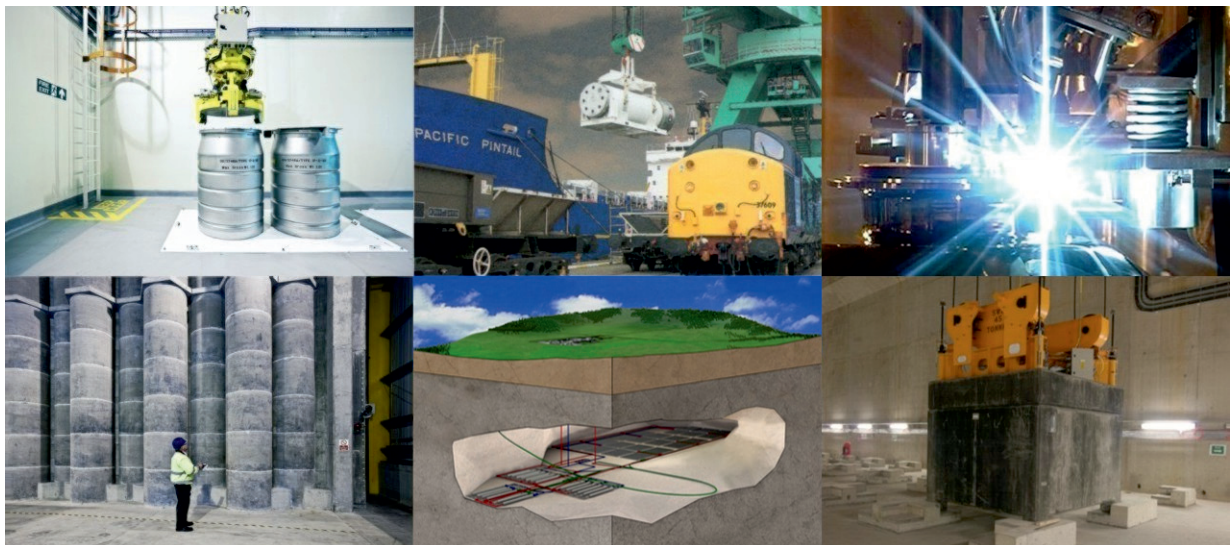


Geological Disposal

An overview of the RWM Disposability Assessment Process

April 2014



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**WASTE PACKAGE SPECIFICATION AND GUIDANCE DOCUMENTATION
WPS/650 AN OVERVIEW OF THE RWM DISPOSABILITY ASSESSMENT PROCESS**

This document forms part of the *Waste Package Specification and Guidance Documentation* (WPSGD), a suite of documents prepared and issued by Radioactive Waste Management Ltd (RWM). The WPSGD is intended to provide a 'user-level' interpretation of the RWM packaging specifications, and other aspects of geological disposal, to assist UK waste packagers in the development of plans for the packaging of higher activity waste in a manner suitable for geological disposal.

Key documents in the WPSGD are the *Waste Package Specifications* (WPS) which define the requirements for the transport and geological disposal of waste packages manufactured using standardised designs of waste container. The WPS are based on the high level requirements for all waste packages as defined by the *Generic Waste Package Specification* and are derived from the bounding requirements for waste packages containing a specific category of waste, as defined by the relevant *Generic Specification*.

The packaging specifications provide a baseline against which the suitability of plans to package higher activity waste for geological disposal can be assessed, by way of the RWM *Disposability Assessment Process*.

This document has been produced to provide an overview of the Disposability Assessment Process, the process by which plans to package waste are assessed for their compatibility with RWM's current plans for geological disposal.

The WPSGD is subject to periodic enhancement and revision. Users are therefore advised to contact RWM, or refer to www.nda.gov.uk/RWM/producers/detail.cfm, to confirm that they are in possession of the latest version of any documentation used.

WPSGD DOCUMENT NUMBER WPS/650 - VERSION HISTORY		
VERSION	DATE	COMMENTS
WPS/650/01	June 2006	Aligns with GWPS (Nirex Report N/104) as published June 2005.
WPS/650/02	March 2008	Responsibility for the WPSGD passed to the NDA RWM. Aligns with Issue 2 of GWPS (Nirex Report N/104) as published March 2007. Reflects 2007 Regulatory Guidance.
WPS/650/03	April 2014	Broadened to cover the Disposability Assessment Process as applied to all categories of higher activity waste. Aligns with 2012/13 update of packaging specifications and RWM ' <i>Disposability Assessment Aim and Principles</i> '. Extended to include: <ul style="list-style-type: none"> • Improvements to the Disposability Assessment Process, including early engagement. • The Periodic Review process. • The use of Standard Waste Package Descriptions for disposability assessments. • The assessment of new waste container designs.

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Abbreviations and acronyms used in this document

BAT	best available technique
CCAD	Criticality Compliance Assurance Documentation
DAAPs	Disposability Assessment Aim and Principles
DECC	Department of Energy and Climate Change
DSSC	Disposal System Safety Case
GDF	geological disposal facility
GWPS	Generic Waste Package Specification
HLW	high level waste
HSE	Health and Safety Executive
IAEA	International Atomic Energy Agency
ILW	intermediate level waste
LLW	low level waste
LoC	Letter of Compliance
MRWS	Managing Radioactive Waste Safely
NDA	Nuclear Decommissioning Authority
ONR	Office for Nuclear Regulation
PDSR	Package Design Safety Report
RWMC	Radioactive Waste Management Case
RWM	Radioactive Waste Management Ltd
SFM	safe fissile mass
SWPD	Standard Waste Package Description
UK RWI	UK Radioactive Waste Inventory
WAC	waste acceptance criteria
WPS	Waste Package Specification
WPSGD	Waste Package Specification and Guidance Documentation
WPrS	Waste Product Specification

1 Introduction

1.1 Background

The Nuclear Decommissioning Authority (NDA), through Radioactive Waste Management Ltd (RWM), is responsible for implementing UK Government policy for long-term management of higher activity radioactive wastes. Government policy for geological disposal of higher activity radioactive wastes, preceded by safe and secure interim storage, is set out in the *Managing Radioactive Waste Safely (MRWS) White Paper* [1].

As the implementer and future operator of a geological disposal facility (GDF), and therefore as the ultimate receiver of waste for disposal, RWM will be responsible for the production of waste acceptance criteria (WAC) for the facility. While plans for the construction of a GDF remain at an early stage, the information necessary to define WAC is not available. In the meantime, and as a precursor to the WAC, RWM produces packaging specifications so wastes can be converted into passively safe and disposable forms as soon as is reasonably practicable. These specifications define the bounding features and performance requirements for waste packages that would be compatible with the anticipated needs for transport to and disposal in a GDF, as set out in the documented disposal system concept and safety case (see the generic *Disposal System Safety Case* (DSSC) [2]). Thus, the packaging specifications provide a baseline against which the suitability of plans to package higher activity waste for geological disposal can be assessed.

The packaging specifications form a hierarchy of three levels:

- The *Generic Waste Package Specification* (GWPS) [3] defines the requirements for all waste packages destined for geological disposal;
- *Generic Specifications* apply the high-level packaging requirements defined by the GWPS to waste packages containing a broad category of waste (e.g., ‘low heat generating waste’). The Generic Specifications assist in the development of ‘new’ packaging concepts so that the high-level compatibility of the proposed waste packages with the disposal concepts can be assessed; and
- *Waste Package Specifications* (WPS) apply the general requirements defined by a Generic Specification to waste packages manufactured using standardised designs of waste container that have been shown to be compatible with RWM’s current plans for geological disposal for the packaging of a specific category of waste. Each WPS defines the features of the waste container (e.g., dimensions, lifting features) and sets down the minimum performance requirements for the waste package (e.g., external dose rate, impact accident performance)¹.

The above documents form part of the *Waste Package Specification and Guidance Documentation* (WPSGD) suite, a suite of documents primarily aimed at waste packagers, but also of interest to other stakeholders; these are published and maintained online (see www.nda.gov.uk/RWM/producers/detail.cfm). The WPSGD suite includes explanatory material and guidance that users will find helpful when applying the specifications to practical packaging projects. Further information on the extent and the role of the WPSGD is available in the *Introduction to the RWM Waste Package Specification and Guidance Documentation, WPS/100* [4].

¹ The Disposability Assessment Aim and Principles currently require production of WPS, but this position will be kept under review in light of progress with developing concepts for the range of higher activity wastes.

This document has been produced to provide an overview of the RWM *Disposability Assessment Process*, the process by which waste packaging plans are assessed against the RWM packaging specifications and the disposal system concept and safety case. The role of the Disposability Assessment Process within current regulatory arrangements, its application throughout the life-cycle of a waste packaging plant and the scope of key outputs from the process are described. The requirements for package records, technical audits and periodic review of disposability assessments are also discussed. This document is intended as a high-level guide to the Disposability Assessment Process for waste managers, regulators and others with an interest in the packaging of radioactive waste for eventual geological disposal.

The complementary document *Guidance on the Preparation of Submissions for the Disposability Assessment of Waste Packages*, WPS/908 [5], provides guidance for waste packagers on the content of and the manner by which packaging proposals should be submitted to RWM for assessment.

1.2 Key terms

The Disposability Assessment Process considers the performance and safety of waste packages during their transport to a GDF, handling and emplacement at that facility, and in the longer-term post-closure period. The assessment process also considers interim storage of waste packages prior to transport to a GDF, as far as this may influence their subsequent performance and safety. The term 'disposal' is used hereafter to denote all these periods as they are considered in a disposability assessment.

In all cases, the waste package is taken to comprise a waste container, a wasteform and any internal barriers that form part of the waste package. A 'waste container' is any vessel into which a wasteform is placed to form a waste package suitable for handling, transport, storage and disposal. The term 'wasteform' refers to the waste in the physical and chemical form in which it will be disposed of, including any conditioning media and container furniture (i.e., in-drum mixing devices, dewatering tubes etc.) and any inactive capping material.

A 'disposable' waste package is one that has been shown to be compliant with the relevant packaging specification and the underlying needs for safe transport to and emplacement in a GDF.

Throughout this document, the generic term 'waste packager' is used to describe the organisation that is progressing the development of plans to retrieve and package waste. As such, the waste packager may not be the organisation that produced the waste in the first instance or that has the ultimate responsibility or liability for the waste. In practice, a waste packager is generally the holder of the nuclear site licence for the site where the waste is held, or their contractor. However, the term could also represent organisations, such as commercial suppliers of waste containers or waste conditioning processes etc., who are making submissions for the assessment of such products or processes.

1.3 Document structure

Section 2 of this document describes the regulatory context of the Disposability Assessment Process, its aims and principles. Section 3 describes the staged nature of the Disposability Assessment Process whilst Section 4 describes how the disposability assessment at each stage of the process is conducted. The possible outcomes of a disposability assessment are identified in Section 5. Waste package records are discussed in Section 6, and compliance with future requirements and periodic review of disposability assessments are discussed in Section 7.

2 The Disposability Assessment Process

2.1 Background

The Disposability Assessment Process has a long history, with the earliest formal advice and endorsement being issued in 1986. The process was originally developed primarily as a means to assist site operators to convert intermediate level wastes (ILW) into safe and disposable forms. Nirex, the precursor to RWM, assessed proposed waste packages and indicated to waste packagers whether they were compatible with the disposal concept being developed. This 'endorsement' of waste packaging plans was signified by the issue of a 'Letter of Comfort'.

During the early 1990s, the process matured to a point that the underlying assessments undertaken by Nirex were established on a more structured footing with detailed advice (designated Advice Reports) being issued to waste packagers, highlighting further information needs or a need for further development and/or research before a Letter of Compliance (LoC) could be issued. At this time, the process was also modified to align with the implementation of a packaging plant project, with staged interactions occurring during planning, pre-construction and, finally, before active operation of the packaging plant.

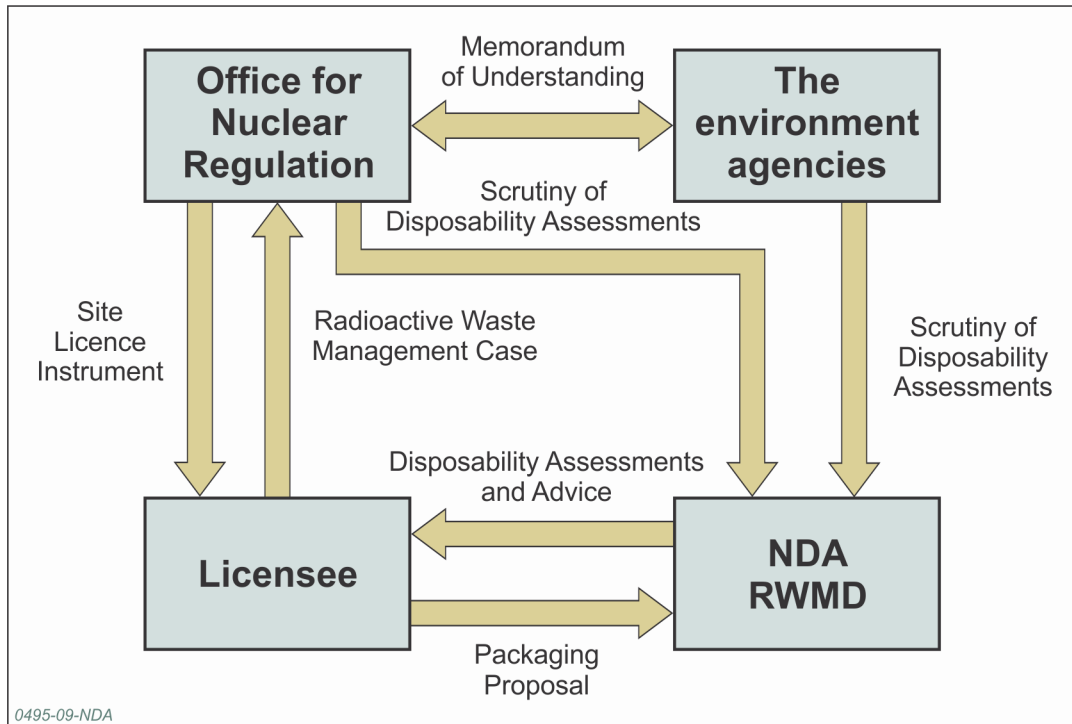
2.2 Regulatory guidance

The status of the Disposability Assessment Process was strengthened in 2003, when support was provided by UK nuclear regulators and it was recognised within regulatory arrangements for nuclear licensed sites [6]. Since this time, joint regulatory guidance has been issued in connection with various aspects of the management of higher activity radioactive waste by nuclear licensed sites. As part of the regulatory framework for long-term waste management, Part 2 of the guidance, published in February 2010 [7], expects that site licensees produce a Radioactive Waste Management Case (RWMC) to provide a transparent demonstration of adequate radioactive waste management for specified waste streams. The RWMC for a waste stream *“should indicate in transparent summary form how the key elements of long-term safety and environmental performance will be delivered for the management of the waste stream or streams covered. This should cover the period from their generation through their conditioning, storage and to their removal from site for eventual disposal”* [7] and *“should include arguments and evidence to provide confidence that proposed or ongoing waste conditioning and storage operations will result in disposable waste products”* [8, Para. 84]. The UK regulators recognise RWM as the appropriate body to advise licensees on the packaging and conditioning for geological disposal of higher activity radioactive wastes, with such advice provided through the LoC process. However, the joint guidance also states *“endorsement through the LoC process should not be confused with and does not necessarily imply regulatory endorsement, nor should it be viewed, necessarily, as a prerequisite to obtaining regulatory consent for waste conditioning”* [8].

The Disposability Assessment Process provides an additional benefit in the development of plans for the implementation of geological disposal in the UK. This arises because it permits the consideration of 'real' waste packages and their performance to be made against the safety cases for transport and the operational and post-closure periods of a GDF. The application of the process in this way helps RWM, nuclear site operators and regulators gain confidence that proposed waste packages will ultimately be compliant with requirements for transport and disposal.

The interactions between the regulators (the Office of Nuclear Regulation and the environment agencies), RWM and the licensee are illustrated in Figure 1.

Figure 1 FY[i `Uhc fm]bhYfUW]c bg "



2.3 Disposability assessment aim and principles

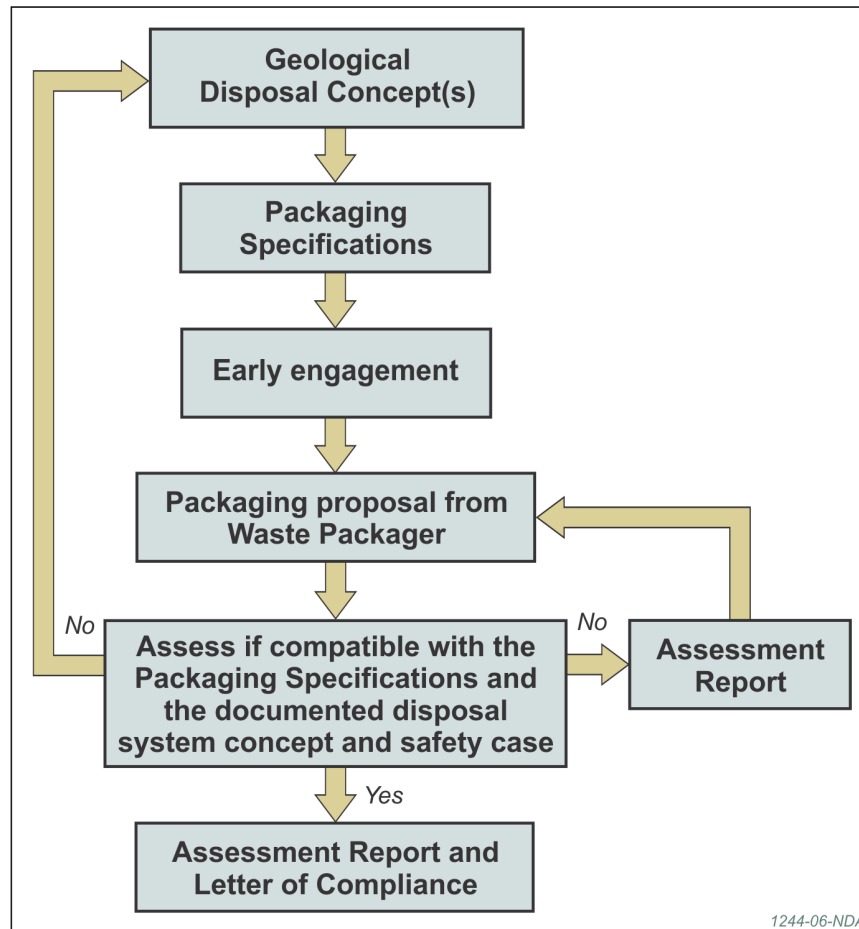
As stated in RWM's *Disposability Assessment Aim and Principles* (DAAPs) [9]:

The principal aim of the Disposability Assessment Process is to minimise the risk that the conditioning and packaging of radioactive wastes results in packages incompatible with geological disposal, as far as this is possible in advance of the availability of Waste Acceptance Criteria for a geological disposal facility. As such, it is an enabler for early hazard reduction on UK nuclear sites.

The Disposability Assessment Process is illustrated in summary form in Figure 2. This shows the main output of the process, the *Assessment Report*, which is intended to show in a transparent and visible way whether the implementation of a packaging proposal would result in the production of waste packages which would be compliant with the relevant packaging specifications and with the underlying safety, environmental and security assessments for transport and disposal. Depending on the extent of an assessment a full Assessment Report (as described in Section 5.1) may be issued, alternatively it might take the form of a more limited technical report or a letter containing advice on a specific aspect addressed by a packaging proposal.. In general a full Assessment Report will include an Assessment of Disposability (AoD), a formal statement of the reasoning that allows the disposability case for the proposed waste packages to be made. The AoD is progressively developed at each Disposability Assessment Process stage, as the packaging process matures and the packaging plant is built and operated, and is a key part of the Assessment Report expected to be used by waste packagers to support the RWMC.

The Assessment Report may also include Action Points as a formal means of identifying specific matters which will require resolution prior to the issue of an LoC, and issues or priority areas expected to be resolved at the next stage of an assessment.

Figure 2 The Disposability Assessment Process.



The production of an Assessment Report may be accompanied by the issue of an LoC if RWM are satisfied that the implementation of the packaging proposal would result in the production of waste packages that are compliant, at that assessment stage, with the relevant packaging specifications and with the geological disposal concept and its associated safety cases.

Issue of a LoC provides confidence for the waste packager and/or owner of the liability for the waste that the risk of inappropriate treatment and the potential for future repackaging, with all the potential dose and cost implications, is minimised, although it stops short of being a contractual agreement.

Disposability assessments are conducted in accordance with RWM's DAAPs [9], which define the philosophy that underpins RWM's approach to the assessment of waste package disposability. The disposability assessment Aim is as stated above and the eleven supporting Principles are listed in Appendix A.

Scottish Government Policy is that *"the long-term management of higher activity radioactive waste should be in near-surface facilities. Facilities should be located as near to the site where the waste is produced as possible"* [10, p.23]. The basis for RWM advice on and the endorsement of packaging proposals for wastes arising in Scotland is the geological disposal system, because the view (supported by regulators) is that packages conditioned in anticipation of geological disposal will also be suitable for long-term storage. In applying the Disposability Assessment Process to Scottish wastes, particular regard is given to the possibility of extended periods of storage. Transport, disposal facility operations and long-term performance assessments are carried out in the normal way. Should endorsement be withheld for reasons associated with post-closure performance,

this would be highlighted. Similarly, opportunities to facilitate near-surface storage through, for example, sorting and segregation, would also be highlighted.

2.4 Engagement and Transparency

Engagement is an important part of the Disposability Assessment Process and waste packagers are encouraged to contact RWM if more detail or explanation is required than is presented in this document.

RWM is committed to keeping stakeholders informed of progress that is being made in recovering and packaging higher activity waste. Annual Reports of interactions on waste packaging matters, in particular identifying the assessments undertaken, have been published since 2001.

The transparency of the Disposability Assessment Process has been strengthened in recent years by the publication of summary details of each Assessment Report issued. These summaries are written in an accessible form suitable for a wide readership and are available on the NDA bibliography (www.nda.gov.uk/documents/biblio/index.cfm). It should be noted that, where information supplied as an input to a disposability assessment is of a commercial or sensitive nature, this is respected within the summary information supplied.

As part of engagement with stakeholders, RWM welcomes comments on this document. Any comments received will be reviewed and the text revised, if necessary, after the document has been in use for about a year.

3 Application of the Disposability Assessment Process

3.1 Early and sustained engagement

As discussed below, a flexible and staged approach is applied in the Disposability Assessment Process whereby RWM engages with waste packagers to establish the most appropriate way forward for a particular proposal, consistent with maintaining the integrity of the overall assessment process. To this end, RWM is keen to promote early, sustained and positive engagement with waste packagers, before the preparation of a formal submission and/or assessment of a packaging proposal at any stage of the Disposability Assessment Process. This is aimed at enabling early identification of key issues to reduce the number of iterations required during the assessment process and to achieve earlier endorsement.

RWM undertakes periodic engagement at senior (director) levels with nuclear site licensees to take a regular overview of developing waste packaging plans, identifying any future submissions and to permit any necessary early engagement. This collaborative planning, or early notification activity, aims to avoid priority clashes and resourcing challenges so that the RWM interface does not appear on the critical path of the waste packager's programme.

At a project-level, RWM encourages early interaction, before formal submission of a packaging proposal, and can offer assistance to facilitate the production of concise and robust submissions. For example, following an options study phase, a preview approach can be applied, with RWM assisting in the definition of any necessary research to support the production of a robust submission. This would provide earlier closure of knowledge gaps and therefore reduce project risk.

The potential value of interactions prior to submission of a packaging proposal should not be under-estimated, particularly for 'challenging' wastes (e.g., those with high heat output or fissile material content) or where some aspect of the packaging process has not previously been assessed (e.g., a conditioning process or waste container design).

Engagement also continues during each disposability assessment and after each step in the process is concluded. For example, RWM performs early reviews of the submission documents received at the start of each disposability assessment to determine if sufficient information is available to sensibly undertake the assessment. As necessary, RWM will engage with the waste packager to seek further information or a revised submission, iterating as necessary to maximise the efficiency of the process. RWM can also comment on draft responses by the waste packager to issues raised during an assessment.

RWM encourages interaction following each assessment to ensure that the waste packager understands the findings of the assessment and the underlying reasoning. RWM may also be able to provide advice on the requirements for any future development work and how uncertainties and any identified issues in the packaging proposal could be addressed.

However, it is emphasised that this collaborative working does not remove the waste packager's responsibility for ownership of the strategy for the management of the waste or compromise RWM's independence in determining compliance with the published RWM packaging specifications and the documented disposal system concept and safety case [2].

3.2 Staged approach

RWM recognises that periodic interactions over an extended timescale of continuing development and implementation of a waste packaging process offers considerable benefits to both the waste packager and to RWM. This approach provides the opportunity to submit information proportionate to the state of development of the proposals and allows the information to be accumulated in consultation with RWM. It is also anticipated that this approach provides step-wise reduction in project risk for the waste packager, ideally aligned with their staged decision-making or sanctioning within the development of a packaging process.

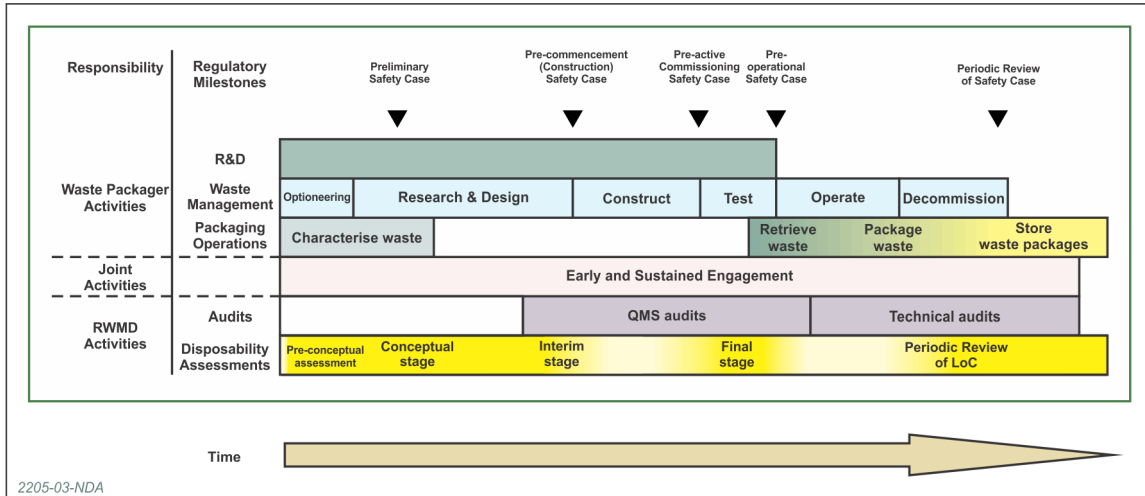
RWM has established a standardised approach for staged disposability assessments, based on an idealised packaging development project. The following stages are recognised in this approach when applied to waste packages intended for disposal:

- Pre-conceptual assessment (option development and review stage) – interaction and provision of advice (optionally as a formal Assessment Report) as packaging options, and other waste management approaches, for a particular waste stream are reviewed and eliminated by the waste owner before a packaging proposal is submitted;
- Conceptual stage (focusing on analysis of feasibility) – establish whether, in principle, and when suitably developed, the proposed waste packages are likely to be compliant with RWM requirements;
- Interim stage (seeking underpinning evidence) – determine whether the evidence allows demonstration that the as-designed waste packages are compliant with RWM requirements; and
- Final stage (confirming plant characteristics) – determine whether the evidence allows demonstration that the waste packages as they would be manufactured would be compliant with RWM requirements.

The sequence of interactions between RWM and the waste packager during the development and implementation of an idealised packaging project broadly follows that illustrated in Figure 3. It should be noted that the actual sequence of interactions will be tailored to suit the demands of the packaging proposal itself and, whilst Figure 3 shows the various assessment activities in chronological order, the timescale for their performance can vary widely to suit the development of the packaging facility. RWM's activities are also shown and these indicate the approximate points in the process when disposability assessment would be sought and the interactions that will continue up to the time of export of the waste packages to the GDF.

In practice, the route to a Final stage LoC is not the same for every packaging proposal and will depend upon a number of factors, including the extent of the understanding of the properties of the waste to be packaged and the maturity of the proposed waste container and/or waste conditioning process(es). Notwithstanding the recognition of the four stages in the standard approach, since the stages represent a step-wise progression towards endorsement at the Final stage, RWM also accepts that some or all of the stages preceding the Final stage may be omitted. Under such circumstances, the requirements of the omitted stage(s) would be considered at subsequent stages. For example, in a case where an existing packaging plant is to be used to condition a different waste stream, it may be possible to commence the assessment process at the Interim or Final stage. Furthermore, for appropriate packaging proposals, a 'fast track' route to Final stage assessment is possible using a Standard Waste Package Description (see Section 3.3). RWM will engage with waste packagers to establish the most appropriate staging for a particular proposal, consistent with maintaining the integrity of the overall assessment process.

Figure 3 Indicative interactions between RWM and the waste packager on an idealised packaging project.



The submissions at each stage in the Disposability Assessment Process should build on each other and therefore waste packagers may consider supplying revised versions of the same submission at each stage. However, assuming the standard approach has been followed with submissions at the Conceptual and Interim stages, the assessment focus at the Final stage is on evidence supporting demonstration that the manufactured packages would meet RWM requirements, data recording and management system procedures. Therefore, a waste packager may supply a more tailored submission at this stage, if desired.

Endorsement may be provided at each of the Conceptual, Interim and Final stages through the issue of a LoC. Endorsement at each stage is dependent on the availability of a suitable RWM packaging specification against which compliance may be demonstrated. The expectations for each stage of the standard approach, and the expected basis for endorsement, are summarised in the sections below.

The issue of a Final stage LoC is only one contribution to the demonstration that waste packages can be accepted into a future facility. The assembled package record (discussed in Section 6) has to be maintained, added to and updated appropriately throughout subsequent stages of the long-term management of the waste package. In addition, the LoC and Assessment of Disposability must remain current with the developing plans for geological disposal. As indicated in Figure 3, this results in two additional activities: technical audits of management systems and Periodic Review of Final stage LoCs, both of which are discussed in Section 6.

3.2.1 Pre-conceptual assessment

RWM involvement should ideally commence at the option selection stage when the waste packager is identifying management options and packaging concepts for a particular waste stream and would want to be guided by RWM's perspective on disposability issues. Examples of RWM involvement include participation in options workshops, study/project definition meetings, and stakeholder engagement meetings. Provision of Pre-conceptual disposability advice from RWM may allow for earlier de-selection or development of options.

A LoC is not issued as a result of Pre-conceptual assessment but, depending on the status of the interaction, RWM would be able to provide verbal and/or written advice on the feasibility of the packaging proposal, which could be used, for example, to inform the preparation of a formal submission for a Conceptual stage assessment of the proposal.

3.2.2 Conceptual stage

The Conceptual stage assessment allows fundamental issues to be identified before significant effort has been expended on the development of waste container designs and/or conditioning processes, or the design of a packaging plant. This stage comprises a preliminary assessment of the compatibility of the proposed waste treatment and packaging process with the anticipated long-term waste management requirements, based on the limited information available at this stage. Conceptual stage assessments are carried out against the relevant Generic Specification for the type of waste to be packaged.

The assessment is based on information describing the expected waste inventory and volume, outline packaging proposals and development plans. At this stage it is expected that the AoD would be in outline form only, but sufficiently developed to judge the overall feasibility of the packaging concept. It is expected that information required to further develop the submission ahead of the Interim stage will also be identified.

Where it is considered that the proposed process will be capable of producing packages that are anticipated to be consistent with the specifications and requirements for geological disposal, a Conceptual stage LoC will be issued.

If the waste packaging proposal is regarded as innovative, then it must be established if any necessary changes to the disposal system concept and safety case are feasible and appropriate before endorsement may be offered at the Conceptual stage. This will also identify if a new WPS must be produced to enable future Interim stage assessments. This is discussed further in Section 3.4.

3.2.3 Interim stage

The Interim stage assessment examines the evidence presented to substantiate the proposed process, including inventory data, design specifications and results from research and development. Based on the 'standard' approach discussed above, the Interim stage submission would be made by the waste packager prior to seeking financial commitment for construction of the packaging plant or facilities. Therefore, it is expected that any required research and development would be complete by the Interim stage submission.

Interim stage assessments assess whether the intended waste packages will be compliant with the specifications defined within the relevant WPS (i.e., that which applies to the waste packages that result from use of the selected standardised design of waste container) and that this is backed up by results from the operator's research and development. The packaging proposal should be well advanced with no major uncertainties. It is expected that the Interim stage assessment would feed into the Pre-commencement Safety Case for construction of the packaging facility.

3.2.4 Final stage

All the information needed to support the disposability assessment should be available for the Final stage assessment, with no outstanding RWM information requests. The submission at this stage is expected to demonstrate that the commissioned packaging plant works and is to be operated as RWM understood at the Interim stage, for example, through documentation of the management and data recording systems. Confirmation that the waste packages, as proposed to be manufactured in the as-built plant, would be compliant with the relevant WPS and the anticipated needs of disposal in a GDF, will be

signified by the issue of the Final stage LoC. The Final stage LoC should be finalised as soon as possible after commissioning of the packaging plant.

3.2.5 LoC qualifications

In some cases it will be necessary to issue LoCs with attached 'qualifications', as described below:

- *exclusion* – where specified components of the waste stream are excluded from the endorsement;
- *conditional* endorsement – where further confirmatory evidence is required regarding the proposed packaging process that may have to be obtained during operations, for example, active commissioning of a packaging plant; or
- *caveated* endorsement – where there is uncertainty as to whether an issue may arise during or after packaging, which would result in a need for further action during or after the manufacture of waste packages.

Conditional and caveated qualifications are commonly applied to Final stage LoCs. Components of a waste stream may be excluded from an assessment or endorsement at all stages of engagement. Excluded components would be the subject of further or separate assessments prior to endorsement.

3.3 Using Standard Waste Package Descriptions to obtain Final stage endorsement

As stated above, the Disposability Assessment Process is flexible and RWM will engage with waste packagers to establish the most appropriate approach for a particular proposal. If appropriate, a 'fast track' route to Final stage LoC endorsement is possible where a waste packager has opted to use a previously endorsed packaging concept for a new waste stream. This approach relies on the waste packager demonstrating that a packaging proposal would be compliant with a *Standard Waste Package Description* (SWPD), which could be defined using information produced during a previous disposability assessment that resulted in the issue of an unqualified Final stage LoC. A SWPD would be created at the request of a waste packager. Use of a standard waste container and a SWPD may be advantageous for the waste packager in that it should simplify production of the packaging submission and eliminate the need to justify an innovative proposal. The adoption of common waste packaging approaches can simplify disposal operations, providing efficiency and minimise use of finite GDF capacity.

A SWPD is a description of a disposable waste package in terms of a specific design of waste container, containing a maximum inventory of waste with specified physical, chemical and radiological properties, which has been conditioned using a defined process. All the information contained in a SWPD is derived from a published Assessment of Disposability that accompanied the issue of a Final stage LoC. The endorsement of a subsequent packaging proposal relies on the waste packager providing sufficient information to demonstrate that the resulting waste packages would be compliant with the descriptions of the waste container, waste, conditioning process and the inventory envelope defined by the SWPD. The waste packager would also need to demonstrate compliance with the data recording and management system requirements.

Guidance on the means by which LoC endorsement can be achieved using a SWPD, and the manner in which submissions should be made, is available in *Guidance on the preparation of submissions for the disposability assessment of waste packages by use of a Standard Waste Package Description*, WPS/921 [11].

3.4 Assessment of innovative proposals

RWM works with waste packagers to facilitate innovation in waste packaging where this can lead to optimum packaging solutions and deliver value for money. An innovative packaging proposal may be defined by one or more of the following criteria:

- the proposed packages are not designed to, or are not expected to, comply with an existing WPS;
- the proposed packages are not designed to, or are not expected to, comply with a Generic Specification for a defined waste type; or
- the proposed packages are expected to require the use of safety functions or arguments that are not adequately encompassed by existing safety case arguments in the generic DSSC.

A GDF represents a valuable resource with finite capacity. Furthermore, the introduction of a new packaging approach potentially represents increased complexity in the disposal system concept, the safety case and the operability of a disposal facility. The associated costs may also be affected. Where safety is not compromised, and provided that any increased use of resources and capacity, compared to existing alternative packaging approaches, is suitably balanced by benefits earlier in the waste management cycle (i.e., a 'net benefit' is achieved), RWM will modify the disposal concept following due process. Conversely, in the absence of a net benefit, RWM may not progress the necessary change to the disposal concept, preventing endorsement. Therefore, Pre-conceptual assessment is particularly valuable for innovative proposals, aiding earlier selection of options and reducing project risk and cost. RWM will provide information on the advantages and disadvantages, including the potential costs, of the proposed packaging approach in the disposal system to enable the waste packager to analyse the whole life-cycle benefit of the proposal.

When a packaging proposal is identified as innovative, the relevant RWM procedure for preliminary assessment of innovative packaging proposals is invoked. The objective of the preliminary assessment is to establish the basis for pursuing an innovative packaging proposal through the Conceptual stage assessment and to define a work programme that will deliver the necessary additional or expanded contributions to the Conceptual assessment. Satisfactory completion of the preliminary assessment, confirming any necessary changes to the disposal system concept and safety case are feasible and appropriate, is required before endorsement of the innovative proposal may be offered at the Conceptual stage.

The preliminary assessment also establishes the basis for a change management evaluation to identify the necessary changes controlled by the RWM change management procedure. Subsequent assessment and endorsement at stages after the Conceptual stage must follow the approval of the changes to the disposal system concept and safety case. For example, where an innovative proposal does not comply with an existing detailed WPS, the submission would be assessed against the Generic Specification for the relevant waste type at the Conceptual stage. The change management evaluation would identify that an appropriate WPS requires development and this must be produced before the proposal could be endorsed at the Interim stage. The proposal will no longer be regarded as innovative once the identified necessary changes to the disposal system have been implemented at the Interim stage.

3.5 Topic-specific assessments

Whilst disposability assessments are generally carried out to consider the suitability of proposals to package a specific waste in a specified container, the process can also be applied to consider particular aspects of a packaging proposal. Such topic-specific

assessments can be undertaken to determine the suitability of a new design of waste container or a new wasteform, for example. Topic-specific assessments may also be carried out to consider specific aspects of a packaging proposal, such as criticality safety, or in response to limited submissions that have been provided by waste packagers as a result of individual Action Points (see Section 5) or requests for further information made by RWM at earlier assessment stages.

A topic-specific disposability assessment would generally take the same form as that for a full packaging proposal but would be limited to consideration of the issues directly related to the assessment topic. To illustrate this option, the process for a container-only assessment is presented here.

Container-only assessments are limited to ensuring that the proposed container is compliant with the container-related requirements of the relevant packaging specification and that it is, in principle, capable of being used to manufacture disposable waste packages containing appropriate wastes. The issue of a Conceptual stage LoC to endorse a new container design signifies RWM's confidence that waste packages manufactured using the proposed waste container for appropriate wastes would be compliant with the disposal system concept.

A Conceptual stage container-only assessment comprises:

- Assessing the feasibility of incorporating the container design into the disposal system concept by determining whether the basic properties of the waste container (i.e., external dimensions, handling features, identification, durability of integrity) are adequately compliant with the requirements defined by the relevant specification. It must also be determined whether any waste packages manufactured using the proposed waste container would be expected to be capable of satisfying the remaining requirements of the relevant packaging specification, if the container was used for the packaging of waste with suitable properties (suitable waste types should be proposed by the container designer).
- If the container design is regarded as innovative (and therefore the RWM procedure for preliminary assessment of innovative packaging proposals is invoked), the basis for pursuing the proposal through the Conceptual stage assessment must be established and a work programme that will deliver the necessary additional or expanded contributions to the Conceptual assessment defined. As discussed in Section 3.4, the net benefit of the proposal must be considered, noting that a full benefit analysis cannot be performed without consideration of the waste the container will contain. This should also consider the likelihood of the use of the new container, in particular whether there are any plans to use the container to package a specific waste stream.

Issues identified in the Conceptual stage assessment can be addressed by the waste packager; RWM is happy to review these as part of an Interim stage assessment of the proposed container design. However, RWM would generally not endorse a container-only assessment by issue of an interim stage LoC, because information about the combined behaviour of the waste and the waste container (if both are necessary to meet the package performance requirements) would not be available in a limited container-only submission.

3.6 Packaging proposals with multiple waste management steps

The Health and Safety Executive's Safety Assessment Principle RW.6 states that radioactive waste should be processed into a passively safe state as soon as is reasonably practicable [12]. The rationale for deciding when the radioactive waste is processed into a passive state needs to be transparent, and should be based on an appropriate balance of

relevant factors. Radiological hazards should be reduced progressively, in line with Government policy.

The regulators have indicated that [7, Para.18], ideally, disposable packages should be produced in a single process step, so as to avoid multiple handling operations, limit the requirement for significant future interventions and minimise future burdens.

Notwithstanding this position, RWM recognises that in some circumstances there may be over-riding reasons for the adoption of a staged approach to producing disposable packages. This aligns with the regulatory acknowledgement that, for some wastes, it may not be practicable to complete the process of packaging in the short term but that initial waste processing steps, such as waste retrieval, sorting, drying etc., can provide a worthwhile degree of hazard reduction. However, the regulators [7, Para.19] expect that, where a multi-stage conditioning route is chosen, risks and environmental impacts during and between all stages are reduced so far as is reasonably practicable and are appropriately balanced. Each stage should generally give an overall improvement and any conditioning process should take account of and not compromise the envisaged downstream management/disposal arrangements.

Under such circumstances, RWM may endorse an intermediate step in the production of disposable packages, subject to the following conditions:

- there is a justifiable benefit in such an approach; and
- each step represents a progressive step towards a disposable waste package or does not jeopardise the subsequent production of disposable packages.

Such an approach would be supported by RWM if it did not jeopardise production of disposable waste packages. As such it should be part of a coordinated longer-term strategy. In such circumstances, the waste packager is encouraged to engage with RWM as early as possible.

4 Conduct of a disposability assessment

The Disposability Assessment Process is initiated at each stage when a waste packager contacts RWM with a request for assessment of a proposal for packaging particular wastes or waste streams. The assessment is conducted as a contractual deliverable under standard terms and conditions agreed between RWM and all major nuclear licensed sites.

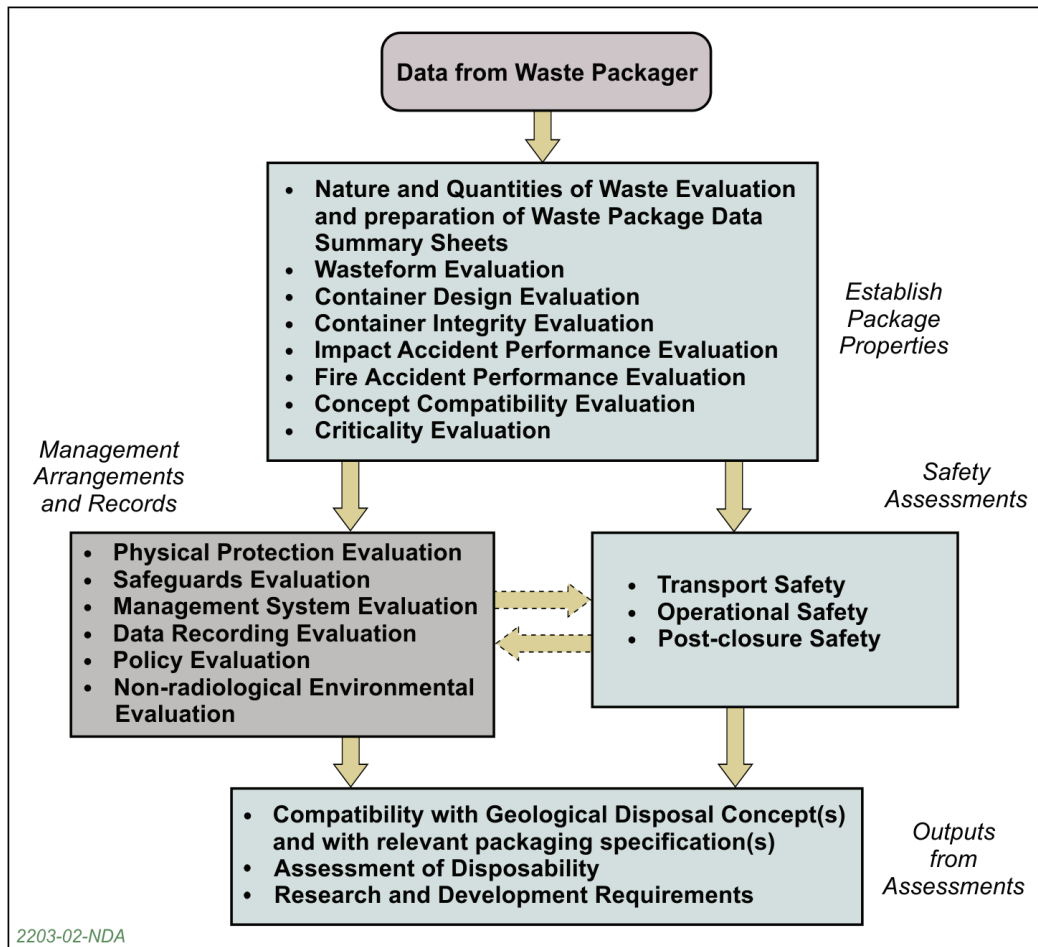
Each stage of a disposability assessment has three components:

- establishing package properties (technical evaluations that inform the safety assessments): establishing a good understanding of the properties of the waste and the proposed waste packages;
- management arrangements and records (technical evaluations that do not inform the safety assessments): assessing the adequacy of the proposed arrangements for quality management, data recording and the management of nuclear materials; and
- safety assessments: comparing the performance of the packaged waste against the safety case assessments for transport and the operational and post-closure periods of a GDF.

An objective of each disposability assessment is to clearly identify any shortfalls in the demonstration of compliance and, where appropriate, give guidance on possible solutions. Such solutions may include changes to aspects of the packaging proposals or improvements in the supporting evidence.

The activities required under each of the three components are identified in Figure 4 and are discussed below. The identified activities are undertaken at appropriate stages in the process and need not be repeated at subsequent stages if the previous disposability assessment met all the relevant requirements, all issues were resolved and there have been no changes in the packaging proposal.

Figure 4 Evaluations and assessments that may be performed in a disposability assessment.



4.1 Establishing package properties (technical evaluations that inform the safety assessments)

RWM undertakes a series of technical evaluations to understand the properties and performance of the proposed waste packages in sufficient detail to assess compliance with the relevant packaging specification and to compare with RWM's existing transport and disposal safety case assessments.

Table 1 summarises the main objectives of each of the technical evaluations performed during a disposability assessment that are input to the safety assessments; RWM seeks to achieve these objectives based on the range of information supplied by the waste packager. It should be noted that not all of the technical evaluations identified in Figure 4 are carried out at every stage of the process and that the depth of each evaluation will vary depending on the disposability assessment stage at which it is carried out.

Table 1 The package property technical evaluations and their objectives.

Evaluation	Evaluation objective <i>This includes conducting a critical analysis of the quality of the information available and assessing whether the expected waste package properties and performance are consistent with the requirements defined by the relevant waste package specification</i>
Nature and quantities of waste evaluation and preparation of waste package data summary sheets	Provide, or confirm, a description of the origins, composition and quantity of the waste proposed to be packaged, and a critical analysis of the quality of the information available.
Wasteform properties	Provide, or confirm, a description of the range of composition and anticipated properties of the proposed wasteforms, including the potential effects of wasteform evolution and behaviour under storage and disposal conditions.
Container design	Provide, or confirm, a description of the proposed waste container design and material specifications.
Container integrity	Provide, or confirm, a description of the proposed waste container and likely internal environment together with anticipated corrosion-related properties of the waste container, including the potential effects of wasteform evolution during extended storage.
Impact accident performance	Provide, or confirm, a description of the proposed waste package design and properties together with anticipated impact accident performance, including the potential effects of waste package evolution and ageing.
Fire accident performance	Provide, or confirm, a description of the proposed waste package design and properties together with anticipated fire accident performance, including the potential effects of waste package evolution and ageing.
Concept compatibility	Confirm that the proposed waste packages (and any proposed transport system) are consistent with the relevant WPS, and the Generic Disposal System Designs developed from the Generic Disposal System Technical Specification, or otherwise highlight potential inconsistencies.
Criticality safety	Assess whether deployment of the proposed waste packaging process is likely to result in production of waste packages that are compliant with a justified Safe Fissile Mass (SFM), where the method of control of package fissile content is defined and justified in Criticality Compliance Assurance Documentation (CCAD).

4.2 Management arrangements and records (technical evaluations that do not inform the safety assessments)

The packaging proposal, particularly at the Final stage, is also reviewed from the perspective of management system and data recording requirements. As these evaluations do not directly inform the safety assessments that need to be undertaken in a disposability assessment, they are often undertaken in parallel to the safety assessments. The requirements for these technical evaluations are summarised in Table 2.

Each disposability assessment also includes a check to ensure records are available that demonstrate that the waste packager has undertaken a non-radiological environmental assessment of the packaging proposal to check that there are no aspects that are inconsistent with wider environmental protection considerations. Such aspects of a packaging proposal are often considered as part of the option selection process during the Pre-conceptual assessment. Therefore, this requirement may be satisfied by submission of the waste packager's best available technique (BAT) exercise report(s). The evaluation is also often performed at the Conceptual stage. The objective of the non-radiological environmental evaluation is summarised in Table 2.

Table 2 The management arrangements and records technical evaluations and their objectives.

Evaluation	Evaluation objective
Management system	Review whether the waste packager has established, implemented and maintained a suitable management system to ensure arrangements are in place covering all safety and quality related aspects throughout the lifetime of the waste package, as defined in the Generic Waste Package Specification and in <i>WPS/200 Waste Package Quality Management Specification</i> [13].
Data recording	Establish whether the waste packager has designed a suitable system for waste package data acquisition, recording and retention in support of all future stages of the long-term management of the waste packages, as defined in the Generic Waste Package Specification and in <i>WPS/400 Package Data and Information Recording Specification</i> [14] (this is further discussed in Section 6).
Physical protection	Review the status of the waste packages from the perspective of physical security to ensure the package will be compliant with regulatory requirements and with the security plan developed for transport to and disposal in a GDF.
Safeguards	Establish that arrangements are in place to ensure effective nuclear materials accountancy (NMA) during the retrieval and packaging of waste containing nuclear material and that such information is suitable for transmission to a future GDF operator. Confirm that the obligations of the waste packager with regard to international safeguards will be maintained and that the plans are consistent with the safeguards arrangements currently envisaged for a GDF.
Policy	Review the packaging proposal from the perspective of RWM's DAAPs (see Appendix A and [9]).
Non-radiological environmental protection	Confirm that there are no aspects of the packaging proposal that are inconsistent with wider environmental protection considerations.

4.3 Safety assessments

The technical evaluations that establish package properties are reviewed by RWM to confirm the robustness of the packaging proposal and the suitability of the understanding for input to the safety assessments. As discussed in Section 4.3.1, this involves comparison of the waste packages and their expected performance against the safety case assessments of transport and the operational and post-closure periods of a GDF (described in the three safety cases produced as part of the DSSC [15, 16, 17]). The DSSC also considered implementation of a GDF in a range of geologies, the implications of which are discussed in Section 4.3.2.

4.3.1 DSSC safety case assessments

Each of the DSSC safety case assessments has been undertaken for a defined inventory based on RWM's understanding of the total quantity of waste that will ultimately require disposal in a GDF. The safety case assessments are based on various assumptions regarding the form of packaging that will be applied to each waste stream, together with estimates of the radionuclide inventory and waste package performance characteristics, using data and assumptions in the *UK Radioactive Waste Inventory* (UK RWI) [18] and the generic *Disposal System Technical Specification* [19].

An output of the package property technical evaluations is a full definition of the waste packages that would result from the implementation of a proposal to package a particular waste stream. This comprises waste package numbers, the radionuclide inventories to be used as the basis for the assessments and a range of qualified performance characteristics (e.g., impact and fire accident release fractions, external dose rate, gas generation rates etc.). RWM uses the information obtained during the technical evaluations to undertake new safety assessments, using assessment toolkits, to compare with the baseline DSSC assessments (the objectives of each of the three assessments undertaken in the Disposability Assessment Process are summarised in Table 3).

A secondary benefit of undertaking these assessments is the chance to identify opportunities to optimise the proposed waste package for disposal in a GDF, in order to avoid or minimise unnecessary constraints on the future GDF safety assessment. These safety assessments also offer RWM the opportunity to determine whether 'real' package data would change the outcomes of any of the generic safety case assessments or raise significant issues that were not visible at the generic assessment level. RWM intends to progressively replace the originally assumed generic information on the numbers of waste packages and their performance in the DSSC with actual information produced through the Disposability Assessment Process.

4.3.2 Consideration of alternative geologies

The implications for safety of the implementation and long-term performance of a GDF in a range of different geological environments have been considered in the DSSC, leading RWM to conclude that a safe GDF can be designed to suit a wide variety of environments. The Disposability Assessment Process uses this consideration of different geologies during the comparison of proposed waste packages with the generic operational and post-closure safety case assessments².

Apart from the notable exception of the potential use of a shaft for transferring waste packages underground in the evaporite geological environment, RWM believes that, of the

² The transport safety case considers the implications for transport safety of locating a GDF in *any geographical location* in England and Wales. The impact of different geological environments for the transport safety case is reflected through any difference in disposal container.

three geological environments considered in the DSSC³, a GDF constructed in higher strength rock is bounding in terms of the potential consequences of impact and fire faults [16]. This is due to the larger dimensions of the vault which leads to increased stack heights and associated drop heights. The frequency of dropped loads and impact events could conceivably be argued to be greater for those concepts employing stacker trucks rather than cranes for emplacement, but this cannot be established definitively at this generic stage.

With regard to external radiation faults, the illustrative disposal concepts potentially give rise to different exposure geometries (due to differences in underground facility dimensions) and hence different worker doses. The consequences of such faults will be very dependent on the actual characteristics of the selected site, including the host rock. The use of additional shield doors at the entrances to the disposal vaults and tunnels for a GDF constructed in lower strength sedimentary rock or evaporites will increase the potential for external exposure faults due to failure of access controls, although these will not necessarily lead to greater consequences. In any case, the operational safety assessment indicates that these faults tend to be relatively insignificant in terms of consequences and risks compared to fire and impact faults.

The differences are more subtle in the case of post-closure safety, but the most notable relate to groundwater flow characteristics; RWM argues that basing decisions under the Disposability Assessment Process using a GDF constructed in higher strength rock is likely to be conservative [17].

A qualitative consideration of any differences that arise in other geologies is undertaken for each packaging proposal. RWM's understanding of the performance of a GDF constructed in a higher strength host rock is more developed than that for other geological environments. However, it is believed that RWM's understanding is sufficiently developed for qualitative assessments of the consequences of alternative geologies to be carried out.

Table 3 The safety assessments and their objectives.

Safety assessment	Safety assessment objective
Transport safety assessment	Assess whether the expected radionuclide content and surface contamination of the proposed waste packages are consistent with the requirements defined by the relevant WPS. Determine whether the proposed transport package meets the requirements of the IAEA Transport Regulations. Assess the impacts of the proposed transport package on the doses to operators.
Operational safety assessment	Determine whether a proposed waste package meets the criteria which will ensure safe operations at the GDF. Assess whether the expected fissile material content, toxic/hazardous materials and heat output of the proposed waste packages are consistent with the requirements defined by the relevant WPS.
Post-closure safety assessment	Evaluate the waste packaging proposal for post-closure safety in order to determine compliance with the generic DSSC Post-closure Safety Assessment.

³ The three illustrative geological environments considered in the DSSC are higher strength rock, lower strength sedimentary rock and evaporites.

5 Possible outcomes of the Disposability Assessment Process

The primary output at the end of each stage of the assessment process is an Assessment Report. The Assessment Report can be a short technical report or a letter providing advice on a particular issue, but a full assessment would typically result in a detailed major report that draws together the results of the technical evaluations and concept assessments undertaken at that stage. The general structure of the Assessment Report is explained in Section 5.1.

At the request of the waste packager, RWM can also produce interim updates on the findings so far during a disposability assessment, for example, to support discussions with regulators before the full disposability assessment is completed.

A LoC can be issued when the proposed waste packages are assessed to be compliant with the published suite of RWM Packaging Specifications and with the documented disposal system concept and safety case [2]. The structure of a LoC is discussed in Section 5.2.

However, a disposability assessment may not result in the issue of a LoC and may mean that the waste packages do not comply with one or more of the following:

- the relevant specification for the selected waste package type;
- the geological disposal concept, as currently defined; and/or
- one or more of the three safety assessments produced for the transport and disposal of waste packages.

Figure 2 illustrates the two routes available in the event that an assessment cannot be immediately accompanied by a LoC:

- changing some aspect of the packaging proposal or the submitted information such that previous areas of non-compliance are removed (e.g., by reducing the proposed radionuclide inventory, by adopting alternative conditioning processes, or by providing further information); or
- changing some aspect of the disposal concept or packaging requirements with which compliance could not be shown to accommodate the proposed waste packages, if this could be carried out without any risk to overall safety.

The RWM change management procedure must be applied for changes involving the second option. The purpose of this procedure is to ensure that proposed changes to the geological disposal concept are recorded, assessed and implemented at an appropriate time and in a consistent way. This includes assessing the effects of any change on the disposal safety cases and ensuring that changes are recorded in the relevant documentation, such as the disposal system designs and the packaging specifications. Subsequent endorsement of the packaging submission cannot take place until approval of the necessary change to the disposal system concept and safety case has been obtained through the procedure.

5.1 The Assessment Report

The Assessment Report, the general structure of which is shown in Box 1, summarises and draws together the evaluations and safety assessments undertaken during the disposability assessment. The Assessment Report is intended to show in a transparent and visible way whether the packaging proposal is compliant with the relevant packaging specifications and with the underlying safety, environmental and security assessments for transport and

disposal. The AoD, contained in full Assessment Reports, is the formal statement of the reasoning that allows the disposability case to be made.

At the Conceptual stage it is expected that the AoD will be in outline form only, but sufficiently developed to judge the overall feasibility of the packaging concept. As the packaging concept and plant is developed through Interim and Final stages, it is expected that the AoD will become progressively developed such that at the Final stage it is robustly supported by all the necessary research and design. In line with regulatory guidance [7], it is envisaged that the AoD presented at the conclusion of the Final stage assessment will be adopted by the waste packager and incorporated into the RWMC as part of the overall safety case for the packaging plant.

At the Conceptual and Interim stages, the Assessment Report will include the outcomes of the technical evaluation of the proposed waste packages. This will highlight areas where further development or information is required and any actions necessary to take the disposability assessment to the next stage. Any issues flagged as requiring resolution or where further information, research or development is needed, are denoted as Action Points. Any compliance gaps preventing endorsement of the packaging proposal at that stage of the assessment are also raised as Action Points. All Action Points are given a unique identifier for tracking purposes and state at which stage the issue should be closed out.

As part of sustained engagement, an Assessment Report is accompanied by the offer of a meeting between RWM and the waste packager. The intention of such engagement is to ensure that the conclusions of the Assessment Report, any identified Action Points and the underlying reasoning are fully understood by the waste packager, and to provide advice on the requirements for any future development work and the manner in which each Action Point could be closed out.

Box 1 Current typical structure of a full Assessment Report

Executive Summary
1 Introduction
2 Background to Disposability Assessment
3 Description of Proposal
4 Parameters Used as Basis for Assessment
5 Assessment of Disposability
6 Review of Technical Issues and Action Points
7 Conclusions
8 References
Appendices and Annexes

5.2 The Letter of Compliance

The issue of a LoC, the general form of which is described in Box 2, signifies that the proposed waste packages have been assessed and judged to be compliant with RWM specifications and the requirements for geological disposal, as defined by the current generic designs and safety and environmental assessments. Depending on the stage of the assessment, issue of a LoC indicates:

- Conceptual stage: That the proposed waste package would in principle be compliant with the generic geological disposal concept(s) and with the relevant Generic Specification.
- Interim stage: That evidence has shown that the as-designed waste package would be compliant with the generic geological disposal concept(s) and with the relevant WPS.
- Final stage: That evidence has shown that the as-manufactured waste package would be compliant with the generic geological disposal concept(s) and with the relevant WPS.

Where limited but significant issues remain upon completion of a Final stage assessment, it may be appropriate to issue a qualified endorsement rather than to seek continued engagement around relevant Action Points. The possible conditions, caveats and exclusions are discussed in Section 3.2.5 and are stated in Box 2.

Issue of a LoC gives the waste packager confidence that the waste packaging submission has been assessed and has been found to be compliant with the concept for geological disposal as presently understood. However, it is emphasised that whilst the LoC does signify that the proposed waste packages are compliant with 'the requirements currently foreseen as being necessary for waste storage, transport, handling and disposal' (i.e. are 'disposable'), it does not signify that they would definitely satisfy the eventual GDF WAC. Further, the costs associated with any future reworking that may be necessary to render the waste packages compliant with future WAC would be the responsibility of the waste packager.

Box 2 Current general structure of a Letter of Compliance

A Letter of Compliance is a letter issued to endorse defined wastes packaged in a defined manner.

All LoCs follow a standardised structure in which:

- the waste packaging process and/or plant is specified;
- the specific wastes are defined and any exclusions noted;
- the documentation submitted by the waste packager that forms the basis of the assessment is specified;
- a statement is made that the proposed waste packages have been assessed and judged to be compliant with the relevant RWM requirements;
- a warning is given that the LoC does not signify compliance with the eventual WAC for a GDF; and
- any qualifications attached to the LoC are stated:
 - conditions that can only be closed out with operational experience;
 - caveats where there is an issue that may manifest itself dependent upon circumstances and, hence, remedial action may be required; and
 - exclusions where certain wastes are explicitly excluded from the endorsement.

6 Waste package records

Waste package information is required to support all future stages in the long-term management of the waste. Therefore, RWM requires that waste packagers establish a data recording system for acquiring, recording and subsequently managing information for each waste package such that it can be used to establish, infer or predict package properties and performance under all relevant circumstances. Ultimately, this information may be used to demonstrate conformance with future requirements for transport and GDF WAC, as discussed in Section 7.

Waste packages require an associated waste package record that should:

- describe the physical, chemical and radionuclide content of the waste package;
- identify and define the properties and performance of the waste package that are relevant to its ongoing management;
- provide a comprehensive radionuclide inventory; and
- provide sufficient data to predict the evolution of the waste package with time, and of the effect of interactions with other packages and the various GDF components.

The data recording system needs to cover the entire lifetime of the packaged waste, from the time of waste arising, through initial waste characterisation, process conception and development, to waste package production, storage, transport and emplacement in a GDF.

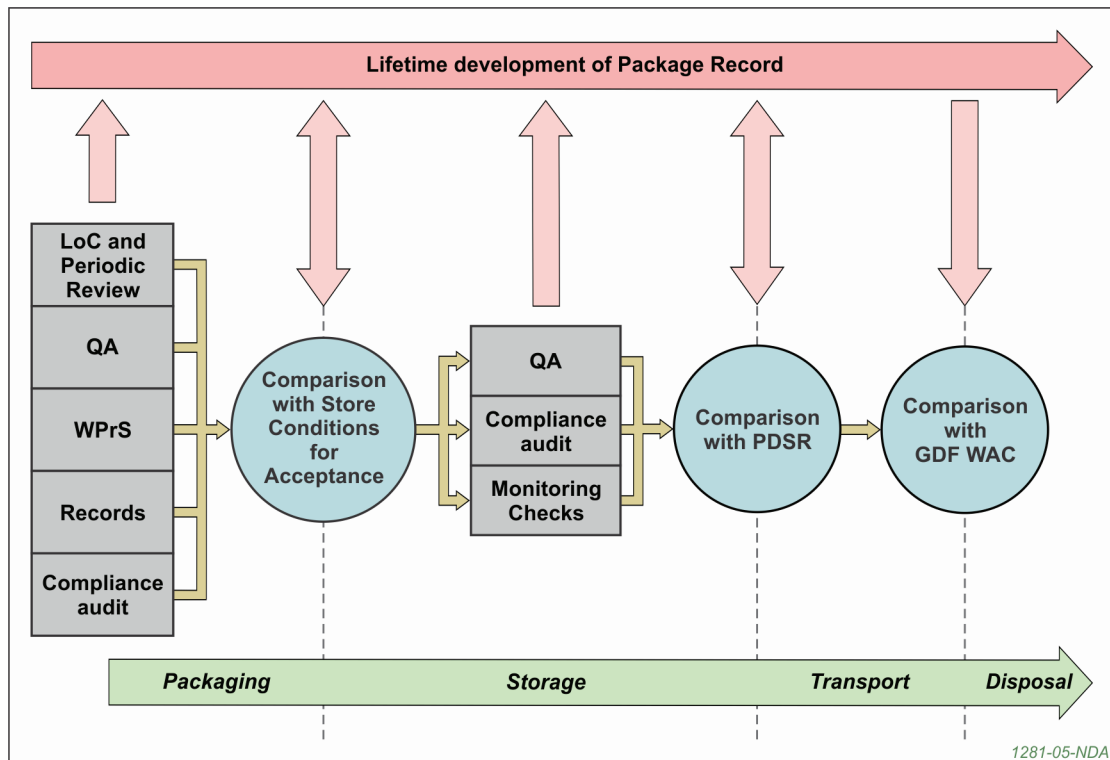
The LoC, information and records generated are all part of the package record, which will follow each waste package through the subsequent stages of its onward long-term management. The waste packager's submission for disposability assessment can itself be used as a valuable source of traceable data for waste packages. In particular, the Waste Product Specification (WPrS), which is produced by the waste packager to support the submission, is a key element of the package record. The WPrS is a document that describes the waste package that is to be manufactured by the proposed processes, by defining the key limits and controls that will apply during manufacture. An important part of a WPrS is the Criticality Compliance Assurance Documentation (CCAD), which describes the procedures that will be followed to control the quantities of fissile materials in the waste packages. Guidance is available on the preferred form and required content of a WPrS [20] and on the production of CCAD [21].

Furthermore, the AoD documentation compiled by RWM may form a key part of the waste package record (e.g., as a means of recording arguments and analogies, referencing research and defining methods).

Once a package has been manufactured to the agreed specification decades may elapse until its ultimate disposal. Consequently, package evolution may be significant. To demonstrate that the waste package would continue to meet the requirements for handling, transport, storage and potential disposal, the package record should also include a chronological history of the package, including storage duration, environmental conditions, results of periodic inspections and any significant events to which the waste package has been exposed (e.g., minor impacts or excursions in storage environment conditions).

These elements of the package record play an essential role as the waste package passes from one management stage to the next. The contributions to and role of the package record are summarised in Figure 5.

Figure 5 Contents, role and development of the package record.



The waste packager is responsible for the development of a data recording system that establishes an information capture strategy to create the data record for each package. However, the range of information that would need to be recorded for each distinct waste package will be unique and the development of a tailored system may be required for each waste type and packaging campaign.

The *Waste Package Data and Information Recording Specification* [14] and the associated guidance document [22] provide further information on the data recording requirements. RWM can advise on, and where appropriate, will formally endorse the adequacy of the proposed data recording system through the Disposability Assessment Process. Where beneficial, the waste packager and RWM can also hold informal discussions to aid the development of the data recording system. RWM can help optimise the proposed data recording system by providing advice on aspects such as key data requirements, the accuracy required for quantitative data and identification of those data that need to be derived on a package-specific basis.

7 Compliance with future requirements

7.1 Technical audits

RWM requires waste packagers undertake all activities that may affect the product quality of packaged waste under an appropriate management system, including waste characterisation, design, development, commissioning and operation of waste packaging plants and stores. The aim of this requirement is to ensure that:

- packaged waste has the properties ascribed to it;
- the waste complies with the agreed specifications and packaging is taking place in accordance with the terms of the LoC endorsement and with the various control documents (notably the waste packager's WPrS, endorsed through the LoC); and
- adequate records are maintained.

Waste packagers are required to provide assurances and objective evidence to demonstrate compliance with these requirements.

Therefore, in addition to evaluating the management and package record systems during a disposability assessment (see Section 4), RWM also undertakes on-site technical audits of waste packagers' management systems and package records. The focus of these audits is to assess compliance with RWM's requirements as the eventual custodian of the waste packages, with the emphasis on the technical aspects of waste packaging and record keeping. The objectives of these audits are:

- to obtain verification that waste packagers have appropriate management systems in place to control activities which could directly or indirectly impact the quality of the packaged waste;
- to establish that waste packages have been manufactured according to the previously agreed and endorsed WPrS, and hence within the requirements of the LoC;
- to focus on aspects considered of particular significance to RWM, such as conditions applied to LoCs; and
- to support the waste packager in meeting RWM's requirements.

The Office for Nuclear Regulation and the environment agencies possess legal powers for ensuring technical compliance. RWM's role, as ultimate custodian of the waste, is to establish that packages are being manufactured consistently with the agreed specification and under a quality controlled regime. The importance of this role has been recognised by the regulators through ongoing interactions with RWM; it was agreed in August 2010 that the role of RWM should include an element of compliance checking against the endorsed Waste Product Specifications owned by the waste packagers. The role of RWM in supporting the regulators is formally identified in the Joint Regulatory Guidance [23, Para. 35]:

“Although the prime responsibility for safety and environmental protection lies with the licensee, and the responsibility for regulation lies with the regulators, other bodies should be involved in radioactive waste management. The following bodies should be involved in the collaborative working process, where appropriate: ... the operators of radioactive waste disposal facilities, who define the acceptance criteria for waste. These include both the operators of current low-level waste facilities and NDA (RWM) as the current representative of the intermediate/high-level waste disposal facility operator.”

As the ultimate recipient of waste packages, RWM needs to be assured of the quality of manufactured waste packages, since this dictates the disposability of those packages in a GDF. The technical audits are designed to examine whether the management system meets the requirements of the *Waste Package Quality Management Specification*, [13] and accompanying guidance [24], and that waste packages are being produced in compliance with the agreed WPrS.

RWM aims to undertake routine technical audits of operating packaging plants annually. Technical audits of stores and store operations are also undertaken regularly, although on a less frequent basis. Audits of development facilities are undertaken as appropriate. However, the audit schedule may also be varied to meet suitable opportunities in the assessment and waste packaging process, such as:

- pre-operational 'readiness' audits, potentially linked to Final stage assessments;
- early operational audits, soon after operations commence, to ensure good practices are in place for continuing operations (e.g., records management processes); and
- auditing in advance of Periodic Review (discussed in Section 7.4).

7.2 Compliance with transport requirements

When a GDF has been constructed and licensed to receive waste, a programme for the emptying of interim stores will commence. Up to this point, the ability of waste packages to be compliant with the needs of transport will have been addressed by the criteria defined within the relevant generic specification. However, the waste packages will need to be shown to comply with the requirements for transport applicable at that time.

The transport of waste packages through the public domain must demonstrate compliance with relevant UK legislation for road, rail or sea transport of radioactive materials, such as the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (UK legislation has the effect of enacting the IAEA Transport Regulations [25]). Demonstration that a transport package (which may comprise a waste package or one or more waste packages transported within a transport container) is compliant with these regulations is the responsibility of the package consignor and requires:

- confirmation that appropriate management systems have been applied during manufacture and storage;
- records to demonstrate that the waste inventory is compliant with the transport 'contents specification' (a contents specification uses the various transport package limits defined by the IAEA Transport Regulations to derive numerical limits on the waste package radionuclide inventory for the full range of radionuclides that could be present);
- confirmation that the waste package performance is compatible with the Package Design Safety Report (PDSR); and
- confirmation that the overall transport package is compliant with the PDSR.

These aspects are all considered in a disposability assessment, which gives confidence that a package that is covered by a Final stage LoC and accompanied by a full package record will meet transport safety requirements.

The package record will supply bounding values for quantities such as the radionuclide inventory of waste packages containing material from a particular waste stream. This would be backed up by physical measurements (e.g., external dose rate, heat emission, non-fixed surface contamination) and visual examination to confirm the lack of visible signs of any deterioration of the waste packages, which could have occurred since manufacture (e.g., waste container corrosion).

7.3 Compliance with the GDF WAC

Once the design, location and mode of operation of a GDF have been agreed and licensed, the generic specification would be replaced by facility-specific WAC based on the site licence and environmental authorisation. Before waste packages are received into the GDF, the receiver would require confidence that the waste packages are compliant with the facility WAC. The WAC would be generated based on the appropriate safety cases (operational and post-closure), the site licence issued by ONR and authorisations received from the relevant environment agency (as appropriate).

The GDF WAC are expected to be derived in a similar manner to the criteria that make up the existing generic packaging specifications but would be specific to the selected geographical location, host geology and disposal facility design. As noted previously, RWM's strategy is that a range of possible WAC will be bounded by the envelopes defined by the existing packaging specifications; hence it is expected that any waste package coming forward with a Final stage LoC, together with an appropriate package record, would be acceptable, although this is not guaranteed. Assessment against the WAC and checks to determine that the package record is in place and complete would be conducted before transport. Checks would be completed on receipt to confirm the identity of the waste package.

As in the case of transport, the process of demonstrating compliance will be by a combination of administrative checks backed up by measurements and/or visual inspections. These would be expected to include:

- analysis of the WPrS (or equivalent) and comparison with the WAC;
- analysis of the package record and comparison with the WAC;
- outcomes of the handover process (the 'handshake') between the waste consigner and the transport operator prior to despatch;
- outcomes of the handshake between the transport operator and the GDF operator on receipt; and
- visual checks prior to emplacement in the disposal vaults (e.g., visual inspection of external surfaces of waste packages for deformation, damage or deterioration of surface, and confirmation of the legibility and validity of the package identification number).

In the event that the waste package is deemed not to be compatible with the transport requirements in force at the time and/or the GDF WAC, the waste owner, in consultation with regulators, would need to decide on measures to remediate, or rework, the waste package. The extent of rework that might be necessary would need to be established on a case-by-case basis. It might involve over-packing within a larger waste container that can compensate for some known deficiencies or might require reworking of the wasteform itself. In either case the consequences in respect of cost and dose uptake to workers could be significant and certainly undesirable. Hence, the Disposability Assessment Process has an important role in avoiding such potential future activities.

7.4 Periodic Review

It is important for the validity of the LoC and the supporting Assessment of Disposability that they remain current with respect to RWM's developing plans for geological disposal and the associated safety cases for transport, operations and disposal. As a means of ensuring this, RWM has developed a process for the Periodic Review of Final stage LoCs, guidance for which is available in WPS/909 [26], whereby the existing disposability assessment of the waste package is reviewed against the current geological disposal concept and updated as necessary. A further benefit of Periodic Review is that it supports waste packagers in ensuring that the required waste package records are generated and

maintained, and that the manufactured packages are maintained under suitable conditions to support their eventual transfer and disposal in a GDF.

These reviews are conducted approximately every ten years, which means that each Final stage LoC and its associated records remains 'live' and the Assessment of Disposability would never be more than 10 years old. A Periodic Review could also be triggered as a result of the introduction of new wastes or an extension of the terms of an existing LoC endorsement, and by a review of any safety case relevant to the manufacture and/or storage of the waste packages (e.g., periodic reviews will be aligned with the continuous operational safety reviews undertaken by ONR).

The primary intent of a Periodic Review will be maintaining the currency of the Assessment of Disposability in light of the developing DSSC. Additionally, RWM will seek to verify that waste package manufacture and storage is taking place in accordance with the terms of the LoC endorsement and with the various control documents. This will include a review of the interim storage of the waste packages, in particular the results of monitoring and a consideration of the consequences of any package evolution that this monitoring has identified. RWM will also seek to resolve any pertinent outstanding issues arising from its ongoing programme of Technical Audit.

The scope and focus of the additional elements of each Periodic Review will be tailored to the specific needs of the waste, waste package type and/or packaging plant. This scope is particularly influenced by whether the packaging plant is still operating, or if all of the waste packages relevant to a specific LoC have been manufactured and are now in long-term storage. RWM will discuss the scope and required documentation for each Periodic Review with the waste owner/packager. For example:

- for LoCs relating to waste packages being produced from plants still operating at the time of the Periodic Review, the emphasis of the review will be on the status of the conditions, restrictions and caveats, a review of actual plant performance, assessment of the status of the management system and relevant audits, and any proposals for processing new wastes; and
- for LoCs applicable to waste packages which are all in interim store at the time of the Periodic Review, the additional review will concentrate on the condition of packaged wastes, closure of plants and preservation of manufacturing records, and on the significance of any new issues or audit actions.

At the commencement of a Periodic Review all existing Final stage LoCs that apply to the waste packages (actual and/or proposed) are deemed to be 'under review'. This status is maintained until the review is completed and all issues preventing completion of the disposability assessment are addressed, at which point the existing LoC will be replaced. The existence of any issues regarding the disposability of waste packages will be indicated by the inclusion of time-limited Action Points in the Assessment Report produced as part of a Periodic Review; replacement of the LoC is dependent on the close out of those Action Points. RWM will support the waste packager in finding solutions to the identified Action Points. However, if the identified Action Points are not addressed by the waste packager within the period specified, then appropriate courses of action will be reviewed.

7.5 Transfer of undertakings

Historically, the nuclear industry has undergone significant structural change, including organisational mergers and takeovers resulting in the transfer of waste ownership and responsibilities to new parties. As the nuclear industry continues to evolve, particularly over the long timescales required for waste package production, storage and disposal, it is recognised as inevitable that there will be changes to the identity and ownership of nuclear licensed sites.

The regulatory system in the UK seeks to ensure that a competent licensee will exist with responsibility for pre-disposal management of raw and packaged wastes. This means that site licensees can be assumed to be enduring organisations, with transfer of undertakings being appropriately managed under regulatory oversight. These undertakings include the responsibility for producing and maintaining disposable packages, and all the associated lifetime records, safety documentation, etc., for meeting any LoC conditions and ongoing requirements, and for making provision to address any caveats imposed by RWM.

It is important that documentation and records of interactions with RWM are retained within the site licensee and, as part of due diligence, are explicitly transferred to the new organisation as an intelligent customer activity.

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Appendix A RWM Disposability assessment aim and principles

Disposability Assessment Aim	
The principal aim of the Disposability Assessment Process is to minimise the risk that the conditioning and packaging of radioactive wastes results in packages incompatible with geological disposal, as far as this is possible in advance of the availability of Waste Acceptance Criteria for a geological disposal facility. As such, it is an enabler for early hazard reduction on UK nuclear sites.	
Disposability Assessment Principles	
1	Independent disposability assessments are undertaken against published RWM Packaging Specifications and the documented disposal system concept and safety case.
2	A Letter of Compliance can be issued when proposed waste packages are assessed to be compliant with published RWM Packaging Specifications.
3	Proposed waste packages should not unnecessarily or disproportionately consume the resources for geological disposal or disposal system capacity.
4	A staged approach to the submission of information and, hence, the assessment and endorsement of proposed waste packages is encouraged, supported by active engagement with waste owners.
5	Resolution of outstanding issues arising from the assessment of proposed waste packages will be managed in a systematic manner to facilitate timely resolution.
6	The adoption of common waste packaging approaches and sharing of substantiated good practice in waste packaging is encouraged, subject to consistency with other principles.
7	Innovative approaches to the packaging of wastes that reflect the hazard presented will be facilitated, subject to consistency with other principles and an appropriate justification.
8	Where there are proposed to be multiple waste management steps prior to the production of a disposable package, these should not jeopardise, and ideally should facilitate, production of a disposable package.
9	The continued validity of Letters of Compliance will be ensured by a process of periodic review of the supporting disposability assessments and related information.
10	The principles of openness and transparency will be applied to the Disposability Assessment Process and RWM will engage with interested stakeholders in the process, subject to the constraints of security and commercial considerations.
Principles applying to Higher Activity Wastes arising in Scotland	
11	RWM recognises Scottish Government Policy and provides advice and endorsement of proposed packages for Scottish wastes based on Principles 1-10, based on the requirements of the geological disposal system.

Glossary of terms used in this document

Assessment of Disposability (AoD)

A statement of the reasoning that allows the case to be made for the disposability of specific waste packages in a geological disposal facility. The AoD is progressively developed as the packaging process matures and the packaging plant is built and operated.

conditioning

Treatment of a radioactive waste material to create, or assist in the creation of, a wasteform that has passive safety.

container

The vessel into which a wasteform is placed to form a waste package suitable for handling, transport, storage and disposal.

criticality

A state in which a quantity of fissile material can maintain a self-sustaining neutron chain reaction. Criticality requires that a sufficiently large quantity of fissile material (a critical mass) be assembled into a geometry that can sustain a chain reaction; unless both of these requirements are met, no chain reaction can take place and the system is said to be sub-critical.

criticality safety

A methodology used to define the conditions required to ensure the continued sub-criticality of waste containing fissile material.

disposability

The ability of a waste package to satisfy the defined requirement for disposal.

disposal

In the context of solid waste, disposal is the emplacement of waste in a suitable facility without intent to retrieve it at a later date; retrieval may be possible but, if intended, the appropriate term is storage.

disposal facility (for solid radioactive waste)

An engineered facility for the disposal of solid radioactive wastes.

Disposal System Safety Case (DSSC)

The RWM generic DSSC is a suite of reports that will be developed as the disposal system progresses and will eventually form the basis for full, detailed safety cases that will be required in order to seek permission to undertake construction, transport or disposal operations. The underpinning reports provide more detail on the transport, operational safety and environmental safety of a geological disposal system.

fissile material

Fissile material is that which undergoes fission under thermal neutron irradiation. For regulatory purposes material containing any of the following nuclides is considered to be 'fissile': uranium-233, uranium-235, plutonium-239 and plutonium-241.

Generic Specification

The RWM packaging specifications define the bounding features and performance requirements for waste packages that would be compatible with the anticipated needs for transport to and disposal in a GDF. Formed of a hierarchy of three levels, the Generic

Specification applies the high-level requirements in the Generic Waste Package Specification [3] to packages containing a broad category of waste.

Generic Waste Package Specification (GWPS) [3]

The RWM packaging specifications define the bounding features and performance requirements for waste packages that would be compatible with the anticipated needs for transport to and disposal in a GDF. Formed of a hierarchy of three levels, the top-level GWPS defines the high-level requirements for all waste packages destined for geological disposal.

geological disposal

A long-term management option involving the emplacement of radioactive waste in an engineered underground geological disposal facility or repository, where the geology (rock structure) provides a barrier against the escape of radioactivity and there is no intention to retrieve the waste once the facility is closed.

geological disposal facility (GDF)

An engineered underground facility for the disposal of solid radioactive wastes.

geological disposal system

All the aspects of the waste, the disposal facility and its surroundings that affect the radiological impact.

geological environment

The structure, composition and physical and chemical characteristics of the rocks that make up the geosphere.

hazardous materials

Materials that can endanger human health if improperly handled. As defined by the Control of Substances Hazardous to Health Regulations, 2002.

Health and Safety Executive (HSE)

A statutory body whose role is the enforcement of work related health and safety law. HSE is the licensing authority for nuclear installations. HSE exercises this authority through and Executive Agency – the Office for Nuclear Regulation.

higher activity radioactive waste

Generally used to include the following categories of radioactive waste: low level waste not suitable for near surface disposal, intermediate level waste and high level waste.

high level waste (HLW)

Radioactive wastes in which the temperature may rise significantly as a result of their radioactivity, so this factor has to be taken into account in the design of storage or disposal facilities.

immobilisation

A process by which the potential for the migration or dispersion of the radioactivity present in a material is reduced. This is often achieved by converting the material to a monolithic form that confers passive safety to the material.

intermediate level waste (ILW)

Radioactive wastes exceeding the upper activity boundaries for LLW but which do not need heat to be taken into account in the design of storage or disposal facilities.

International Atomic Energy Agency (IAEA)

The IAEA is the world's centre of co-operation in the nuclear field. It was set up as the world's "Atoms for Peace" organization in 1957 within the United Nations family. The Agency works with its Member States and multiple partners worldwide to promote safe, secure and peaceful nuclear technologies.

Letter of Compliance (LoC)

A document, prepared by RWM, that indicates to a waste packager that a proposed waste package is compliant with the relevant packaging criteria and disposal safety assessments, and is therefore deemed to be compatible with the requirements for storage, transport, handling and disposal.

low level waste (LLW)

Defined as "radioactive waste having a radioactive content not exceeding 4 gigabecquerels per tonne (GBq/te) of alpha or 12 GBq/te of beta/gamma activity".

management system

The overall system by which an organisation determines, implements and ensures safety, quality and data recording throughout the lifetime of the waste package.

Managing Radioactive Waste Safely (MRWS)

A phrase covering the whole process of public consultation, work by CoRWM, and subsequent actions by Government, to identify and implement the option, or combination of options, for the long-term management of the UK's higher activity radioactive waste.

Nirex (United Kingdom Nirex Limited)

An organisation previously owned jointly by Department for the Environment, Food and Rural Affairs and the Department for Trade and Industry. Its objectives were, in support of Government policy, to develop and advise on safe, environmentally sound and publicly acceptable options for the long-term management of radioactive materials in the United Kingdom. The Government's response to the Committee on Radioactive Waste Management in October 2006 initiated the incorporation of Nirex functions into the NDA, a process which was completed in March 2007.

Nuclear Decommissioning Authority (NDA)

A non-departmental public body created through the Energy Act 2004. The NDA is a strategic authority that owns 19 UK sites and the associated civil nuclear liabilities and assets of the public sector, previously under the control of UKAEA and BNFL. It reports to the Department of Energy and Climate Change (DECC); for some aspects of its functions in Scotland, it is responsible to Scottish Ministers. The NDA has been identified by DECC in the 2008 MRWS White Paper as the organisation responsible for planning and delivering geological disposal.

nuclear licensed site

Any site which is the subject of a license granted by the Office of Nuclear Regulation under the Nuclear Installations Act 1965. Nuclear licensed sites include nuclear power stations, nuclear fuel production and reprocessing sites, sites undertaking storage of and/or research into nuclear materials, and major plant producing radioisotopes.

nuclear material

Fissile material or material that can be used to produce fissile material (i.e., source material). This includes all isotopes of uranium, plutonium and thorium, together with certain isotopes of neptunium and americium.

passive safety

The need to provide and maintain a safety function by minimising the need for active safety systems, monitoring or prompt human intervention. Requires radioactive wastes to be immobilised and packaged in a form that is physically and chemically stable. The waste package should be stored in a manner that is resistant to degradation and hazards, and which minimises the need for control and safety systems, maintenance, monitoring and human intervention.

post-closure period (of a disposal facility)

The period following sealing and closure of a facility and the removal of active institutional controls.

Radioactive Waste Management Ltd (RWM)

A wholly owned subsidiary of the NDA established to design and build an effective delivery organisation to implement a safe, sustainable, publicly acceptable geological disposal programme. Ultimately, RWM will evolve under the NDA into the organisation responsible for the delivery of the GDF. Ownership of this organisation can then be opened up to competition, in due course, in line with other NDA sites.

safeguards

Measures used to verify that nation states comply with their international obligations not to use nuclear materials (plutonium, uranium and thorium) for nuclear explosives purposes. Global recognition of the need for such verification is reflected in the requirements of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) for the application of safeguards by the International Atomic Energy Agency. Also, the Treaty Establishing the European Atomic Energy Community (the Euratom Treaty) includes requirements for the application of safeguards by the EC.

safety case

A 'safety case' is the written documentation demonstrating that risks associated with a site, a plant, part of a plant or a plant modification are as low as reasonably practicable and that the relevant standards have been met. Safety cases for licensable activities at nuclear sites are required as license conditions under NIA65.

surface contaminated object (SCO)

A solid object which is not itself radioactive but which has radioactive material distributed on its surfaces.

Transport Regulations

The IAEA *Regulations for the Safe Transport of Radioactive Material* and/or those regulations as transposed into an EU Directive, and in turn into regulations that apply within the UK. The generic term 'Transport Regulations' can refer to any or all of these, since the essential wording is identical in all cases.

UK Radioactive Waste Inventory (UK RWI)

A compilation of data on UK radioactive waste holdings, produced about every three years. The latest version, for a holding date of 1 April 2013, was published in February 2014. It is produced by DECC and the NDA. It is the latest public record of information on the sources, quantities and properties of LLW, ILW and HLW in the UK. It comprises of a number of reports and additional detailed information on the quantities and properties of radioactive wastes in the UK that existed at 1 April 2013 and those that were projected to arise after that date.

waste acceptance criteria (WAC)

Quantitative and/or qualitative criteria, specified by the operator of a disposal facility and approved by the regulator, for solid radioactive waste to be accepted for disposal.

waste container

Any vessel used to contain a wasteform for disposal.

wasteform

The waste in the physical and chemical form in which it will be disposed of, including any conditioning media and container furniture (i.e., in-drum mixing devices, dewatering tubes etc.), but not including the waste container itself.

waste package

The product of conditioning that includes the waste form and any container(s) and internal barriers (e.g., absorbing materials and liner), as prepared in accordance with requirements for handling, transport, storage and/ or disposal.

waste packager

An organisation responsible for the packaging of radioactive waste in a form suitable for transport and disposal.

Waste Package Specification (WPS)

The RWM packaging specifications define the bounding features and performance requirements for waste packages that would be compatible with the anticipated needs for transport to and disposal in a GDF. Formed of a hierarchy of three levels, each WPS (the most detailed of the specifications) defines the requirements for the transport to and geological disposal of waste packages manufactured using a standardised design of waste container that have been shown to be compatible with RWM's current plans for geological disposal for the packaging of a specific category of waste

Waste Package Specification and Guidance Documentation (WPSGD)

A suite of documents prepared and issued by RWM that are intended to provide a 'user-level' interpretation of the RWM packaging specifications, and other aspects of geological disposal, to assist UK waste packagers in the development of plans for the packaging of higher activity waste in a manner suitable for geological disposal.



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