

Geological Disposal

Waste Package Specification and Guidance Documentation WPS/909: Guidance on the Scope of Periodic Review of Final stage Letters of Compliance

January 2009

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Bibliography

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**WASTE PACKAGE SPECIFICATION AND GUIDANCE DOCUMENTATION
GUIDANCE ON THE SCOPE OF PERIODIC REVIEW OF FINAL STAGE LETTERS OF
COMPLIANCE**

This document forms part of a suite of documents prepared and issued by the Radioactive Waste Management Directorate (RWMD) of the Nuclear Decommissioning Authority (NDA).

The Waste Package Specification and Guidance Documentation (WPSGD) provide specifications and guidance for waste packages, containing Intermediate Level Waste and certain Low Level Wastes, which meet the transport and disposability requirements of geological disposal in the UK. They are based on, and are compatible with, the Generic Waste Package Specification (GWPS).

The WPSGD are intended to provide a 'user-level' interpretation of the GWPS to assist Site License Companies (SLCs) in the early development of plans and strategies for the management of radioactive wastes. To aid in the interpretation of the criteria defined by the WPSGD, and in their application to proposals for the packaging of wastes, SLCs are advised to contact RWMD at an early stage.

The WPSGD will be subject to periodic enhancement and revision. SLCs are therefore advised to contact RWMD to confirm that they are in possession of the latest version of any documentation used.

This document has been compiled on the basis of information obtained by Nirex and latter by the NDA. The document was verified in accordance with arrangements established by the NDA that meet the requirements of ISO 9001. The document has been fully verified and approved for publication by the NDA.

1 INTRODUCTION

The Radioactive Waste Management Directorate (RWMD) of the Nuclear Decommissioning Authority (NDA) has been established with the remit to implement the geological disposal option for the UK's higher activity radioactive wastes. The NDA is currently working with Government and stakeholders through the *Managing Radioactive Waste Safely* (MRWS) consultation process to plan the development of a Geological Disposal Facility (GDF).

As the ultimate receiver of wastes, RWMD, acting as GDF implementer and future operator, has established waste packaging standards and defined package specifications to enable the industry to condition radioactive wastes in a form that will be compatible with future transport and disposal.

The primary document which defines the packaging standards and specifications for Intermediate Level Waste (ILW), and certain Low Level Wastes (LLW) not suitable for disposal in other LLW facilities is the Generic Waste Package Specification (GWPS) [1]. The GWPS is supported by the Waste Package Specification and Guidance Documentation (WPSGD) which comprises a suite of documentation primarily aimed at SLCs, its intention being to present the generic packaging standards and specifications at the user level. The WPSGD also includes explanatory material and guidance that users will find helpful when it comes to application of the specification to practical packaging projects. For further information on the extent and the role of the WPSGD, reference should be made to the *Introduction to the Waste Package Specification and Guidance Documentation, WPS/100*¹.

To assist SLCs with particular aspects of the packaging of radioactive waste RWMD has produced, and continues to add to, a suite of thematic Guidance Notes. A full list of the Guidance Notes produced by RWMD, together with an abstract of each, can be found in *Introduction to the NDA Waste Packaging Guidance Notes, WPS/900*.

RWMD assesses the suitability of SLCs proposals for packaging waste against the requirements of the PGRC by way of the Letter of Compliance (LoC) assessment process. Endorsement by RWMD of such proposals is signified by the issue of a 'Final stage LoC', following which the SLC can seek regulatory approval to implement the packaging proposal and manufacture waste packages.

The issue of a Final stage LoC by RWMD indicates that waste packages manufactured in accordance with a proposed process, will be 'disposable' when judged against the requirements of the PGRC. The LoC also provides a key component of the 'package record' that will be needed for interactions with the disposal facility operator at the time of disposal. However, the issue of a Final stage LoC should not be seen as a one-off event but rather an initial step in the process of the long-term management of a particular radioactive waste. Maintenance of the continued validity of the LoC is therefore an essential component of the strategy of managing the risks that waste packages will not be accepted into future disposal facilities such as a GDF.

This document discusses the need for, and sets out the scope of, periodic review of such Final stage LoCs as a means of ensuring their continued validity over the extended period from the endorsement of a packaging proposal to the time when waste packages are consigned for final disposal.

¹ Specific references to individual documents within the WPSGD are made in this document in *italic script*, followed by the relevant WPS number.

2 BACKGROUND

2.1 Aims and Structure of this Document

The aim of this document is to define a process of periodic review by which the currency of Final stage LoCs can be maintained following the manufacture of waste packages.

The remainder of this Section provides a brief description of the LoC assessment process².

Section 3 discusses the wider role of the Final stage LoC, in particular the documentation that would be expected to follow it as waste packages, manufactured in accordance with endorsed process(es), move from interim storage to final disposal.

Section 4 explains how periodic review of Final stage LoCs is carried out to ensure that their currency is maintained over this extended period.

Section 5 outlines the scope, timing and means by which periodic reviews should be initiated for the packaging of particular waste streams.

The term SLC is used in this document to describe one or more organisations which could have responsibility for the safe and environmentally responsible management of radioactive wastes, in accordance with regulatory requirements, and the funding thereof at any stage prior to final disposal. As such an SLC may be the organisation that:

- produced the waste in the first instance;
- is responsible for the conditioning of 'raw' waste and rendering it into a passively safe and disposable form, and/or;
- stores raw and/or packaged waste prior to onward management.

2.2 The Concept of Geological Disposal

In line with the MRWS consultation process, RWMD are continuing to develop concepts for the geological disposal for higher activity wastes which include ILW, and certain LLW not suitable for disposal in other LLW facilities³. It is envisaged that the geological disposal of such wastes would comprise a number of distinct stages including:

- the retrieval and conditioning of the waste to create disposable waste packages, usually at the site of waste arising;
- a period of interim surface storage, also at the site of arising;
- transport of the waste packages to a GDF;
- transfer of waste packages underground and emplacement in disposal vaults;
- a period of monitored storage underground, during which retrieval by relatively simple means would be feasible;
- back-filling of the disposal vaults, followed by eventual sealing and closure.

The timing and duration of each stage would depend on a number of criteria, including the geographical location and host geology of the GDF as well as the disposal concept selected for implementation.

² A fuller description of the LoC assessment process can be found in *Guide to the Letter of Compliance Process, WPS/650*.

³ The generic description 'ILW' is used in the remainder of this document to describe both these categories of waste.

The Phased Geological Repository Concept (PGRC) [2], has been developed as one manifestation of geological disposal and has been adopted as the reference concept for the purposes of establishing packaging standards. The PGRC is supported by a suite of safety, security and environmental assessments intended to demonstrate that this concept will provide safety to workers and the public and provide the necessary level of environmental protection.

The safety philosophy adopted in the PGRC is one of containment of radionuclides by multiple barriers, of which that provided by the waste package is a key component. Included in these barriers are those provided by the waste package, which itself can be considered as two independent but complimentary barriers, the waste container and the wastefrom, each of which plays an important role in the containment of radionuclides.

As the MRWS consultation process continues it is anticipated that the siting process, based on expressions of interest from volunteer communities, may lead to the identification of sites for investigation as to suitability to host a GDF. The disposal concept design and safety case will be developed to suit the specific characteristics of the site and packaging standards will be updated to reflect the new circumstances as appropriate.

2.3 The Generic Waste Package Specification

A major area of the RWMD's work is the provision of advice to the packagers of radioactive waste in the UK, by way of the definition of packaging standards and the assessment of individual waste packaging proposals against those standards.

The primary document that defines packaging standards for ILW is the GWPS [1]. Derived from the PGRC and its associated generic documentation, which comprise the system specifications and safety assessments that define the PGRC, the GWPS provides the basis for assessing the suitability of waste packages containing ILW for disposal in a GDF.

The packaging standards defined by the GWPS are generic in two respects in that they are:

- derived from a full consideration of all future stage of long-term waste management; and
- independent of the location of the site of a GDF, which could be implemented at a range of different sites within the UK, representing a range of geological environments.

The format of the GWPS is to define:

- general requirements that are applicable to all waste packages;
- a range of standard waste containers;
- specific requirements for the standard waste package design that are created using the standard waste containers;
- requirements for the conditioned wastefroms that are placed into containers;
- requirements for quality management and for the creation and maintenance of records about each individual waste package.

The GWPS therefore defines the performance requirements for the two barriers to the release of radionuclides provided by the waste package, the waste container and the wastefrom, against which the overall performance of waste packages can be assessed.

2.4 The Assessment of Packaging Proposals

Since the mid-1980s, waste producers in the UK have made significant investment in waste retrieval and packaging plant as a means of ensuring that such wastes are rendered passively safe and suitable for disposal. Historically Nirex was responsible for the assessment and endorsement of the suitability of packaging processes for this latter need, originally by way of the 'Letter of Comfort' assessment process. Over the ensuing two decades the Letter of Comfort process has developed and matured to a point that the assessments undertaken were established on a more structured footing with detailed advice being issued to waste producers highlighting further information needs, or need for further development and/or research before a Letter of Comfort could be issued. The assessment process was also modified to integrate better with the implementation of packaging plant projects, with staged interactions occurring at a number of stages before active operation of a packaging plant commenced. The status of the assessment process was strengthened in January 2004, when support was provided by UK nuclear regulators, and it was recognised within improved regulatory arrangements for nuclear licensed sites [3]. This was accompanied by significant changes to the assessment process which was renamed the 'Letter of Compliance' assessment process.

In April 2007 Nirex was dissolved and its responsibilities assumed by RWMD. This included the role of assessing and endorsing nuclear site operators' waste packaging proposals through the LoC assessment process.

In undertaking LoC assessments RWMD determines whether wastes, when packaged, will have characteristics compliant with plans for transport to, and operations at the GDF, and ultimately whether the wastes could be accommodated within the GDF long-term post-closure safety case. The main output of a LoC assessment is an Assessment Report which may be accompanied by the issue of a LoC endorsing the packaging proposal. In line with the recently updated regulatory guidance [4] such endorsement is now seen by the regulators as an important component of the operator's Radioactive Waste Management Case.

The Assessment Report may recommend prior treatment of the waste to deal with specific concerns. These and other particular uncertainties and risks arising from the chosen packaging method(s) will be highlighted, as Action Points. Subsequent to the issue of an Assessment Report, the RWMD will continue to monitor progress with the resolution of such Action Points by the SLC.

The LoC assessment process is usually divided into 3 stages corresponding to the key development phases of the packaging plant; concept, pre-commitment and final stage before active operations. The disposability case would be developed in line with these stages and would not be expected to be completed until the Final stage. A successful end to the process would see the issue of a Final stage LoC endorsing the finalised proposed waste package design. The issue of the final stage LoC would normally be on a timescale consistent with site licence permission for the start-up of the packaging plant.

3 BEYOND THE FINAL STAGE LETTER OF COMPLIANCE

The issuance of a Final stage LoC is not a one-off event but is one step in the process of managing radioactive wastes. It signifies that the packaging of the waste by the proposed method will produce waste packages that are compatible with the packaging standards and specifications defined by the GWPS, and with the disposability criteria that are derived from the requirements of geological disposal.

This also requires that:

- waste packages are produced against a defined Waste Product Specification (WPrS);

- appropriate data are generated and recorded for each waste package;
- all processes are undertaken in accordance with controlled quality management systems (QMS), and ;
- independent checks are made to confirm that the SLC is actually making the packages according to the WPrS.

After a waste package has been produced it will usually be sent to an interim store, typically located adjacent to the packaging plant. The store will have an associated safety case and the store operator will ensure that waste packages received are safety compliant, by comparison against established store Waste Acceptance Criteria (WAC).

During the storage period, the SLC will operate the store in accordance with the safety case, and will be required to maintain the waste packages under appropriate environmental and safety control. This will imply continued application of an agreed QMS and periodic checks by the regulator to give confidence of continued compliance.

At some time in the future, the operator may need to transfer the waste packages to a national disposal facility, or possibly to another store on the same or an alternative site. If such a transfer requires transport of the waste packages through the public domain, the package contents will need to be shown to be compliant with the Design Safety Report (DSR) applicable to the transport package⁴. Before waste packages can be received into a new facility confirmation will be required that they are compliant with the WAC for that facility.

For a GDF, these WAC will have been derived in a similar manner to the criteria that make up the GWPS, but will be specific to the location and geology of the particular site and to the actual GDF design. The GWPS has been defined in such a way as to bound the WAC of GDFs in a range of credible geographical locations, host geologies and designs and hence it is expected that any waste package coming forward with a LoC and appropriate waste package records would be acceptable. At that time the SLC will require authorisation from the environment agencies to transfer waste and a GDF operator will require authorisation for disposal. These processes will be assisted by the availability of a LoC forming part of the 'package record'.

It is apparent from the above that all parties; i.e. SLC, GDF operator and regulators, would expect measures to be put in place to mitigate the risk that waste packages in the future are found not to be acceptable for transport or for acceptance into a GDF. A key part of the management of this risk is to maintain the LoC and package record up to date, and consistent with latest safety and environmental assessments.

4 MAINTAINING THE CURRENCY OF FINAL STAGE LoCs

Following issue of the Final stage LoC, and on receipt of regulatory licence permissions, it is anticipated that the SLC will manufacture waste packages in accordance with the endorsed proposals and to an agreed WPrS.

As noted previously, the Final stage LoC will need to have been maintained under a process of periodic review to ensure that it remains up to date and consistent with potentially evolving safety and environmental assessments as concepts for geological disposal evolve towards an operational GDF. This process of periodic review will need to address a number of areas which are dealt with in this Section.

⁴ Note that a 'transport package' may be the waste package itself or a combination of one or more waste packages contained within a transport overpack.

4.1 Evolution of Disposability Safety Assessment

Since the issue of the first LoC in the 1980's significant changes have taken place in the LoC assessment process⁵ and in the regulatory framework within which the process operates. Specific examples of such changes include:

- recognition of the LoC process within regulatory arrangements for nuclear licensed sites (2004);
- the need for explicit assessment of waste package disposability (2005);
- production of generic safety and environmental assessments within the geological repository concept (2001);
- introduction of the use of discrete WPrS (1998), and;
- introduction of Criticality Compliance Assurance Documentation (CCAD) and developments in methods of demonstrating criticality safety (1997).

In view of the fact that a number of major packaging plants (i.e. the Magnox Encapsulation Plant (MEP) at Sellafield) were commissioned in the early 1990's and are still operating and producing waste packages, it is important that there are mechanisms in place to give confidence that the waste packages thus produced remain compliant with evolving plans for disposal and the similarly evolving supporting safety and environmental assessments.

Furthermore the improved regulatory arrangements [4] now require that plant safety cases now explicitly address the disposability of the waste packages. These safety cases are themselves subject to periodic review and this process is therefore a key driver for the periodic review of LoC endorsement and a review and update of the Disposability Assessment, or for those plants that pre-date the improved regulatory arrangements and current LoC process, to develop a Disposability Assessment for the first time.

4.2 Conditions, Restrictions and Caveats

A variety of conditions, restrictions and caveats have been historically attached to LoCs issued in the past two decades. This was particularly commonplace for some of the earliest LoCs and historically Nirex had limited leverage to seek close-out. This unsatisfactory state of affairs was highlighted by regulatory scrutiny of the LoC process in 2005 [5] and efforts are now being made to remediate this position and ensure close-out of such issues. It is clear that the process of periodic review offers an opportunity to initiate a review and update the status of outstanding conditions, restrictions and caveats.

Periodic review is also used to explore how any remaining conditions are to be closed out, whether restrictions are being complied with, and whether it is possible to remove or revise caveats.

4.3 Actual Plant Performance

It is important to build confidence that all waste packages that are manufactured in a particular packaging plant, and in accord with an endorsed process, are compliant with the scope and assessments conducted as part of the original LoC assessment.

During operation of the packaging plant, experience may show that the actual plant performance has deviated from the assumptions that formed the basis of the original assessments. These deviations could be due to:

- systematic differences between the design intent, which was likely to have been based on the design flowsheet developed using demonstration rigs, calculations

⁵ See *Guide to the Letter of Compliance Process, WPS/650*.

and engineering or scientific judgements, and actual operational performance. This may affect all of the waste packages produced by the plant or possibly those at the limits of radionuclide inventory etc, or;

- manufacturing faults of varying severity, probably only affecting a small proportion of waste packages, resulting in production of packages which are deemed to be 'non-compliant'.

Processes for managing manufacturing faults are generally subject to oversight by a local Product Quality Review Committee (or similar) as described in *Guidance on the Sentencing of Non-compliant Waste Packages, WPS/911*.

Under regulatory arrangements, compliance with a WPrS, approved as part of a LoC assessment, would be subject to audit by the regulators and this should provide early identification of non-conformances where a SLC has not complied with agreed arrangements. The SLC would normally be expected to record any systematic deviations from the WPrS and, where this potentially impacts disposability to be part of the process for the review of waste package quality.

Periodic review also provides a convenient opportunity to review the performance of the packaging plant and to determine whether operational experience is indicating any trends that require actions to be taken on plant, or for the requirement to extend the operational envelope by undertaking additional supporting research or development work.

4.4 Closure of Plants and Preservation of Manufacturing Records

Packaging plants will eventually cease operations and enter a post-operational clean out (POCO) phase and/or decommissioning. The waste package manufacturing records will at this stage need to be preserved and managed. Ideally the features of the records relating to waste package manufacturing would be closed by that stage, and if necessary converted to a form compatible with the requirements described in *Long-term Management of Information and Records, WPS/870*. This may include duplication on to suitable media to allow long-term preservation and re-location away from the packaging plant or plant management centre to some more permanent location to prevent loss.

Periodic review should be used to positively confirm whether the necessary steps have been taken to manage such changes.

4.5 Condition of Stored Waste Packages

It is anticipated that following manufacture waste packages may spend several years in on-site interim storage. Evolution of waste packages during this time could affect their acceptability for transport and/or of satisfying GDF WAC.

Periodic review provides an opportunity for SLCs to provide information on the results of the monitoring of store environmental conditions and of the condition of the waste packages themselves. It also provides an opportunity to review waste package monitoring strategies against up to date knowledge concerning monitoring techniques and observations from other stores, in the UK or elsewhere, concerning the effectiveness of store regimes.

4.6 Status of Quality Management Systems

The audit of QMS is an on-going process applicable to the entire process of the management of radioactive waste from initial project development, through waste package manufacture and long-term storage to transport and final disposal. It is anticipated that routine auditing of these process will occur and action taken against any issues arising. *Guidance on the Implementation of a Quality Management System for Waste Packaging, WPS/913* is of relevance in this matter.

Periodic review provides an opportunity to overview the position and ensure there are no long-standing issues requiring resolution. Also, where plants are still operating at the time of the review, the review should consider key QMS documentation such as plant Conditions for Acceptance and Quality Plans to ensure the wastes being accepted into the plant and the packaging methods are still consistent with the original LoC endorsement.

4.7 New Wastes

SLCs may wish to use existing packaging plants to condition other wastes which fall outside the WPrS on which Final stage LoC endorsement was based. Where this is the case a new submission for LoC endorsement would be necessary and this may lead to existing LoCs being extended in scope to include the new wastes, or to an entirely new endorsement. In either case, a periodic review should be triggered.

5 SCOPE, TIMING AND INITIATION OF PERIODIC REVIEWS

The scope of periodic review should be tailored to the specific needs of a particular waste, waste package type or packaging plant and covering the relevant issues identified in Section 4. The scope of specific reviews will also be affected by factors such as whether the packaging plant is still operating, or whether all of the waste packages relevant to a specific LoC have been manufactured and are now in long-term storage.

It is expected that, as a minimum, the review should review any conditions, caveats or restrictions, either from the original Final stage LoC and/or from any previous periodic review.

The periodic review should consider all of the issues described in Section 4 at some level. However, the evolution of the regulatory processes and documentation, condition of stored packages and new technical issues should apply in equal measure to LoCs covering packages produced historically and now stored, and also those currently being produced from a long-running packaging plant since they are of common relevance.

For LoCs relating to waste packages being produced from plants still operating at the time of the periodic review, the emphasis of the review should fall on the evolution of the regulatory processes and documentation, the status of the conditions, restrictions and caveats, a review of actual plant performance, assessment of the status of the quality management system and proposals for processing new wastes.

For LoCs applicable to waste packages which are all in interim store at the time of the periodic review, the review should concentrate on the condition of packaged wastes, closure of plants and preservation of manufacturing records, and on the significance of any new issues.

The timing of periodic reviews should be flexible and it is recommended that periodic review be undertaken at an interval of not more than ten years. Notwithstanding this regular review, periodic review should also be triggered by any periodic of any safety case relevant to the waste package manufacture and/or storage and as a result of introduction of new wastes or extension of the terms of an existing LoC endorsement.

Periodic reviews should feature within SLC Life Time Plans and, in line with NDA guidance [6], should feature as RWMD interactions in the Regulatory Schedule. It is proposed that existing lines of communication between RWMD and SLCs are used to co-ordinate and plan the timing for future periodic reviews.

The detailed scope of the review will need to be determined on a case by case basis, since the factors listed in Section 4 will not always apply. The scope of the review should be determined by a process of dialogue between RWMD and the SLC.

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