radioactivity.	Requirement to apply BAT and (for radioactivity) ALARA and comply with regulations to minimise environmental impacts.	0	0	The radiological health risk of an increase in transport is considered low due to mitigation measures. Therefore, the impact is likely to be insignificant.		N/A

Assessment of transport increase								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Life Expectancy	An increase in transport could impact life expectancy due to an increase in casualties along the transport routes.		0	-	The magnitude is likely to be low, considering that reported road and rail fatalities have decreased year on year [8] [9] and the number of increased journeys will not be substantial. In addition, due to the nature of the cargo, it is likely more care will be taken on transport routes. The sensitivity is also likely to be low, depending on the number of additional journeys.	ü	
	Mental Health	Mental health can be affected by an increase in noise and vibration, leading to annoyance and increase in aggression.	Assessment undertaken for increased transport routes considering the impacts to human health.		-	Vehicle movements would likely be spread out over a considerable length of time, making the magnitude of impact low. The sensitivity would depend on the distance to the increased transport	??	The number of journeys required to enable the credible options are currently unknown.

Assessment of transport increase								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
Socio-economic	Diversity	An increase in transport could create employment opportunities and offer an opportunity for increased diversity.	NDA Group Inclusion Strategy [7].	+	0	It is likely that the magnitude would be low as additional drivers on the road and/or rail may be required but likely to be low. The sensitivity is dependent on available workforce and likely to be low.	??	Extent that diversity is dependent on available workforce.
	Employment	An increase in transport would likely lead to increased employment in NTS and drivers of the transport option.		+	0	It is likely that the magnitude would be low as NTS already transports NDA assets and liabilities across the UK. Additional drivers on the road and/or rail may be required but these may be low. The sensitivity would likely be medium.	??	The number of journeys required to enable the credible options are currently unknown.

Assessment of transport increase								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Economy	If an increase in transport led to additional jobs, this would present an opportunity for the local economy in those areas to improve. However, increasing transport would cost the NDA and hence the UK government more money and so might present a risk to the wider economy.		+	-	The magnitude of any impact would be low, considering the length of time an increase in transport might occur. The sensitivity of the local economy and the NDA / UK government may also be low as it is likely only additional drivers may be low in number.	? ?	The number of journeys required to enable the credible options are unknown.
	Local and National Assets	If there was an increase in rail, these could lead to improvements in the rail infrastructure. However, an increase in road transport could lead to faster degradation of local roads.		+	-	The magnitude would likely be low, considering the length of time it could take to see improvements or degradation. The sensitivity is likely to be medium, as improvement of rail infrastructure could improve access to locations and increased mobility of non-road users.	? ?	The number of journeys required to enable the credible options are unknown.

Assessment of transport increase								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Population	Employment opportunities may encourage people to relocate to the area. However, increased transport in specific areas may cause relocation away from these areas.		+	-	The magnitude will likely be low given there may not be numerous additional jobs. The sensitivity depends on the current population and their opinions on increased transport. As transport is likely to already run on the route the sensitivity is likely to be low.	? ?	The number of journeys required to enable the credible options are unknown.

Table 8: Assessment of Transport Decrease

Assessment of transport decrease								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
Environment	Air quality	A decrease in transport will present an opportunity to better the air quality surrounding the transport routes.		+	0	The magnitude of any impact would be low, considering the length of time a decrease in transport might occur. The sensitivity is low as the air quality across the sites is within legal limits and generally improving [1].	? ?	The reduction in the number of journeys is unknown.
	Biodiversity	A decrease in transport would not directly impact biodiversity. Biodiversity could be impacted through other routes, such as a betterment of air quality.		0	0	The impact on biodiversity will be insignificant.		N/A
	Climate change	Transportation produces greenhouse gases such as CO_2, CH_4 and NO_x.		+	0	The magnitude is likely to be low or medium depending on the amount and type of transport to increase.	? ?	The reduction in the number of journeys is unknown. The type of transport to be reduced is unknown.

Assessment of transport decrease								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
		A decrease in transport would decrease the risk of negatively impacting climate change as fewer fossil fuels would be used depending on the type of transport used.				The sensitivity is likely to be medium as NTS are the second highest carbon contributor within the NDA Group and their carbon emissions have not reduced from 2019/2020 to 2023/2024 (data provided by the NDA).		
	Coastal change and flood risk	A decrease in transport is unlikely to impact coastal change and flood risk. These could be indirectly impacted through other routes, such as decrease in greenhouses gases and hence climate change.		0	0	The direct impact on coastal change and flood risk will be insignificant.		N/A
	Cultural heritage	A decrease in transport would not directly impact cultural heritage.		0	0	The impact on cultural heritage will be insignificant.		N/A
	Geology and soils	A decrease in transport would not directly impact geology and soils.		0	0	The impact on geology and soils will be insignificant.		N/A

Assessment of transport decrease								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Landscape and visual impacts	Decreased transport may lead to a positive impact through less vehicles on transport routes.		+	0	The magnitude and sensitivity are likely to be low considering that transport will still run on the routes.	?	The number of journeys required to enable the credible options are unknown.
	Materials and waste	A decrease in transport would not directly impact materials and waste.		0	0	The direct impact on materials and waste will be insignificant.		N/A
	Noise and vibration	Noise and vibration would likely decrease with a decrease in transport.		+	0	Vehicle movements would likely be spread out over a considerable length of time, making the magnitude of impact low. The sensitivity of the receptor (people, fauna) is likely to be medium depending on the distance from the transport route.	? ?	The reduction in the number of journeys is unknown.
	Radiological emissions and discharges	A decrease in transportation of radiologically active materials could decrease emissions and discharges along transport routes.	Transportation of NDA assets and liabilities follow strict legislation and protocols regarding the packaging and movement.	0	0	Considering the mitigation measures required during transportation of any radiologically active material, the impact will be insignificant.	ü	

Assessment of transport decrease								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Water resources and quality	Decreased transport could decrease contaminated run-off on roads and railways.	Run-off should pass through drains and interceptors and not directly into water courses.	+	0	A decrease in vehicle movement would likely be spread out over a considerable length of time, making the magnitude of impact low. The sensitivity of the receptor depends on the current water quality, and as transport will remain running along the route the sensitivity is likely to be low.	? ?	The reduction in the number of journeys is unknown.
Health	General Health	A reduction in transport may reduce noise and vibration along transport routes. This presents an opportunity to improve general health.		+	0	Vehicle movements would likely be spread out over a considerable length of time, making the magnitude of impact low. However, the sensitivity could be medium depending on the location of the decreased transport.	? ?	The number of journeys decreasing in the credible options are currently unknown.

Assessment of transport decrease									
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Respiratory Disease	A decrease in transport could improve air pollution. This would decrease the risk of respiratory disease.		+	0	Vehicle movements would likely be spread out over a considerable length of time, making the magnitude of impact low. However, the sensitivity could be medium depending on the location of the increased transport. A decrease in road transport will impact the likelihood of respiratory conditions more than rail transport.	?	The number of journeys decreasing in the credible options are currently unknown.
	Radioactivity	A decrease in transport of radioactive material could decrease releases of radioactivity.	Requirement to apply BAT and (for radioactivity) ALARA and comply with regulations to minimise environmental impacts.	0	0	Due to mitigation measures in place for transport, the impact is likely to be insignificant.		N/A

Assessment of transport decrease								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Life Expectancy	A decrease in transport could provide opportunity to increase life expectancy due to a decrease in casualties along the transport routes.		+	0	The magnitude is likely to be low, considering that reported road and rail fatalities have decreased year on year [8] [9] already. Due to the nature of the cargo, it is likely more care will be taken on transport routes already. The sensitivity is also likely to be low, depending on the number of additional journeys.	?	The decrease in the number of journeys is unknown.
	Mental Health	There could be an opportunity to improve mental health by decreasing noise and vibration.		+	0	A decrease in transport would likely be spread out over a considerable length of time, making the magnitude of impact low. The sensitivity would depend on the distance to the increased transport	??	The decrease in the number of journeys is unknown.
Socio-economi	Diversity	It is unlikely a decrease in transport would lead to an impact on diversity within the NDA.		0	0	The impact on diversity will be insignificant.		N/A

Assessment of transport decrease								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Employment	It possible that a decrease in transport could lead to a decrease in available jobs within NTS and drivers of that transport option.	Transfer within the NDA group.	0	-	It is likely that the magnitude would be low as NTS would still transport NDA assets and liabilities across the UK. The sensitivity would likely be medium in areas of employment.	??	The decrease in the number of journeys is unknown.
	Economy	If a decrease in transport led to a reduction in jobs, this would present a risk to the local economy in those areas. However, decreasing transport would cost the NDA and hence the UK government less money and so might present an opportunity to the wider economy.		+	-	The magnitude of any impact would be low, considering the length of time an increase in transport might occur. The sensitivity of the local economy and the NDA / UK government may also be low.	??	The number of journeys required to enable the credible options are unknown.
	Local and National Assets	A decrease in road transport would lead to less degradation of local roads.		+	0	The magnitude is likely to be low considering the number of vehicles still likely to use the roads. The sensitivity may also be low because of this.	??	The number of journeys required to enable the credible options are unknown.

Assessment of transport decrease								
	Topic	Risk / Opportunity for Impact	Current Mitigation / Enhancement	Significance of Impact			Uncertainty	
				+ve	-ve	Description		
	Population	Less employment opportunities may cause people to relocate from the area. However, decreased transport in specific areas may cause relocation to these areas.	Transfer within the NDA group.	+	-	The magnitude will likely be low given the NDA may transfer people within the group. The sensitivity depends on the current population and their opinions on decreased transport. As transport is likely to remain on the route the sensitivity is likely to be low.	? ?	The number of journeys required to enable the credible options are unknown.

4. Discussion

A summary of the significant impacts of credible options from the detailed assessment is provided in the relevant sections below. Additional details are discussed where relevant to the credible option.

4.1Site Decommissioning and Remediation (SDR)

4.1.1 Safe Stewardship

The objective for Safe Stewardship is to keep the NDA's assets and liabilities safe until decommissioning and remediation is possible in line with the NDA group's priorities. This includes, but is not limited to, the management of infrastructure, land quality, waste and natural capital. Options relating to the management and maintenance of these assets and liabilities prior to decommissioning can vary widely and will be decided on a site-specific and case by case basis. However, there are two broad credible options applicable to this strategy topic.

4.1.1.1 Utilise existing assets to manage and maintain the estate

Utilising existing assets to manage and maintain the estate may only be suitable in certain situations. Where considered appropriate, existing assets would be used to manage risk, with controls in place to ensure the risks do not increase.

There are relatively few environmental risks associated with utilising existing assets to manage and maintain the estate due to activity only requiring operation and maintenance. Once it has been established that risks are minimised there would be very small energy use requirements, waste generation, vehicle movements and impacts in terms of pollution. However, this is highly dependent on the nature of the risks being correctly understood and whether potential pathways exist which might lead to effects on receptors such as people, water, flora and fauna. As such, this credible option may not always be suitable, and additional work may be required to minimise the risk. There may also be reduced environmental opportunities in terms of improving biodiversity as existing assets and land will continue to be used for industrial purposes.

From a socio-economic perspective, utilising existing assets to manage and maintain the estate offers opportunities through maintaining jobs over a sustained period of time, though employment may largely be restricted to operation and maintenance, and monitoring activities. This would also provide opportunities to enhance knowledge and skills and provide education and training. There would also be socio-economic benefits in terms of continued investment in the local economy, and improvement in road and rail infrastructure.

4.1.1.2 Develop/construct new assets to manage and maintain the estate.

Developing and constructing new assets to manage and maintain aspects of the estate may be appropriate where it is not possible to utilise existing assets. In such instances new assets would be constructed at existing NDA sites. As such there would be both opportunities and risks associated with an increase in land utilisation and construction in the short term, as well as additional operation and maintenance in the long term.

There are a relatively large number of potential environmental risks associated with developing and constructing new assets to manage and maintain the estate due to the need to utilise additional land and undertake construction work. During these stages waste generation, vehicle movements and impacts in terms of pollution to air and water would potentially be high, as well as potential reductions in biodiversity where there is an increase in land utilised. These risks can be mitigated if they are correctly understood through assessments so that pollution risks can be anticipated and preventative measures put in place. In addition, mitigation such as legislation is in place to prevent harm to receptors such as people, water, flora and fauna. The significance of the impacts will also depend on the current baseline, for example the biodiversity of the site and surrounding land prior to construction and current air and water quality. Impacts could be reduced where land already used for industrial processes can be reused.

Developing and constructing new assets to manage and maintain the estate offers socio-economic opportunities due to the creation of employment in the short term through construction, and over the long term through operation and maintenance. As a wide range of employment opportunities would be maintained over a long period of time there would also be opportunities to enhance knowledge and skills and provide education and training on a similarly wide range of subjects. There would also be socio-economic benefits in terms of continued, and potentially increased, investment in the local economy.

Where construction is undertaken there may be risks from a health perspective, for example the risk of respiratory illnesses associated with pollution of air and water, while increased traffic might influence the risk of road accidents on the local transport network.

4.1.2 Decommissioning

The NDA preferred strategy is for decommissioning to be undertaken as soon as possible. However, the updated Strategy 5 recognises that there are clear benefits to slowing or deferring decommissioning, for example to allow for radioactive decay, to adopt a 'lead and learn' approach, or to realise an opportunity for reusing a facility. The preferred strategy for a site will be case-specific and will consider the benefits and disbenefits of credible options in line with the UK policy framework for managing radioactive substances and nuclear decommissioning strategies [10] and the NDA Value Framework [11].

4.1.2.1 Immediate dismantling – either accelerated, parallel or sequential

Dismantling includes both the dismantling (removal of building contents) and demolition phases to achieve an interim or end state. Immediate dismantling is where there is no significant delay between cessation of operations and the completion of the transition phase, including post operational clean out (POCO) and commencement of decommissioning to chosen end state [12]. When implementing immediate dismantling, buildings would be dismantled, decontaminated and in some cases demolished, with the majority of activity occurring over the short-term. It is considered likely that immediate dismantling will pose the greatest risk of impact through its requirements for land to be utilised in the short term and in the construction of facilities to enable decommissioning. Opportunities will also be provided associated with the decrease in utilisation of NDA land in the long term.

Given that radioactive material may need to be conditioned and stored for this option, there may be a need to build and operate other interim storage facilities that currently do not exist. Implementation of this option would bring the closure programme forward. However, the handling plants would still be required to place the remaining material into containers. As such, this option would bring forward closure programmes for some plant but would not lead to closure of existing facilities directly.

Immediate dismantling offers the opportunity of reducing the environmental hazards and risks associated with land and facilities most quickly; allowing access to subsurface contamination, which can then be managed more efficiently. This could lead to the opportunity for improving the landscape, and air and water quality, quicker. Additionally, immediate dismantling can make use of existing infrastructure which might otherwise need to be maintained or upgraded if dismantling is deferred.

There is a risk that immediate dismantling could put a strain on waste management and storage facilities, as greater volumes of waste would arise in the short-term that would need to be stored until an appropriate disposal facility was available.

Immediate dismantling would provide an opportunity for land to become available for alternative uses earlier. Such uses may include supporting new facilities or providing some other form of socio-economic or environmental benefit to the local community. A key socio-economic risk associated with immediate dismantling is the potential for skills and the workforce to be ‘locked up’ on a particular site or area of a site. This may prevent other sites or areas receiving attention, which could have further risk of impact from an environmental and health perspective.

It is likely that more intensive activity would be required to clean up the site or facility if immediate dismantling was implemented. This could lead to higher magnitude environmental impacts in the short-term, which may have implications for receptors

including people, flora and fauna. However, mitigation measures are in place to negate the impact on health from decreases in air quality, for example.

Negative impact on workers' and their families' mental health and well-being could occur as a result of immediate dismantling, as once a site is decommissioned the workforce are no longer required, so workers may have to relocate to other sites or seek employment in a different industry.

4.1.2.2 Deferred dismantling – Minimal interventions during Care and Maintenance (C&M)

Deferral for a short, medium or long C&M period with minimal interventions involves preparing the site or facility for deferral such that minimal maintenance or other activities are required during the deferral period. This approach requires significantly more effort during the preparatory phase than the following credible option [12]. The preferred strategy is for the dismantling phase of decommissioning to be undertaken as soon as possible after cessation of operations as this generally represents the cheapest option in real terms, particularly when decommissioning has been considered at the design stage. However, UK policy and international practice also recognises that the deferral of decommissioning can be an appropriate choice.

In some cases, there are clear benefits to be had from slowing or deferring work. For example, to take benefit from radioactive decay, to adopt a 'lead and learn' approach, or to realise an opportunity for reusing a facility. In addition, there are a number of constraints that might require the deferral of decommissioning. Constraints include access restrictions, a lack of waste management infrastructure, and limited resources including supply chain capacity.

Dismantling of structures offers the opportunity of reducing the environmental hazards and risks associated with land and facilities by allowing access to subsurface contamination, which can then be managed more efficiently. It also allows for improvements to the landscape, air quality and water quality. Deferred dismantling would still offer these opportunities, but they would be realised over a longer timeframe than if a site or structure was dismantled immediately.

In certain cases, deferring dismantling can provide an opportunity to allow natural decay, which reduces the radiological risk to the public and the environment and may reduce the level of physical activity required to clean up a site or facility. This reduction in activity may reduce environmental impacts such as noise and vibration, as well as air and water pollution. If there are short-lived radionuclides, then deferred dismantling may reduce the waste management burden, with potential knock-on implications in terms of reduced transport.

Whether or not deferred dismantling is appropriate is highly dependent on site-specific considerations, such as the nature of the facilities in question and the level of contamination. Deferred dismantling may not always be suitable, in which case the opportunities it affords may not be realised.

Deferred dismantling presents the opportunity of maintaining a skilled workforce and jobs in the supply chain. However, it can also mean that land becomes available for alternative uses more slowly.

A risk for negative impact associated with deferred dismantling is the potential for jobs and skills to be lost during periods of deferral due to a decline in demand. However, deferred dismantling would offer the opportunity to maintain some jobs and the possibility of reusing facilities during the deferral period.

Deferred dismantling may provide opportunities to spread out environmental impacts (and associated health impacts) over time, but at the risk of incurring negative effects on mental health and well-being due to extended impacts on the landscape and land use. As deferring dismantling allows time for radioactive decay, doses received by workers may be lower (noting that in either case doses to workers will be managed and minimised as far as reasonably practicable), though there may be a short-term increase in the initial preparatory phase.

The opportunity to maintain jobs over a longer time period through deferred dismantling could offer mental health and well-being benefits, although there would be a decline in jobs during periods of deferral under that option. This may enable attention, in terms of resources, skills and workforce, to be diverted to sites and facilities where health risks are higher. This could be considered an additional health opportunity of slower or deferred dismantling.

4.1.2.3 Deferred dismantling – Planned interventions during C&M

This option is defined as deferral for a short, medium or long C&M period with planned interventions. This assumes a significant maintenance programme of work being required during the deferral period itself offset by much less work being required during the preparatory phase [12]. A short or medium period of deferral with planned interventions could be equated to a continuous decommissioning strategy at a much reduced pace.

With the implementation of deferred dismantling with planned interventions, there may be periods of C&M with no active dismantling. During such periods, programmes are implemented to ensure that the required level of safety and asset management is maintained. Dismantling would still be completed, but activity may peak during the short and long-term. Deferred dismantling may apply only to particular buildings or structures in a facility or at a site, whilst everything else around it is cleared without interruption.

Benefits of deferred dismantling include providing opportunities for a reduction of environmental risks, such as contaminated land and facilities, through natural radioactive decay. The risk of incurring negative effects on mental health and well-being due to extended impacts on the landscape and land use would also remain with deferred dismantling with planned interventions.

As deferring dismantling allows time for radioactive decay, doses received by workers may be lower (noting that in either case doses to workers will be managed and minimised as far as reasonably practicable). However, due the requirement for personnel to carry out interventions, and the significant amount of maintenance work required, overall exposure may be higher in the long term than for deferred dismantling with minimal interventions.

The maintenance programme required for deferred dismantling with planned interventions will provide opportunities to maintain jobs over a sustained, longer period of time. This offers benefits to the local economy as well as mental health and well-being benefits. There may also be short term opportunities to move resources (in terms of skills and workforce) to sites and facilities where risks are higher. This could be considered an additional health opportunity of deferred dismantling with planned interventions.

4.1.2.4 Combined strategy including interim state(s).

Any preferred strategy for a site will be case-specific and will consider the advantages and disadvantages of credible options in line with the code of practice for the selection of decommissioning strategies [12] and the NDA Value Framework [11] It may be that some sites require a combination of strategies, starting with a pause at an interim state to consider and review performance, with a judgement made at that time to either change the timing of dismantling or to accelerate or slow down the rate of progress. An example would be to accelerate progress to realise a specific benefit such as reusing the site earlier. Any such approach would offer a mixture of the opportunities and risks of impacts discussed in Sections 4.1.2.1 to 4.1.2.3.

4.1.3 Site end-states

The Site end-states strategy describes the condition to which the site (including land, infrastructure and natural capital) will be left at the end of the decommissioning process. Many site-specific issues and factors drive the determination of an end state. The NDA do not want to rule out credible options too early, considering most site end states will not be achieved for decades.

4.1.3.1 Leave the hazard where it is and prevent use

The option of leaving the hazard where it is and preventing use would not involve physical activity to improve the condition of the site, but may involve minimal activity to maintain,

stabilise or prevent migration of contamination. For the most part, it would rely on controls (legal or administrative tools or actions such as restrictions on land use, environmental monitoring requirements, and site access and security measures) to manage risks to people and the environment.

Such a strategy is only suitable in extreme cases where remediation is very difficult and turning the site into a disposal site, which needs to be managed by preventing use, is preferable to attempting extensive and costly remediation in order to create a new facility or alternative land use.

Managing the risk through leaving the hazard where it is and preventing use using controls could offer some opportunities from an environmental perspective in terms of reducing the physical activity needed in the short and medium-term. This would present opportunities to keep impacts to changes in air, water and soil quality to a minimum by avoiding pollution-generating activities such as excavation or demolition, vehicle movements and energy use.

However, this option offers no environmental opportunities in terms of improving water and soil quality at the site as the hazard would continue to exist in largely unaltered form.

Preventing the site from being reused would limit socio-economic opportunities but may lead to some employment opportunities to undertake monitoring activities whilst also potentially ensuring continued NDA investment in the local community.

4.1.3.2 Make land suitable for next planned use

Where land is made suitable for its next planned use, sites would be remediated only as far as is required to be suitable for their next planned use. Where the next planned use does not need a nuclear site licence, the licence will be surrendered, with any residual radioactive or non-radioactive contamination subject to appropriate permit, planning and institutional controls.

Making land suitable for next planned use ensures that the level of intervention (taking into account the cost, energy use and risk to workers) and the volume of waste generated are appropriate (no more or less than required) to meet the requirements of the site's next planned use. Whilst this can help to ensure that environmental, health and socio-economic risks are minimised, the exact nature and extent of risks (and therefore impacts) will be dependent on the next planned use and the activities needed to make the land suitable for it.

Activities required to make land suitable for a next planned use, including construction and on-going maintenance, are likely to generate a range of short to long-term environmental impacts, including changes in air, water and soil quality, the generation of carbon emissions and wastes, and changes to habitats or landscape. The exact extent of

such impacts and whether they were a risk or opportunity would depend on the next planned use and the current state of the land. For example, in order to make the land suitable for use as a car park, the extent of physical activity (and thus the magnitude of associated environmental impacts) may be reduced when compared to making the land suitable for use as a nature reserve.

However, there would also be various environmental opportunities, including mitigation of contamination, improvement of long-term air, water and soil quality at the site, enhancement of biodiversity and removal structures or facilities which have adverse landscape and visual impacts.

Making land suitable for its next planned use presents opportunities to generate employment and enhance knowledge and develop skills in the local community. Regardless of the next planned use for a site, a degree of remediation may need to take place to make the site safe with the greater the extent of intervention required, the greater the opportunities there may be for developing knowledge and skills and promoting education and training. A further socio-economic opportunity is the potential for reuse or divestment of the land which, following remediation, may become a local or national asset.

The main health opportunity associated with making land suitable for its next planned use is the removal of hazards which may be affecting the health of workers and the local population through their impact on land, water and air quality.

Remediation of a site to a condition suitable for its next planned use has the potential to generate adverse environmental impacts in the short-term, though these would be reduced compared to making a site suitable for any foreseeable use. Such impacts are unlikely to have significant implications on health due to mitigation measures during the activity.

Making land suitable for its next planned use may offer further opportunities to facilitate dialogue with stakeholders, which can have a positive effect on community cohesion and may lead to mental health and well-being benefits.

4.1.3.3 Remove the hazard completely so that the risk does not need to be controlled

Removing a hazard completely so that the risk does not need to be controlled would enable sites to be restored to a condition where they can be used for any foreseeable use without the need for additional remediation or management controls. The level of intervention required to achieve this would likely be high.

Removal of a hazard completely would likely lead to higher magnitude adverse impacts in terms of air quality, noise and vibration, carbon emissions and energy use in the short to medium-term, when compared to the other credible options, but may result in long-term

improvements in air, water and soil quality. It is also likely that greater volumes of waste would be generated which may then need to be removed from the site. However, it could present opportunities for positive impacts on habitat for biodiversity, landscape and the visual environment.

The removal of hazards may also free the land up for alternative uses, which could include amenity or recreational features. Creation of such features could positively impact levels of physical activity undertaken by the local population, thereby providing health benefits.

Due to the increased level of intervention required to make the land suitable for any foreseeable use, there may be a range of socio-economic opportunities provided, including employment, development of skills and opportunities for education and training. This could have positive health effects in terms of mental health and well-being. Conversely, removing the hazard completely would likely take longer, and thus the land would not be made available for reuse as early as it would be under the make the land suitable for its next planned use option. This could limit the realisation of socio-economic opportunities such as investment into the local economy and jobs.

From a health perspective, removing the hazard completely would offer considerable long-term health opportunities. However, there is the risk of impact in the short-term, for example works to excavate contaminated material and transport it off-site could lead to changes in air quality which might influence the risk of respiratory illnesses. Increased traffic might increase the risk of road accidents on the local transport network.

4.1.4 Operational Estate use

This strategy identifies credible uses for NDA land and assets following completion to end state, or on an interim basis during C&M. Historically within the UK and internationally it was assumed that, upon completion of nuclear decommissioning and remediation, sites would be returned to their previous state or 'greenfield'. Today it is recognised that this is not always possible nor necessarily desirable and so the aim is to optimise the use of the operational estate and determine the most appropriate reuse of the land.

Options for credible uses will be made on a site-by-site basis and will explore all opportunities to achieve the best use of NDA land and assets, whether that is reuse by the NDA or by others. There are three high-level credible options for this strategy and a combination of all three may occur at any site. This will be informed by the strategy for 'Safe Stewardship'.

4.1.4.1 Divest the land (freehold) for social, environmental or economic benefit

Future site use will be defined by the NDA, UK Government, or a future owner in accordance with local planning regimes and incorporating consultation with

stakeholders as appropriate. Suitable potential land uses may vary from site to site and could range from anything as simple as a recreation area to a nuclear new build site, or a business and technology park. The aim of all the varying potential uses will be to provide opportunities for positive environmental, social or economic impacts.

The decommissioning and clean-up of existing NDA sites may allow for those sites to be divested for nuclear new build. This could offer a number of environmental opportunities, including the avoidance of the extensive environmental impacts associated with an increase in land utilised and development of new sites. Such development at existing sites would also offer opportunities by providing a low carbon form of power generation, which could have a positive impact from a climate change perspective.

Alternatively, there may be substantial opportunities for positive environmental impacts if sites are converted into nature conservation sites or habitats having been divested by the NDA. This could lead to potentially significant benefits in helping to promote biodiversity and improve local landscapes.

A nuclear new build site could offer potentially large positive impacts for the socio-economics of the local community through the creation of long-term employment, education and training. If land is used to support the new generation of nuclear build this could provide an opportunity to create a national asset, providing jobs and economic investment into the community or region.

Alternately, clean-up and closure of the NDA sites may provide socio-economic opportunities if a community facility was created. This might include a business park or some other facility which provides benefits to the local economy. It is likely that any such development would provide opportunities for employment and could also lead to opportunities to enhance knowledge and skills. Development of a centre of higher education or research establishment could promote opportunities for education and training.

The creation of a recreational or amenity space or some other form of community facility could lead to health opportunities from improvements in mental health and well-being, as well as having positive physical health implications, such as reduced obesity in the local community, if it leads to increased levels of physical activity. This is on top of the health benefits associated with reduced air, water, visual and noise pollution as a result of the land no longer being used for industrial processes.

A key socio-economic risk associated with divesting NDA land is the potential for skills and the workforce to be 'locked up' on a particular site or area of a site. This may prevent other sites or areas receiving attention, which could have further implications from an environmental and health perspective. It is also likely that more intensive activity would be required to clean up the site or facility which could lead to higher magnitude environmental impacts in the short-term. This may have implications for health. Intensive

demolition or excavation works, for example, could result in changes in air quality which might lead to slightly increased risks of cardiovascular and respiratory illness amongst the local population.

4.1.4.2 Retain land as an NDA asset or liability

An alternative to divesting the land for socio-economic or environmental benefit is to either retain the land as an NDA asset or liability or to divest the land as leasehold (discussed in Section 4.1.4.3 below). The option to retain the land would offer reduced opportunities for environmental and socio-economic benefits and would only be preferred in the event that a more suitable use could not be identified.

Divesting land may require intensive works in the short term for the land to be divested in a suitable state. As discussed in Section 4.1.2.2, in certain cases there are opportunities for benefits through slowing or deferring this process, for example to take benefit from radioactive decay. Through retaining and maintaining land as an NDA asset or liability there would be the opportunity to spread environmental impacts (and associated health impacts) over time, though with the risk of incurring negative effects on mental health and well-being due to extending impacts on the landscape and land use. Additionally, there are a number of constraints to immediately preparing a site for divestment that would not need to be overcome, such as access restrictions, a lack of waste management infrastructure, and potentially limited resources including supply chain capacity.

Retaining land as an NDA asset may present the opportunity of maintaining a skilled workforce and jobs in the supply chain, particularly in maintenance roles. There may also be the opportunity of reusing facilities, which could be more economical and offer more environmental benefits than having to acquire additional land and construct new sites, with the potential for impacts through pollution that this entails.

The opportunity to maintain skilled jobs, training and investment in the local community through retaining land as an NDA asset could offer mental health and well-being, as well as socio-economic, benefits.

4.1.4.3 Divest the land (leasehold) for social, environmental or economic benefit

Divesting the land but as leasehold instead of freehold gives opportunities for reusing the land to support other government priorities such as national infrastructure projects, and in particular, for nuclear new build. This could include Small Modular Reactors (SMRs) as part of the Great British Nuclear competition. Land could also be divested for agriculture, or industrial businesses that would benefit from being adjacent to a nuclear site.

Many of the opportunities and risks associated with divesting the land as leasehold are expected to be similar to those identified in Section 4.1.4.2.

It is likely that a higher level of decommissioning and remediation would be required if land is to be leased by the NDA. As such, there is the potential for environmental risks associated with this work in the short term, such as discharges to air and land.

Depending on the future use of the land once it has been leased, there is the possibility that there will the opportunity to maintain, or possibly increase, employment and investment in the local area. This could have knock on positive effects on mental health and diversity.

4.2 Spent Fuel

Reprocessing operations ceased in the UK in July 2022. The credible options for spent fuels are split into the stages of their lifecycle. These are: Consolidation, Interim Storage; and Disposition. The spent fuel inventory is at varying stages along this lifecycle.

4.2.1 Consolidation

In recent years, the NDA has been contractually committed to receiving and managing all of the spent fuel arising from the seven currently operating EDF Energy AGR power stations in England and Scotland, and spent fuel from Dounreay, at Sellafield. This strategy of consolidation enables sites to be decommissioned then transferred to the NDA. This approach also enables the NDA to optimise the use of suitable facilities, skills and capability already in existence at Sellafield to treat and manage spent fuels. The long-term objective is for spent fuel to be disposed of in a Geological Disposal Facility (GDF) following their consolidation.

4.2.1.1 Only consolidate AGR spent fuels at Sellafield and store spent fuels from Dounreay at Dounreay until a disposition option becomes available

Storing spent fuel from Dounreay at Dounreay rather than at Sellafield would require the spent fuel to be interim stored in newly built facilities pending the long-term aim of treatment and packaging prior to disposal in a GDF. New storage at Dounreay would need to be built in the short- to medium-term, and spent fuel would be moved to these storage facilities when they are available.

Constructing new storage facilities at Dounreay would present a risk of short-term negative impacts to air and water quality and the local landscape. There would also be the risk that vehicle movements and the use of plant may generate noise, would require energy and generate carbon emissions. The impact of this may be low, however, in the context of the Dounreay site as a whole due to its industrial and isolated setting.

Construction of a new storage facility would require a large number of resources in the short term. There is also significant risk that it would lead to the generation of more waste through the creation of an extra store that will require decommissioning following the transfer of stored spent fuel to a GDF. However, as the facility would be designed with decommissioning and the waste hierarchy in mind, the impact of this would be minimised as far as reasonably possible.

The need to transfer the spent fuel to a GDF would also create risks associated with the transport of nuclear materials, although 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 fuel inventory, and movement of the inventory, is considered low. However, the spent fuel would not be transported to Sellafield prior to transfer to a GDF, providing opportunities for better environmental and health impacts from a decrease in transport overall.

The construction of new stores at Dounreay would provide the opportunity to generate more construction jobs in the local area and benefit the local economy during this period. Additionally, as personnel would be required to operate the stores and transport waste to a GDF when it becomes available, appropriate education and training, and maintenance of knowledge and skills would be required. The loss of these employment, education and training opportunities at the Sellafield site may be considered as having a negative socio-economic impact on Cumberland.

Due to mitigation measures including the requirement for BAT and ALARA, there is an insignificant risk of increased impacts on health as a result of the construction and operation and future maintenance of new storage facilities. However, nuisance and road traffic impacts will be greater during the construction period. That annoyance and road traffic impacts would likely not be felt in Cumberland could be considered an opportunity, especially as road traffic impacts associated with Sellafield are already high.

Storing spent fuels at Dounreay until a disposition option becomes available provides an opportunity to maintain, and potentially increase, skilled jobs, training and investment in the local community and could offer opportunities for mental health and well-being benefits.

4.2.1.2 Stop all consolidation activities and leave spent fuels on reactor sites until a disposition option becomes available

Stopping consolidation activities and leaving spent fuels at reactor sites until such time as a disposition option becomes available is not currently considered a viable option, but circumstances may lead to it becoming one in the future. Stopping consolidation would create a number of issues to consider, such as non-optimal storage conditions at the

reactor sites and the difficulty of packaging for GDF created by storing spent fuel on different sites for long time periods.

The risks and opportunities associated with stopping consolidation and leaving spent fuel at reactors would be the same as for Section 4.2.1.1, however they would be on a much wider scale due to the number of AGR sites at different locations around the country.

4.2.2 Interim Storage

The current baseline for interim storage of spent fuels is that existing assets are used where they are appropriate, for example pond storage for oxides, and new storage solutions are developed for smaller inventories coming through, for example self-shielded boxes and interim storage facilities for Magnox fuel.

4.2.2.1 Treat and package all spent fuels now ready for disposal in a GDF, including drying spent oxide fuels and storing in disposal containers

Spent fuels that have not been reprocessed following closure of the reprocessing plants will require significant investment in infrastructure, as such there needs to be considered the impact of constructing new storage compared to using or modifying an existing store.

Impacts of constructing new storage facilities include short-term changes in air and water quality and landscape and visual impacts. Noise may also be generated from vehicle movements, and the use of plant would require energy that could generate carbon emissions. The modification of an existing store would risk similar impacts on a smaller scale.

The construction of a new facility to treat and package all spent fuels rather than using an existing facility requires more resources. This process would also generate more waste through the creation of an extra store to decommission once fuels have been transferred to the GDF. However, as the facility would be designed with decommissioning and the waste hierarchy in mind, the impact of this would be minimised as far as reasonably possible.

Construction of new facilities would provide an opportunity for the generation of construction jobs in the short-term that would be a considerable boost to the local economy during this period. There would also be a long-term requirement for personnel to operate and maintain the stores and transport waste to a GDF when it becomes available. Appropriate education and training, and maintenance of knowledge and skills would be required for both short term construction jobs and the longer-term operational employment.

Treating and packaging all spent fuels in new facilities would potentially provide an opportunity to reduce the dose to workers through the avoidance of contact with radioactive material already in place in an existing store.

Air quality and associated health impacts, such as increased risks of cardiovascular and respiratory illness amongst the local population, are likely to be increased during the construction of new facilities as a result of the likelihood of increased pollution of air and water. Nuisance and road traffic impacts will also be greater. The increase in construction, operation and maintenance of work, and increased opportunities for education and training, over a longer period of time, would likely offer mental health and well-being benefits locally.

4.2.2.2 Minimise new storage solutions and use existing packages and facilities for all fuels.

Managing the spent fuel inventory through existing storage facilities avoids most of the short-, medium- and long-term environmental impacts associated with construction, operation and decommissioning of a new facility to store the inventory. These impacts may include emissions of air pollutants, noise and vibration, landscape and visual impacts, energy use and consumption of raw materials. Some construction will still be required to maintain existing stores.

Operation of the packaging plant could generate a number of environmental impacts, particularly from a materials and waste perspective, as several thousand tonnes of spent fuel would be packaged to produce a waste product.

Managing spent fuel in existing facilities may lead to slightly greater volumes of water abstraction, given the current wet storage of some spent fuels. However, any reduction in water abstraction as a result of constructing new facilities is likely to be small compared to water abstraction volumes for the site as whole. Managing spent fuel in existing facilities may also lead to slightly greater radiological discharges and operational waste volumes compared to newer facilities, because newer facilities would be optimised to reduce these risks. However, given the current stringent controls on radiological discharges, which are required to be very low, any reduction in discharges as a result of constructing new facilities would be small.

There may be additional increased risk of corrosion of spent fuel stored in current storage facilities, which could lead to releases to the ground or water environments. Such risks would need to be carefully managed.

Management of the spent fuels using existing facilities offers limited opportunities for developing new knowledge and skills, with the exception of the knowledge and skills that might be gained from implementing techniques to prolong the life of existing interim stores. This might lead to some minor opportunities for education and training.

Minimising new storage solutions and use existing packages and facilities for all fuels may offer some health opportunities by avoiding the additional movement of spent fuel to a new facility prior to packaging and disposal to a GDF. These risks would include conventional risks associated with transport movement and air quality, but also the small radiological risk associated with movement of radioactive waste.

Avoiding the construction of new facilities may have mental health benefits through the avoidance of environmental effects, including reduced air quality, noise and vibration generation, and visual and landscape effects. Overall, the effects on mental health of storing spent fuel in existing facilities is likely to be small.

4.2.3 Disposition

The current baseline for disposition is to store spent fuels pending a decision to declare them as waste for disposal in a GDF.

4.2.3.1 Declare all fuels as waste today

A decision by the NDA, the UK government and regulators to declare all spent fuels as waste today will not present any additional risks or opportunities for impact than the current baseline. Regardless of whether spent fuels are classed as waste there is a continued need for them to be stored appropriately due to the nature of the inventory. The NDA and Nuclear Waste Service's (NWS's) current plans for Sellafield are for all spent fuel to ultimately go to a GDF, and spent fuels are included on the planned inventory.

4.2.3.2 Store fuels indefinitely

The risks and opportunities of storing fuels indefinitely depends a great deal on the decision of whether to construct new storage or modify existing storage, and the location of the storage, and those associated with the construction of new spent fuel stores are discussed in Section 4.2.2.1. If fuel were to be stored for an indefinite amount of time, then any storage facility would require ongoing operation and maintenance for indefinite period of time. The spent fuel itself would similarly require management indefinitely.

Managing spent fuel indefinitely would lead to an ongoing risk of radiological discharges and operational waste generation. Indefinite storage of spent fuels without construction of new stores would increase the risk of corrosion of spent fuel stores, which may potentially lead to radiological releases to the ground or water environments. Indefinite storage of AGR fuel risks a greater amount of effluent from wet storage in ponds needing to be treated, with a consequent increased risk of impact on the water environment and health. However, where newer facilities are utilised, these risks may be reduced due to improvements in design.

Storing spent fuels indefinitely presents the opportunity of maintaining a skilled workforce and jobs in the supply chain, potentially in construction and certainly in operation and maintenance. The opportunity to maintain jobs over a longer period of time through indefinite storage of spent fuel could offer mental health and well-being benefits.

4.3 Nuclear Materials

4.3.1 Uranium

4.3.1.1 Continued safe and secure storage pending sale for reuse, where economically and/or technically practicable

The NDA have updated their strategy to acknowledge that the selling of uranium for re-use, which remains the baseline, must be economically and/or technically viable, otherwise it does not reflect the NDA's mission nor present value for the government or taxpayers.

There are several environmental risks associated with the safe and secure storage of uranium. These include the landscape and visual impacts of the existing stores, and any pollution generated from maintenance activities required to repackage the material or replace the stores. Environmental impacts associated with construction would be avoided where uranium is sold for reuse. This option would also offer opportunities for the improvement of landscapes and reduced visual impacts by facilitating the closure of existing facilities.

It is important to note that the sale of uranium for reuse is highly dependent on market conditions and external factors such as the availability of technologies to use the uranium. Therefore, the associated opportunities may not be realised for many years, during which time the environmental impacts associated with continued storage, including repackaging and replacing the stores, would apply.

The sale of uranium for reuse, where economically and/or technically practicable, would ultimately lead to the generation of waste depleted uranium.

The storage of the NDA's uranium inventory on a continuous basis presents the risk that the land that the stores are built on cannot be reused by the local community. However, uranium maintenance and repackaging activities support ongoing employment opportunities. These opportunities include jobs in construction and monitoring.

The sale of uranium for reuse presents risks including the loss of jobs involved in managing and maintaining existing uranium stores when the stores close, with limited employment opportunities created. Depending on the timescales over which the uranium is sold, there may be an opportunity to transfer some of these jobs to other areas of the NDA's operations. The sale of uranium for reuse would not directly lead to opportunities

for the development of knowledge and skills but may facilitate indirect advances in knowledge of uranium reuse in fuel.

All strategy options involve the deconversion of the NDA's uranium hexafluoride (UF_6) inventory at the Tails Management Facility (TMF) at Capenhurst. This process converts the uranium into a more stable and less hazardous form, thereby reducing radiological health risks. Risks associated with respiratory illness and cancer may be reduced, as canisters used to store UF_6 can leak when not actively maintained.

Closure of existing uranium stores may also offer landscape, visual and land use opportunities, which could lead to positive effects on mental health and well-being.

4.3.1.2 Continued safe and secure storage pending disposal

The risks and opportunities associated with continued safe and secure storage of uranium that apply in Section 4.3.1.1 apply equally in this section (and Section 4.3.1.3 below). The disposal of uranium would involve the construction of new facilities and the generation of materials and waste. Construction impacts can include temporary changes in air quality and reduced water quality, as well as landscape and visual impacts. Noise may also be generated from vehicle movements and the use of plant and machinery. The production of construction materials, and the use of vehicles and plant in the construction of new facilities would require energy and generate carbon emissions.

There is a risk that opportunities for employment would be lost should disposal options be implemented. This could, to some extent, be offset by the opportunity for operational jobs created to manage conditioning and interim storage facilities. In addition, there would be short-term employment opportunities created during construction of the any new facilities.

Short-term construction impacts associated with the continued safe and secure storage, and disposal, of uranium, such as changes in air quality, as well as noise and vibration, present the risk of impacts to health by increasing the risk of cardiovascular and respiratory illness in the local population. Construction traffic may also put pressure on the local transport network which could increase the risk of road accidents and lead to increased driver stress.

The creation of employment associated with the disposal of uranium could lead to positive effects on mental health and well-being. The opposite would be true for the sale for reuse option, where employment associated with maintaining stores and repackaging the uranium would be lost.

4.3.1.3 Continued safe and secure storage pending conditioning to an appropriate form for disposal

The risks and opportunities associated with disposal of uranium that apply in Section 4.3.1.2 apply equally in this section.

The continued safe and secure storage of uranium pending conditioning to an appropriate form for disposal may offer opportunities to enhance knowledge and skills in uranium conditioning, which could then be applied to the management of other radioactive materials.

There are a relatively large number of environmental risks associated with developing and constructing new assets to condition uranium prior to disposal. During these stages waste generation, vehicle movements and impacts in terms of pollution to air and water would be increased, as well as potential reductions in biodiversity where there is an increase land utilised. These risks can be mitigated if they are correctly understood through assessments that identify potential pathways which might lead to effects on receptors such as people, water, flora and fauna, so that pollution risks can be anticipated and preventative measures put in place. The significance depends on the biodiversity of the land and surrounding land prior to construction. Impacts would be reduced where land already used for industrial processes can be reused.

From a socio-economic perspective, developing and constructing new assets to condition uranium offers socio-economic opportunities through the creation of employment in the short term through construction and over the long term through operation and maintenance of the new facilities. As a wide range of employment opportunities would be maintained over a long period of time there would also be opportunities to enhance knowledge and skills and provide education and training on a similarly wide range of subjects. There would also be socio-economic benefits in terms of continued, and potentially increased, investment in the local economy, and improvement in road and rail infrastructure.

4.3.2 Plutonium

There are two credible options for management of the NDA inventory of civil plutonium, one of which is the continuation of the current baseline of continued safe and secure storage of plutonium, renovating and replacing stores as required.

4.3.2.1 Build facilities to condition and treat plutonium prior to storage and disposal to a GDF

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.

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.

Regardless of which conditioning technology is implemented, there would be a requirement for construction and the associated increased risk of polluting emissions, including CO_2. The extent of construction would likely be a single treatment plant and one or more interim stores. 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. 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.

Conditioning the plutonium would generate substantial volumes of waste during operation. For technologies such as vitrification and cementation, conditioned waste volumes increase significantly. Compared to the baseline of continued safe and secure storage of 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.

This conditioning and treatment option would result in closure of existing facilities used to manage the plutonium inventory. Removal of industrial facilities could have a positive, albeit of low significance, on the local landscape. There would also be an eventual requirement to close the new facilities once the inventory had been disposed of to a GDF. Disposal at the earliest opportunity would avoid the need to continuously replace existing stores and repackage the plutonium, which will 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 they would likely require regular maintenance works. 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 intermediate level waste (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 Low Level Waste Repository (LLWR). The bulk of waste generated from closing existing facilities is likely to be non-radioactive and may be suitable for reuse.

Any conditioning technology selected would create a full range of employment, from construction to highly skilled technical and managerial jobs. 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.

Construction works can negatively affect health through changes in air quality from emissions of pollutants such as NO_x, SO_2 and PM. Effects of construction are likely to be confined within the site boundary, so the magnitude of health impacts on the community can be considered low. The knock effect of increased traffic activity during the construction phase may create the risk of health impacts on the local community through increased noise, vibration and pollution to air.

4.4 Integrated Waste Management

The Strategy for Integrated Waste Management employs a systems approach, looking at the overall capability of the NDA's waste management system rather than for individual projects and sites. The system comprises four stages, three of which – treatment and packaging, storage, and disposal – are discussed below.

It should be recognised that a systems approach means there may not be prescriptive options for each of the stages. In addition, the system is not a linear process, and the strategy demonstrates a circular view of waste, for example, waste may be put in interim storage then go backwards in the system cycle to be treated once a new treatment process has been developed. This can impact the credible options that are available at each stage for different waste streams.

4.4.1 Treatment, Packaging and Storage

A variety of wastes arise from the NDA estate which are considered on a case-by-case basis in accordance with BAT/Best Practicable Means (BPM) and as low as reasonably practicable (ALARP) requirements. The current baseline involves treatment, packaging and storage at currently open facilities. In practice, there is likely to be a combination of the below credible options in line with the updated Strategy which will likely be influenced by the SDR Strategy and programmes for decommissioning. This is discussed further in Cumulative Effects (Section 5).

4.4.1.1 Treatment, packaging and storage at local (on or near site) facilities

The treatment and packaging of waste at local facilities will involve the construction of new facilities that are on or near to sites where waste continues to be produced. There is the potential for these to be modular in nature, or even mobile, however, are likely to significantly impact the environment, health and socio-economics both positively and negatively around the sites chosen.

From an environmental perspective, the main risks of treatment and packaging at local (on or near site) facilities are associated with the footprint of the facilities themselves, including the extent of construction activities involved. Construction activities risk increased instances of discharges to the air and water environment of dust, emissions from vehicles, and site run off, leading to pollution of the local environment.

The treatment, packaging and storage of wastes locally would involve fewer transport movements than using regional or national facilities. This could provide environmental opportunities in terms of reduced air quality and noise and vibration impacts. In terms of the facility footprint, the construction of numerous local facilities would likely involve the greatest material requirements of the credible options. For each new facility; land, construction, operation and maintenance would be required.

The use of local treatment, packaging and storage facilities may allow socio-economic benefits such as jobs and investment to be spread amongst a number of communities, although opportunities to reuse the land or divest it for some socio-economic or environmental benefit may not be realised.

One of the main health opportunities offered by the local treatment and storage option is the avoidance of risk associated with transport movements. This includes the risk of traffic accidents and changes in air quality that can influence the risk of cardiovascular and respiratory illness amongst the local population. Treatment at or close to sites may reduce health risks by ensuring that wastes are converted to a safe and secure form more quickly.

4.4.1.2 Treatment, packaging and storage at regional facilities

Storage and treatment of waste at regional facilities would involve the construction of a number of regional hubs. These facilities would likely be located at or in close proximity to the site with the highest volume of waste in a particular area.

Compared to local facilities, an increase in transport would create the risk of impact on air quality. This could include increased generation of dust and emissions, and of air pollutants such as NO_x, SO_2 and particulate matter.

Socio-economic benefits would be reduced to the area around these regional hubs rather than spread out across local areas.

Sufficient transport infrastructure would need to be in place to ensure that the facility is equipped to receive and manage waste transported from neighbouring sites, likely improving regional transport assets.

4.4.1.3 Treatment, packaging and storage at national facilities

Treatment, packaging and storage of waste at national facilities would involve establishing individual facilities at national locations that would serve all NDA sites for specific purposes. The implementation of this credible option would be dependent on the availability of sufficient transport infrastructure.

National facilities for the treatment of waste would have the largest physical environmental footprint due to the need for the sites to be large enough to accept entire waste streams from all NDA sites across the country. As a result, landscape and visual impacts, and potentially releases of pollutants to air, water and the ground would risk being larger in scale. Risks of impacts to biodiversity, wildlife and cultural heritage features may also be greater than under the local and regional options, although this is highly dependent on the final location of such facilities.

However, having individual facilities for the treatment of waste would require the transport of waste from NDA sites across the UK to those facilities. This would increase the risks of pollution from these activities, including noise and vibration, as well as the health issues associated with increased pollution.

A degree of packaging and treatment may have to take place prior to transfer of wastes to regional or national facilities, in which case this may result in duplication of efforts and associated environmental risks relating to materials and energy.

A single national or regional facility to manage all wastes of a particular type could be seen as an opportunity in terms of advancing knowledge, skills, education and training, or as a risk if it locked-up skills and resources which could be better directed elsewhere. In such a situation, creation of a single specialised facility to manage a particular waste stream may offer socio-economic opportunities, however these would be confined to one spatial area.

4.4.2 Disposal

The current baseline is for the disposal of waste to currently open appropriate facilities e.g., very low level and low-active low level waste to licensed landfills, on site disposal at a facility on the Sellafield site for the least hazardous low level waste (LLW) (Sellafield only), and the current LLW facilities in West Cumbria at the LLWR and the NWS operated disposal facility adjacent to Dounreay in Caithness.

4.4.2.1 On-site or in situ disposal at additional sites

It is recognised that there are significant constraints associated with the disposal of radioactive waste at the LLWR such as the potential risk of coastal erosion of the site. Therefore, to get the full benefits afforded by the updated policy framework for managing radioactive substances [10], the NDA are investigating alternative capabilities for the disposal of all radioactive waste that does not require disposal in a GDF.

On-site or *in situ* disposal at additional sites may require additional land to be utilised as waste disposal sites. It is therefore likely that there will be significant impacts through its requirements for land to be utilised and in the construction of facilities in the short term. However, it could offer the opportunity to reuse land on an existing NDA site that has been decommissioned, which would reduce the risks associated with an increase in land utilisation. Both scenarios would negate any opportunities associated with the clean-up and release of NDA land in the long term.

Impacts of on-site or *in situ* disposal include the risk of changes in air and water quality and increased landscape and visual impacts. There is additional risk that noise may also be generated from vehicle movements, and the use of plant would require energy that could generate carbon emissions. The construction of a new facility to dispose of waste would also require increased use of resources and generation of carbon emissions.

Disposal of waste *in situ* may offer the opportunity to reduce traffic volumes associated with movement of waste away from site, with the benefits of reduced noise, vibration and air pollution.

Construction of a new disposal site would provide an opportunity for the generation of construction jobs in the short-term that would be a considerable boost to the local economy during this period. There would also be a long-term requirement for personnel to operate and maintain the sites. Appropriate education and training, and maintenance of knowledge and skills would be required for both short term construction jobs and the longer-term operational employment.

4.4.2.2 Disposal to Near Surface Disposal (NSD) at LLWR subject to permitting and planning

The new policy framework for managing radioactive substances [10] enables implementation of NSD of less hazardous ILW in England and Wales. The first phase of NSD has been planned at the LLWR in Cumberland though permitting and planning is still required before it can receive less hazardous ILW.

Disposal of waste to NSD at LLWR, subject to permitting and planning, would not require an increase in land to be utilised. This provides potential benefits of land on NDA sites becoming available for release. There would still be the need to construct relevant facilities at LLWR, and the same opportunities and risks discussed in 4.4.2.1 would apply to this site.

Waste disposal to NSD at LLWR would likely see an increase in the transport of waste from all 17 of the NDA sites from the UK to that facility. This increase in transport presents risks of impact to air and water quality, noise and vibration, and climate change, as well

as the health impacts associated with increased pollution in the vicinity of the transport routes.

The use of the LLWR site for the disposal of NSD potentially offers opportunities in terms of advancing knowledge, skills, education and training, as well as continued employment and local investment. In such a situation, creation of a single specialised facility to manage a particular waste stream may offer socio-economic opportunities, however these would be confined to one spatial area.

4.4.2.3 Disposal to GDF subject to ongoing consultation and investigation.

The strategy for radioactive waste disposal has devolved significantly since the previous IIA (2021) due to the implementation of the new policy framework [10]. The policy continues the implementation of geological disposal for the most hazardous radioactive waste and reaffirms the UK and Welsh Governments' position on implementing geological disposal and their commitment to working in partnership with communities that are willing to participate in the siting process. However, a GDF will be a Nationally Significant Infrastructure Project (NSIP) that will require significant environmental, health and other assessments beyond the scope of this IIA and so has not been assessed.

4.5 Critical Enablers

4.5.1 Transport

The NDA has a commitment to ensuring the effective, safe, and secure transportation of materials. Nuclear Transport Solutions (NTS) is recognised as the NDA group's expert in transporting radioactive and nuclear materials. Additionally, the NDA aims to minimise the environmental, economic, and social impacts of its transport operations.

The increased use of rail transportation is a desirable and preferred option to reduce the impacts associated with the distribution of materials such as construction products and soil from NDA sites. The NDA also intends to support the UK Government's efforts in transporting radioactive and nuclear materials by developing a new National Focal Point for nuclear transport.

Increasing the use of rail transport, and as such being less reliant on road transport, gives the opportunity to decrease the impact of transportation on the environment. Transportation by rail reduces the risk of negative impacts on air quality. This could include reduced generation of dust and emissions, and of air pollutants such as NO_x, SO_2 and PM. Additionally, transport by rail has a greater capacity per journey than road, which would further reduce impact on air quality in comparison to road transport by way of requiring fewer journeys leading to reduced emissions of greenhouse gases such as CO_2, CH_4 and NO_x. It will also use less fossil fuels than traditional road transport, assuming that traditional methods of transportation are used and not clean fuels, e.g.

hydrogen, and so an increased use of rail for transport would decrease the risk of negatively impacting climate change.

Transportation of radiologically active materials presents a risk of increasing radioactive emissions, and discharges, along transport routes. Transport by rail allows for radiological materials to be transported in a more controlled and safer environment, with decreased contact with the general public and hence present an opportunity to decrease the risk to health.

Transport by rail gives an opportunity to reduce the impact of NDA transport on health in other ways as well. The use of road transport necessitates the use of public roads in the vicinity of homes and recreation areas leading to impacts through noise and vibration. An increase in noise and vibration can affect a person's general health over time. If these are in recreation areas, then the risk of impact becomes greater. Noise and vibration can cause disturbed sleep, which can lead to other health conditions in the long-term.

Increased use of rail transport gives the opportunity to lessen air pollution in the vicinity of the alternative road travel route and reduce the risk of respiratory disease within the local community of NDA sites.

For the NDA to increasingly use rail transport there would be a need for increased investment in the rail network, in turn leading improvements in rail infrastructure. This may, however, lead to a decrease in investment in road infrastructure, in turn risking a degradation of the road network in areas local to NDA sites. The reduction in the number trips required through prioritising rail may also lead to reduced employment in the transport sector, with a small opportunity for retaining for some staff.

5. Cumulative Effects

Cumulative effects are those which arise from two or more impacts occurring simultaneously, whereby an impact that may not have a significant effect on its own may combine with another to produce a cumulative effect that is significant. There are two main types of cumulative effect relevant to the Strategy. These are:

- intra-strategy effects: effects which could result from preferred strategic options being taken forward, whereby the timing of option implementation either overlaps to change the severity of an effect (whether to increase or reduce it), or follows sequentially to prolong an effect; and
- inter-plan effects: effects of other strategies, plans or programmes acting in combination with the NDA Strategy.

5.1 Intra-strategy effects

The four driving strategic themes of the Strategy do not operate in isolation at each of the NDA's sites. Instead, all four themes interact with one another and with a fifth theme covering 'Critical Enablers'. The potential environmental, health and socio-economic effects of implementing the Strategy may therefore be altered (increased or decreased) if preferred options under different themes result in development or changes in transport and other infrastructure over similar timescales, or in overlapping geographies.

For most of the sites in the NDA estate, the two strategic themes with the highest level of interaction, and thus most probability for cumulative effects are Site Decommissioning and Remediation and Integrated Waste Management. The Spent Fuels and Nuclear Materials themes may also interact at certain sites.

5.1.1 Interaction between Site Decommissioning and Remediation and Integrated Waste Management

Successful site clean-up depends on the availability of suitable waste management routes and facilities and, as such, these two themes are inextricably linked. The credible options for the Decommissioning strategy are 'immediate dismantling' or 'deferred dismantling' (see Volume 1 for descriptions). Immediate dismantling may put a strain on existing waste management or storage facilities, as greater volumes of waste may be generated in the short-term. As such, immediate dismantling may not only accelerate the effects identified for the Integrated Waste Management options (see section 4.4), but potentially increase them, unless new facilities are built, or additional capacity is identified within the current system.

Deferred dismantling may have a similar effect but would allow more time for impacts on waste management facilities to be negated, for example to plan appropriate management routes for waste generated, as well as allowing transport movements to be

spread out over time. Minimal interventions with more preparation would further negate these impacts. However, there may be a trade-off in terms of extended duration of impacts on land use and landscape, as the sites will not be remediated as quickly.

The extent to which such effects are increased or decreased would depend on the number of sites or facilities undergoing immediate dismantling compared to deferred. In addition, the interactions identified above, and the choice of decommissioning approaches can also impact on the timing of achieving site end states, and therefore the timescales over which environmental, health and socio-economic effects occur (see section 4.1.3).

As with the Decommissioning strategy, there is a potential interaction between the Safe Stewardship and Site End States strategies and Integrated Waste Management. For example, depending on the specific conditions of the site and nature of risks involved, there is potential for options to generate waste materials requiring management under the Integrated Waste Management theme. This may require the addition or expansion of waste management facilities.

5.1.2 Spent Fuels and Nuclear Materials

Management of spent fuels and nuclear materials is an important consideration in the Site Decommissioning and Remediation strategy and has links to the Integrated Waste Management strategy. The timing for defueling of sites may affect decisions on the preferred decommissioning approach and Site End State decisions and can also influence Integrated Waste Management options. For example, storing spent fuel at Dounreay would affect the interim end state programme, and treating and packaging all spent fuels that are consolidated at Sellafield now would require significant investment into Integrated Waste Management facilities.

Spent fuel in the NDA's inventory is currently stored at Sellafield, with some spent exotic fuels also at Dounreay. Additional spent oxide fuel inventory is being transferred to the NDA via contract with EDF Energy from its seven AGR power stations in England and Scotland. The UK stocks of civil plutonium are also located at Sellafield. Uranium is still held at multiple sites, with the aim to consolidate the inventory at Capenhurst and Sellafield.

As such, these particular NDA Estate sites are influenced by potential cumulative effects and the seven non-NDA sites could be affected in terms of their future decommissioning programmes.

5.2 Inter-plan effects

The NDA's remit is focused on historical issues, as per its mission to ensure that civil public sector nuclear legacy sites are decommissioned safely, securely, cost effectively

and in ways that protect the environment. However, there remains some influence from other government policies and plans on how the NDA's Strategy is ultimately implemented. These include:

- The UK policy framework for managing radioactive substances and nuclear decommissioning [10] (issued in May 2024) replaces previous policies with respect to Integrated Waste Management, radioactive emissions and discharges and decommissioning, with particular emphasis on the United Nations Sustainable Development Goals (SDGs). This will theoretically influence selection and implementation of Site Decommissioning and Remediation, and Integrated Waste Management strategies.
- In 2021, the Department for Business, Energy & Industrial Strategy (BEIS) (now the Department for Energy Security & Net Zero [DESNZ]), the Nuclear Liability Fund (NLF) and EDF Energy agreed arrangements for the transfer of ownership of EDF Energy's seven AGR stations to the NDA [13]. This will happen after operations have ceased and the sites have been defueled. Upon transfer, the Site Licence Company (SLC) will be NRS. Hunterston B, Hinkley Point B and Dungeness B have ceased operations. Hartlepool, Heysham 1, Heysham 2 and Torness are scheduled to close on a rolling basis by the end of 2030.
- The Defence Nuclear Organisation's (DNO's) Nuclear Liabilities Management Strategy [14]: Published in 2022, this strategy sets out current and anticipated liabilities to be received by the NDA. This strategy aligns with NDA Strategy 4 [15] and reflects a collaborative approach as set out in The Civil-Defence Collaboration on Nuclear Liabilities. Liabilities that may influence implementation of the NDA Strategy include:
    - As part of the Submarine Dismantling Project (SDP), the reactor cores of disused submarines form ILW, which will be interim stored at Capenhurst [14].
    - Irradiated fuel from Vulcan Naval Reactor Test Establishment and Devonport will be consolidated, along with irradiated fuel in the First-Generation Oxide Fuel Storage Pond at Sellafield, into the Wet Inlet Facility at Sellafield.
    - Research reactor fuel may be transferred to the NDA to exploit benefits of managing similar materials owned by the NDA.
    - Nuclear materials (uranium and plutonium) may be transferred to the NDA to be managed simultaneously with the NDA's current stock.
- DESNZ is currently in the process of preparing a new National Policy Statement (NPS) for Nuclear Power Generation. The previous NPS for Nuclear Power Generation (NPS EN-6) [16] was published in 2011 and identified sites potentially suitable for the development of new nuclear power stations before the end of 2025. DESNZ have issued a 'consultation on the new approach to siting beyond 2025' [17] which recognises that the current NPS was written when the only commercially available nuclear technology was Gigawatt scale. It is anticipated

that changes in technology will look to include SMRs and Advanced Modular Reactors (AMRs) in the new NPS.

- Advanced Nuclear Technologies: the UK government recognises that the advanced nuclear sector, which encompasses a wide range of nuclear reactor technologies under development, has the potential to play an important role in the UK's industrial strategy and is funding development work in this area [18]. If advanced nuclear technologies reactors are built in the UK, they may be sited on or close to NDA sites. This was re-iterated in October 2024 by DESNZ.

For the transfer of EDF Energy's AGRs, the DNO's Nuclear Liabilities, the New Nuclear Programme and advanced nuclear technologies, issues around potential cumulative effects involve the potential for simultaneous construction or intensive decommissioning and remediation activities, which could generate demand for nuclear skills and qualified personnel, higher than expected transport requirements, or lead to timing issues and constraints on options requiring facilities within existing nuclear-licensed site boundaries. The timing of implementation (design, construction and operation) of such developments relative to implementation of the NDA Strategy is uncertain, making it difficult to accurately predict potential cumulative effects.

It is crucial that SLCs and the NDA liaise with, and are informed by, relevant parties during future options development and decision-making at the site level.

6. Conclusion

An assessment of the environmental, health and socio-economic impacts for the credible options for NDA Strategy 5 (2026) has been undertaken. Generic activities were assessed against their impact on environmental, health and socio-economic topics. The most significant impacts were then discussed in relation to the specifics of the credible options.

The assessment concluded that the most significant impacts were in relation to the increase in land utilised by NDA for mission progress and for the construction, operation and maintenance of new facilities. These generic activities will be required for development and construction of new assets for Safe Stewardship (Site Decommissioning and Remediation); all options for the consolidation and interim storage of spent fuels (Spent Fuels); new facilities for plutonium and uranium storage (Nuclear Materials); and additional facilities for the treatment, packaging and storage of waste (Integrated Waste Management).

A change in transport requirements associated with the location and number of new facilities, described above, could offset some of the significant impacts because of reduced construction, operation and maintenance activities.

The cumulative effects of strategic themes of the Strategy were assessed. It is concluded that the two strategic themes with the highest probability for cumulative effects are Site Decommissioning and Remediation and Integrated Waste Management, and that Spent Fuels and Nuclear Materials themes may also interact at certain sites.

The timing of implementation of the DNO's Nuclear Liabilities, the New Nuclear Programme and advanced nuclear technologies relative to implementation of the NDA Strategy is uncertain, consequently making it difficult to accurately predict potential cumulative effects.

7. References

[1] Department for Environment Food & Rural Affairs, "Air Pollution in the UK 2023," 2024.

[2] Environment Agency, Food Standards Agency, Natural Resources Wales, Centre for Environment Fisheries and Aquaculture Science, "RIFE 29, Radioactivity in Food and the Environment, 2023," 07 11 2024. [Online]. Available: https://www.gov.uk/government/publications/radioactivity-in-food-and-the-environment-rife-reports/rife-29-radioactivity-in-food-and-the-environment-2023#nuclear-power-stations. [Accessed 2024 12 10].

[3] Department for Energy Security and Net Zero and National Statistics, "2022 UK Greenhouse Gas Emissions, Final Figures," 2024.

[4] Health and Safety Executive, "Work-related fatal injuries in Great Britain, 2024," 2024.

[5] Office for National Statistics, "Life expectancy for local areas of Great Britain: between 2001 to 2003 and 2021 to 2023," 04 12 2024. [Online]. Available: https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandlifeexpectancies/bulletins/lifeexpectancyforlocalareasoftheuk/between2001to2003and2021to2023. [Accessed 06 02 2025].

[6] Office for National Statistics, "Data showing the age profile of industries (sic) and occupation (soc) in 2016," 25 10 2017. [Online]. Available: https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/adhocs/007651datashowingtheageprofileofindustriessicandoccupationsocin2016. [Accessed 18 12 2024].

[7] Nuclear Decommissioning Authority, "NDA Group Inclusion Strategy 2021-2025," 2021.

[8] Office of Rail and Road, "Rail safety - April 2023 to March 2024," 2024.

[9] Department for Transport, "Reported road casualties in Great Britain, provisional estimates: year ending June 2024 ," 28 11 2024. [Online]. Available: https://www.gov.uk/government/statistics/reported-road-casualties-in-great-britain-provisional-estimates-year-ending-june-2024/49158200-ee7b-402d-8842-cd6c6bbb8d84. [Accessed 11 12 2024].

[10] UK Government, "UK policy framework for managing radioactive substances and nuclear decomissioning," May 2024. [Online]. Available: https://assets.publishing.service.gov.uk/media/6632371769098ded31fca7c1/managing-radioactive-substances-and-nuclear-decommissioning-uk-policy-framework.pdf. [Accessed 8 September 2024].

[11] Nuclear Decommissioning Authority, "The NDA Value Framework," 2021.

[12] NDA, "Determining the timing and pace of decommissioning - code of practice," Gov.uk, 1 1 2023. [Online]. Available: https://www.gov.uk/government/publications/determining-the-timing-and-pace-of-decommissioning/determining-the-timing-and-pace-of-decommissioning-code-of-practice. [Accessed 3 12 2024].

[13] Department for Energy Security & Net Zero, "Advanced Gas Cooled Reactor (AGR) decommissioning: factsheet," 23 06 2021. [Online]. Available: https://www.gov.uk/government/publications/decommissioning-edf-advanced-gas-cooled-reactor-agr-stations/advanced-gas-cooled-reactor-agr-decommissioning-factsheet. [Accessed 10 01 2025].

[14] Defence Nuclear Organisation, "Nuclear Liabilities Management Strategy," 2022.

[15] Nuclear Decommissioning Authority, "Strategy 2021," 2021.

[16] Department of Energy & Climate Change, "National Policy Statement for Nuclear Power Generation (EN-6)," 2011.

[17] Department for Energy Security and Net Zero, "A National Policy Statement for new nuclear power generation: Consultation on the new approach to siting beyond 2025," 2024.

[18] Department for Energy Security and Net Zero, "Advanced Nuclear Technologies - Policy Paper," 17 10 2024. [Online]. Available: https://www.gov.uk/government/publications/advanced-nuclear-technologies/advanced-nuclear-technologies#advanced-nuclear-technology-framework. [Accessed 3 12 2024].

[19] Nuclear Decommissioning Authority, NDA group Draft Strategy. Published for consultation July 2025

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