



# Review of LLW Repository Ltd's 2011 environmental safety case: Non- technical summary

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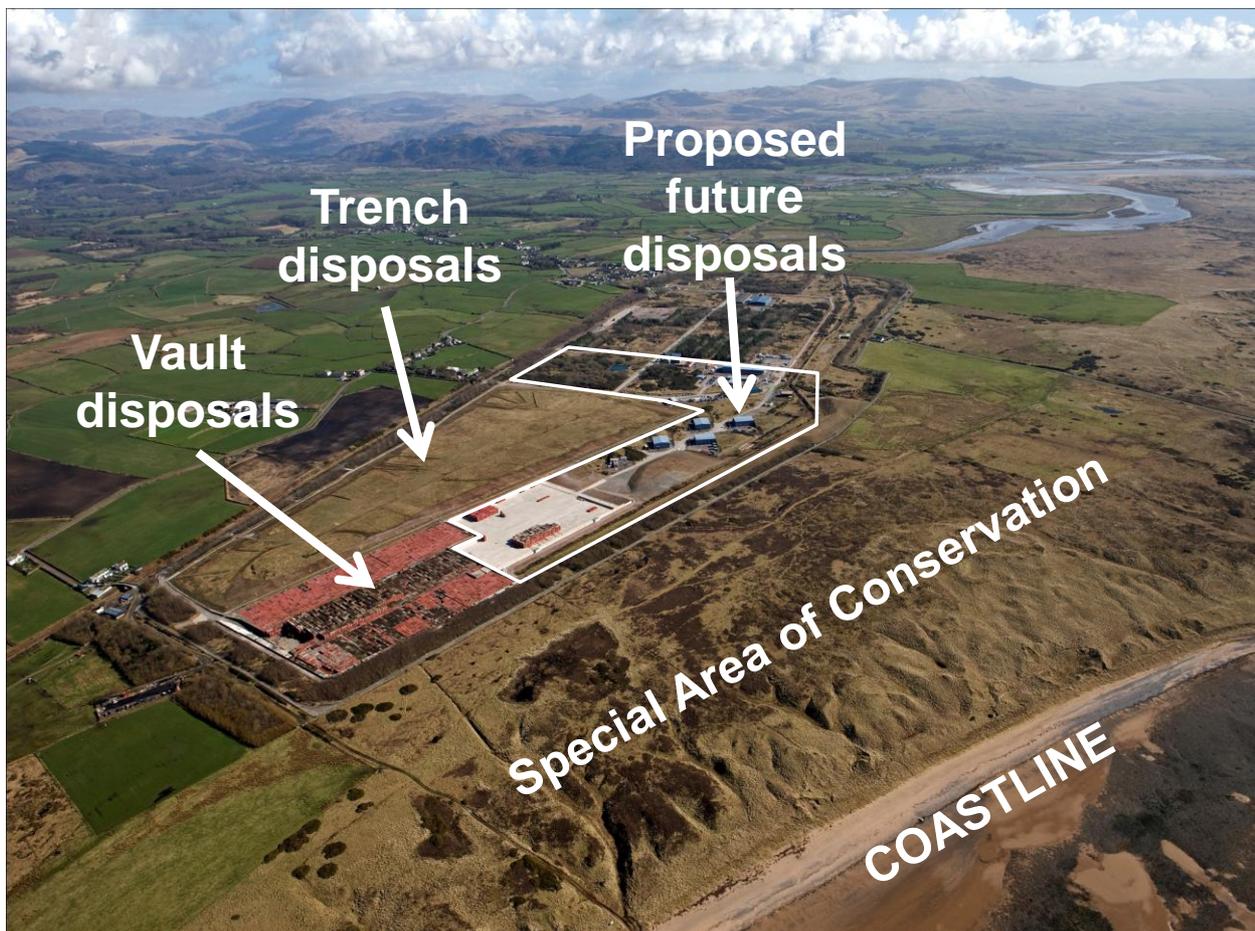
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# Introduction

The Environment Agency is responsible for regulating the disposal of radioactive waste in England under the Environmental Permitting (England and Wales) Regulations 2010 (EPR10) as amended. In accordance with government policy, from time to time we review the environmental permits we issue for disposing of radioactive waste. For a disposal site we consider a wide range of information, including the conclusions from our review of the environmental safety case (ESC) produced by the operator of the disposal facility concerned. The aim of the ESC is to demonstrate that the proposals for disposing of radioactive waste are safe for people and the environment now and into the future.

This non-technical summary provides an overview of the background to and conclusions of our review of the ESC produced by the operator of the Low Level Waste Repository near Drigg in west Cumbria (LLWR).



**Aerial view of the LLWR in March 2011 viewed from the north-west  
(*photograph courtesy of LLW Repository Ltd*)**

The LLWR in Cumbria is currently the UK's main facility for disposing of low level radioactive waste (LLW). LLW consists of contaminated materials from nuclear facilities (such as nuclear power stations) and non-nuclear facilities (for example, hospitals and universities). It typically consists of operational waste such as used protective equipment, soil, rubble, plastic and metals. LLW makes up more than 90% of the UK's radioactive waste by volume, but, because the radioactive content

of this material is low, this waste contains less than 0.1% of the total radioactivity. Around 4.4 million m<sup>3</sup> of LLW are forecast to be generated between 2010 and 2130<sup>1</sup>.

The LLWR is situated on a former Royal Ordnance Factory and has been used as a radioactive waste disposal facility since 1959. In the early days of waste disposal, solid radioactive waste was tipped and buried in shallow trenches. This practice was similar to landfill sites at that time. Between 1959 and 1995, approximately 800,000 m<sup>3</sup> of waste was disposed of in 7 trenches (Trenches 1 to 7). These trenches are now covered by an interim cap, which contains a plastic membrane to minimise the amount of water getting in.

Disposing of waste in metal containers emplaced in an engineered concrete vault (Vault 8) began in 1988. Where possible, this waste is compacted before being packed into the containers. The spaces in the full containers of waste are then filled with cement grout before being placed in the vault. Vault 8 has a total capacity of 200,000 m<sup>3</sup> of packaged waste and is virtually full (assuming the containers are not stacked higher). A further vault (Vault 9) has also been built, but is currently only used for storing waste.



**Vault 8 (photograph courtesy of LLW Repository Ltd)**

The LLWR is owned by the Nuclear Decommissioning Authority (NDA) and operated on its behalf by LLW Repository Ltd as the site licence company responsible for complying with the environmental permit.

In 2002, the former operators of the LLWR submitted ESCs for the site<sup>2& 3</sup>. We reviewed these and found them to be incomplete<sup>4</sup>. As a result, in 2006 we issued an environmental permit for the site<sup>5</sup>, but only allowed disposal of waste into Vault 8. As Vault 8 is virtually full, further waste is currently being stored at the site pending planning permission for additional disposal and an environmental permit allowing further disposal or another suitable way of managing it. As part of the environmental permit we required the operator to submit an updated ESC addressing our concerns by May 2011. We received this on 1 May 2011 (the 2011 ESC)<sup>6</sup>.

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<sup>1</sup> NDA and LLW Repository Ltd. UK Management of Solid Low Level Radioactive Waste from the Nuclear Industry: LLW Strategy Review. NLWS/LLWR/16. March 2011.

<sup>2</sup> BNFL. Drigg Post-Closure Safety Case: Overview Report, British Nuclear Fuels plc, September 2002.

<sup>3</sup> BNFL. Drigg Operational Environmental Safety Case, British Nuclear Fuels plc, September 2002.

<sup>4</sup> Environment Agency. The Environment Agency's Assessment of BNFL's 2002 Environmental Safety Cases for the Low-Level Radioactive Waste Repository at Drigg, NWAT/Drigg/05/001, Version: 1.0. 2005.

<sup>5</sup> Environmental Permit EPR/YP3293SA.

<sup>6</sup> LLW Repository Ltd. The 2011 Environmental Safety Case. Main Report. LLW Repository Ltd Report LLWR/ESC/R(11)10016. May 2011.

The 2011 ESC assesses the safety of waste disposed of in the trenches and Vault 8 in the past as well as proposals to dispose of radioactive waste into a further 12 vaults (Vaults 9 to 20). Within these 12 vaults, LLW Repository Ltd proposes to dispose of a significant proportion of the UK's LLW forecast to be generated up to 2130. To have the capacity for this within the further vaults, the company assumes that operators who generate the waste will divert it to more suitable alternative routes where possible and consistent with best available techniques, for example where the waste has very low radioactivity content and is suitable for landfill disposal. This is in line with the National Nuclear LLW Strategy published by the NDA<sup>7</sup>.

LLW Repository Ltd proposes to dispose of waste in the future in lined vaults, which would be surrounded by a low permeability vertical cut-off wall dug into the ground surrounding all the waste. On completion of disposals the company proposes that a robust engineered cap is progressively placed over the waste in the trenches and the vaults. These engineered barriers are designed to isolate the waste and prevent water seeping in or leaking out, as far as possible and prevent intrusion into the waste by people, plants or animals.

## Environmental safety case review process

The 2011 ESC included the following documents:

- Level 0 - A non-technical summary
- Level 1 - Top level main report summarising the main arguments and supporting evidence
- Level 2 - 16 topic reports with more detailed evidence to support the main arguments
- Key Level 3 - 95 underpinning reports identified by LLW Repository Ltd as being 'key'
- Hundreds of other references referred to in the above documentation but not identified as 'key'

At the time of writing you can view the Level 0, 1 and 2 documents plus the 'key' Level 3 documents at: <http://llwrsite.com/national-repository/key-activities/esc/esc-documentation/>. Alternatively, the same documents are available on our public register.

Qualified and experienced experts from our Nuclear Waste Assessment Team and Nuclear Regulation Group, with support from specialists from elsewhere in the Environment Agency (for example hydrogeologists) and external specialists (for example Public Health England), have carried out an extensive technical review of the 2011 ESC. We considered whether the 2011 ESC meets the principles and requirements set out in the latest environment agencies' guidance on requirements for authorisation (GRA) of near-surface disposal facilities for radioactive waste<sup>8</sup>. The GRA explains the requirements that we expect an operator to fulfil in applying to us for a permit to operate such a facility. It includes our radiological protection requirements and provides guidance on the content we would expect to see in an ESC. We also considered whether the 2011 ESC is based on sound science and engineering.

We followed a proportionate risk-based approach to our review, focusing on issues of importance to the outcome of the 2011 ESC. Where appropriate we carried out targeted audits. In completing our review, we have taken account of regular dialogue and regulatory interactions we have had with the operators of the LLWR since 2006. We have also taken account of independent peer review work completed on the operator's behalf.

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<sup>7</sup> Nuclear Decommissioning Authority. UK Strategy for the Management of Solid Low Level Radioactive Waste from the Nuclear Industry. August 2010.

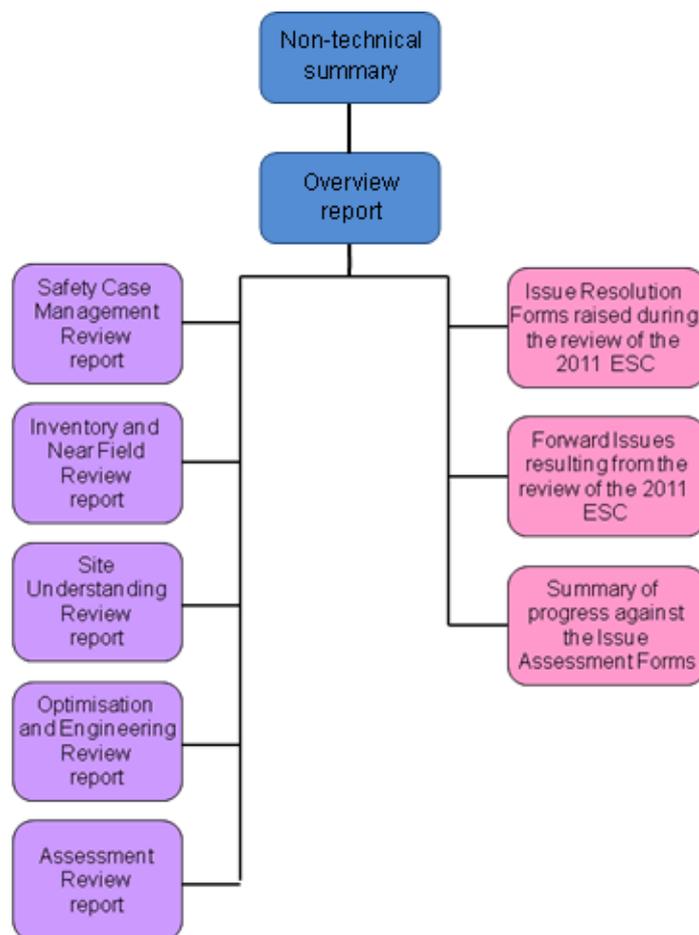
<sup>8</sup> Environment Agency, Northern Ireland Environment Agency and Scottish Environment Protection Agency. Near-Surface Disposal Facilities on Land for Solid Radioactive Wastes: Guidance on Requirements for Authorisation. February 2009.

Our review of the 2011 ESC provides technical evidence on which to base our decision on future permitting of the LLWR. We will only permit further disposals if the ESC demonstrates that this will not present an unacceptable risk to people or the environment. That is, the 2011 ESC needs to demonstrate that the short-term and long-term environmental impacts from past and proposed future disposals, taken together, will be acceptable.

During our review we identified a number of areas where we needed further information or clarification from LLW Repository Ltd to complete our assessment of the 2011 ESC. We issued these requirements for further information on 'issue resolution forms' and categorised them in terms of significance. In total we raised 72 issue resolution forms. LLW Repository Ltd provided satisfactory responses to each of these issue resolution forms. In our review of the 2011 ESC we have included this extra information, together with other information LLW Repository Ltd provided as part of its ongoing maintenance of the ESC up to October 2013. We have also taken into account how LLW Repository Ltd has progressed issues that we identified from our review of the 2002 ESCs, which we previously documented in 'issue assessment forms'.

We also identified a number of areas that we consider will benefit from further work, development or clarification in the future. We have called these 'forward issues'. These represent areas of work that we consider are important for LLW Repository Ltd to progress as part of its future scope of work, recognising the complexity of the ESC and opportunities for continuous improvement to it.

From our review of the 2011 ESC, we have produced a series of reports that will provide the technical basis for future permitting decisions. These are shown below.



**Environment Agency review of the 2011 ESC: Document structure**

The main document of our review is the overview report<sup>9</sup>. Here we consider whether LLW Repository Ltd's 2011 ESC demonstrates to our satisfaction that existing and proposed future disposals meet the GRA requirements. We also consider whether LLW Repository Ltd has satisfactorily met the requirements of its environmental permit to provide an updated ESC.

Our overview report is supported by 5 technical review reports which provide more detailed technical conclusions. These reports cover: Safety case management<sup>10</sup>; Inventory and near field<sup>11</sup>; Site understanding<sup>12</sup>; Optimisation and engineering<sup>13</sup>; and Assessment<sup>14</sup>.

Other reports collate the issue resolution forms<sup>15</sup>, our review against the issue assessment forms<sup>16</sup> and forward issues<sup>17</sup> we have raised.

## Permitting

In October 2013 we confirmed to LLW Repository Ltd that we had received enough information to complete our review of the 2011 ESC. On 28 October 2013 we received an application from them to vary (change) their environmental permit to dispose of more radioactive waste at the LLWR<sup>18</sup>. The 2011 ESC, along with further information provided between May 2011 and October 2013, provides the main supporting evidence for the application. Our review of the 2011 ESC and other information and evidence will help us decide whether or not to vary the LLWR environmental permit.

## Environmental safety case review findings

Overall, we consider that the 2011 ESC submission is of good quality and is generally clear and concise. It has improved on the 2002 ESCs and has addressed our concerns about it. LLW Repository Ltd has directly addressed the requirements of the GRA with evidence and further supporting evidence has been readily traced. The level of detail in the 2011 ESC is proportionate to the hazard associated with the LLWR.

In the 2011 ESC, LLW Repository Ltd has shown that it understands more about:

- The disposed waste and likely disposals in the future (in terms of radioactivity as well as waste form and composition).

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<sup>9</sup> Environment Agency. Review of LLW Repository Ltd's 2011 Environmental Safety Case: Overview. Issue 1. May 2015.

<sup>10</sup> Environment Agency. Review of LLW Repository Ltd's 2011 Environmental Safety Case: Safety Case Management. Issue 1. May 2015.

<sup>11</sup> Environment Agency. Review of LLW Repository Ltd's 2011 Environmental Safety Case: Inventory and Near Field. Issue 1. May 2015.

<sup>12</sup> Environment Agency. Review of LLW Repository Ltd's 2011 Environmental Safety Case: Site Understanding. Issue 1. May 2015.

<sup>13</sup> Environment Agency. Review of LLW Repository Ltd's 2011 Environmental Safety Case: Optimisation and Engineering. Issue 1. May 2015.

<sup>14</sup> Environment Agency. Review of LLW Repository Ltd's 2011 Environmental Safety Case: Assessment. Issue 1. May 2015.

<sup>15</sup> Environment Agency. Review of LLW Repository Ltd's 2011 Environmental Safety Case: Issue Resolution Forms. Issue 1. May 2015.

<sup>16</sup> Environment Agency. Review of LLW Repository Ltd's 2011 Environmental Safety Case: Summary of Progress against the Issue Assessment Forms. Issue 1. May 2015.

<sup>17</sup> Environment Agency. Review of LLW Repository Ltd's 2011 Environmental Safety Case: Forward issues. Issue 1. May 2015.

<sup>18</sup> LLW Repository Ltd. The LLWR Environmental Safety Case: Application to Vary LLWR's Permit/LLWR/ESC/R(13)10057 Issue 1. October 2013.

- How the waste and the engineering at the site is likely to behave (for example, degrade).
- The environmental context of the site and how it is likely to change over time.

LLW Repository Ltd has concluded that the site is almost certain to be eroded by the sea over time. The coast currently lies approximately 400 metres from the nearest part of the site boundary. The company projects that erosion of the LLWR is likely to start between a few hundred and a few thousand years from now. It believes the vaults and trenches will be completely eroded within 1 thousand to a few thousand years. We agree that these projections are reasonable and represent best available knowledge at this time. The 2011 ESC has taken this into account. It has shown that, irrespective of any work to prevent coastal erosion in the future, radiological doses and risks will remain below regulatory and internationally accepted criteria for protecting people and the environment.

The 2011 ESC and supporting work have addressed a number of topics that we considered important in making the case for continuing to dispose of waste at the LLWR. In particular, our review has looked at the assessment of the impact of:

- The degraded condition of some of the exposed containers in Vault 8 on the final cap design, performance and its potential for settlement.
- The effect of variability in terms of radioactivity content and concentration after waste is exposed when the site has been eroded by the sea or disturbed by people. This looked specifically at the implications of higher activity particulate material or discrete items that could become a focus of interest if exposed and which may carry a significant burden of radioactivity.
- Non-radiological characteristics of the waste (for example, the presence of hazardous substances).
- Engineering design and optimisation to demonstrate that environmental impacts are as low as reasonably achievable.

In each case, we are confident that LLW Repository Ltd has provided enough evidence to prove that it has met the requirements of the GRA.

We consider that LLW Repository Ltd has demonstrated that it has a good understanding of the potential effects on people's health and the wider environment. It has shown that impacts will remain at acceptably low levels throughout the period of authorisation, which comprises the period of disposal operations and the period of management following completion of disposals up until the end of management and regulatory control of the LLWR. Once the site has closed and it no longer needs to be managed or regulated, LLW Repository Ltd has projected that doses and risks will remain below regulatory criteria using a reasonable range of cautious assumptions about future scenarios and behaviour of humans, plants and animals. Impacts associated with the non-radioactive component of disposals, though subject to uncertainty, are not projected to cause harm to humans or the environment. Consequently, we consider that the 2011 ESC has demonstrated that an appropriate level of safety for people and the environment can be achieved for the disposal of radioactive waste at the LLWR now and in the future.

We have concluded that LLW Repository Ltd has presented a sufficiently optimised<sup>19</sup> engineering design given the current stage of development of the facility. However, we also note that there is further, more detailed design work to be done before construction. LLW Repository Ltd has started work on developing these designs and we will review its progress in this area.

To make sure that waste accepted at the facility is consistent with the 2011 ESC, LLW Repository Ltd has updated its waste acceptance criteria. These describe the types and forms of waste that it can accept for disposal at the site<sup>20</sup>. We are satisfied that these waste acceptance criteria can control disposals and achieve acceptable doses and risks to people and the environment. LLW

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<sup>19</sup> Optimisation is the principle of ensuring that radiation exposures are as low as reasonably achievable in the given circumstances.

<sup>20</sup> LLW Repository Ltd. Waste Services Contract. Waste Acceptance Criteria - Low Level Waste Disposal. WSC-WAC-LOW-Version 4.0. March 2014.

Repository Ltd has proposed an approach to managing the site's total capacity for radioactive waste over its lifetime. We consider this has been appropriately included within the waste acceptance criteria. We welcome the additional controls proposed on higher activity particulate materials and discrete items, which we believe are necessary to help control the risks of waste that is highly variable in terms of radioactivity content and concentration.

We are satisfied that LLW Repository Ltd has put in place adequate plans to implement the 2011 ESC and its updated waste acceptance criteria and associated procedures, for example related to change control, operation of waste emplacement and capacity management.

We consider that LLW Repository Ltd has demonstrated that the 2011 ESC has adequately addressed all the requirements of the GRA. We are satisfied that the company has the right resources and management systems in place to carry on operating the site in line with our requirements.

We expect LLW Repository Ltd to continue to develop its ESC as a live case with ongoing annual, periodic and major reviews and we expect them to develop and maintain a forward programme of work. We will work with LLW Repository Ltd to make sure that this work meets our regulatory expectations so that its ESC can continue to be improved. We will monitor progress against the forward issues and recommendations we have raised on important areas where we see scope for continued improvement in the ESC and its implementation. We will require further improvements to be made in line with them, such that the ESC continues to meet our expectations.

## Conclusions

Overall, we consider that:

- LLW Repository Ltd has met the requirements of the GRA and its current environmental permit through the 2011 ESC and supporting documents
- The evidence is of a suitable standard and quality to support an environmental permit decision on future disposals at the site
- We are satisfied that the 2011 ESC and supporting documents demonstrate that further disposal of radioactive waste at the facility will be safe for people and the environment both now and in the long-term

Based on the evidence provided, we will describe our proposed decision on permitting further radioactive waste disposal at the LLWR within a draft decision document, supported by a draft permit. We will consult on this draft decision before reaching a final decision on how we vary the environmental permit for the LLWR. Through the environmental permit we will continue to regulate the LLWR to make sure that it remains safe for people and the environment and that the ESC continues to support waste disposal operations.

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