LLW Repository Ltd

Waste Services Contract

Waste Acceptance Criteria – Low Level Waste Disposal

WSC-WAC-LOW – Version 5.0 Issue 1– July 2016

Document Control

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April 2013	Various	Version 3.0 amended to take account of 2011 Environmental Safety Case and subsequent work, and customer consultation comments
July 2016	Various	Version 4.0 amended to take account of implementation of revised permit for disposal

Preface

This document provides the *Waste Acceptance Criteria* for *Low Level Waste* being consigned to *LLW Repository Ltd* for disposal at the *Low Level Waste Repository*, including details of the physical, chemical, radiological, packaging and transport requirements that waste must comply with to be accepted.

The document forms part of the Waste Services Contract between *LLW Repository Ltd* and its customers.

If you need any assistance or have any questions regarding this *Waste Acceptance Criteria* or *LLW Repository Ltd's* Waste Services, please contact the *LLW Repository Ltd* Service Delivery Team: (019467) 70300 or by e-mail: customerteam@llwrsite.com.

Contents

1 Introduction

This document defines the *Waste Acceptance Criteria* (WAC) for the disposal of *Low Level Waste* at the *Low Level Waste Repository.* This is a service offered by *LLW Repository Ltd*. The criteria specified herein are intended to ensure that the *Low Level Waste Repository* is operated safely and in accordance with its *Environmental Permit* and safety cases, including its Environmental Safety Case. As a consequence, the *Low Level Waste Repository* can only accept a subset of the waste listed as *Low Level Waste* in the *UK Radioactive Waste Inventory*.

1.1 Scope

This WAC document represents the full requirements for the packaging, receipt, grouting and disposal of *Low Level Waste* at the *Low Level Waste Repository*. The criteria apply to each *Waste Consignment*.

1.2 Variations

Variations to, or waiver of, the criteria defined in this document may be allowed but only on approval of a Waste Consignment Variation Form (Reference: WSC-FOR-WCV) by *LLW Repository Ltd*. Approval is required prior to waste being prepared for *Consignment* to ensure acceptance. In reviewing a request for variation, *LLW Repository Ltd* will consider the nature of the waste, its treatment prior to disposal and the associated *Suitable Supporting Justification*. Advice on the level of justification required should be sought from *LLW Repository Ltd*. Consideration will also be given to any additional measures that can be taken by *LLW Repository Ltd* at the *Low Level Waste Rep*ository as part of the *Waste Emplacement Strategy*.

1.3 Non-Compliant Waste

Any non-compliant wastes *Consigned* to *LLW Repository Ltd* may require collection by the customer in accordance with the relevant conditions in the Waste Services Contract.

1.4 Defined Terms

Defined terms within this document are highlighted in *italics* and their meanings are presented in the Glossary.

2 Waste Acceptance Criteria

This section details the *Waste Acceptance Criteria* for *LLW Repository Ltd*'s *Low Level Waste* Disposal Service. It is presented in four sections:

- L1 – General conditions of acceptance;
- L2 – Physical and Chemical Properties;
- L3 – Radiological Properties;
- L4 – Packaging and Transport Requirements.

L1 General Conditions of Acceptance

Waste will only be accepted for disposal at the *Low Level Waste Repository* if this management route is *Best Available Techniques* (the term *Best Available Techniques* is used throughout the document but is intended to encompass Best Practicable Environmental Option and Best Practicable Means where applicable). Customers shall ensure that *Best Available Techniques* have been adopted to segregate the constituent parts of wastes such that alternative waste treatment and / or disposal services can be used to avoid disposal at the *Low Level Waste Repository*. Where waste is not selected for alternative management route, acceptance will require *Suitable Supporting Justification* to be provided; this should be for the *Wastestream* or *Waste Consignment* as appropriate.

Waste will only be accepted at *Low Level Waste Repository* if it meets all the conditions and criteria specified in this document or an approved variation is in place.

Waste will only be accepted from customers in accordance with *LLW Repository Ltd's* Waste Acceptance Procedure.

Waste will only be accepted for disposal at the *Low Level Waste Repository* providing sufficient *Volumetric*, *Radiological* and *Non-radiological Capacity* has been allocated.

Capacity is managed by *LLW Repository Ltd* based in part on information in the *UK Radioactive Waste Inventory*; wastes will therefore only be accepted if identified as *Low Level Waste* in the latest issue of the *UK Radioactive Waste Inventory* or after an assessment against remaining capacity by *LLW Repository Ltd*.

L2 Physical and Chemical Properties

L2.1 Waste Volume

Customers shall ensure that *Best Available Techniques* have been adopted to reduce the *Package Volume* requiring disposal at the *Low Level Waste Repository*.

L2.2 Acceptable Waste

Only solid radioactively contaminated or activated waste will be accepted for disposal at the *Low Level Waste Repository*.

Waste *Consigned* for disposal must be compliant with the *Low Level Waste Repository's Environmental Permit* issued under the Environmental Permitting (England and Wales) Regulations 2010 by the Environment Agency (Reference: EPR/YP3293SA). Compliance with the *Environmental Permit* can be achieved by complying with the requirements of these *Waste Acceptance Criteria* and *Consigning* waste in accordance with the Waste Acceptance Procedure.

L2.3 Waste Preparation

Waste must have been treated or packaged in such a way as to render it, so far as is reasonably practicable, insoluble in water and not readily flammable.

L2.4 Non-Waste Materials

Where materials must be added to the waste, the customer shall use reasonably practicable means to limit the quantity of non-waste materials present in a *Waste Consignment*. It is not acceptable to purposely dilute waste or add materials for shielding purposes or otherwise for the sole purpose of achieving compliance with the requirements of this *Waste Acceptance Criteria*.

L2.5 Reactive Metals and Materials

Customers shall use *Best Available Techniques*, which might be by painting or wrapping, to limit the surface area of *Reactive Metals* accessible by grout. In any case, the total exposed (including any wrapped metal but not painted) surface area of *Reactive Metal* must not exceed 10 m^2.

Other materials that readily react either with each other, grout, water or air, with the evolution of heat or flammable gases, or in a way that might affect containment of the wastes, may be accepted for disposal but only on approval of a Waste Consignment Variation Form (Reference: WSC-FOR-WCV) with *Suitable Supporting Justification* by *LLW Repository Ltd*.

L2.6 Explosive Materials

Waste shall not contain *Explosive* materials or materials that readily react with air, water or grout to cause an *Explosive* hazard.

L2.7 Liquids

Waste shall not contain any *Free Liquid* or liquids with flashpoint less than 21 °C absorbed on solid materials.

Aqueous and / or non-aqueous liquid waste may be accepted for disposal but only on approval of a Waste Consignment Variation Form (Reference: WSC-FOR-WCV) with *Suitable Supporting Justification* by *LLW Repository Ltd*. In addition, the following conditions must be met:

- Any liquid shall, prior to *Consignment*, be fixed in a *Suitable Solid Matrix* which will not result in release of liquid under applied loads of up to 400 kN/m^2;
- The non-aqueous content of any liquid in the waste shall be conditioned, prior to *Consignment*, such that no visible oil or grease will be released by leaching as demonstrated using a *Leach Test* agreed with *LLW Repository Ltd*.

L2.8 Soluble Solids

Soluble Solids present as *Bulk Chemical Compounds* greater than 1 kg mass in a *Waste Consignment* may be accepted for disposal but only on approval of a Waste Consignment Variation Form (Reference: WSC-FOR-WCV) with *Suitable Supporting Jus*tification by *LLW Repository Ltd*. Such materials shall be fixed, prior to *Consignment*, in a *Suitable Solid Matrix* that will not readily release that component as demonstrated using a *Leach Test* agreed with *LLW Repository Ltd*.

L2.9 Strong Oxidising Agents

Waste shall not contain strong oxidising agents.

L2.10 Corrosive Materials

Waste shall not contain any material such that the expected performance and integrity of the *Disposal Container* could be significantly reduced, unless such materials are treated, prepared or made safe by a method approved in advance by *LLW Repository Ltd*.

L2.11 Pressurised Gas Receptacles and Aerosols

Waste shall not contain pressurised gas receptacles and aerosols, as defined within The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (or as amended). Such items that have been depressurised are acceptable for disposal.

L2.12 Toxic Materials

Waste shall not contain materials that, in contact with air, water, grout or otherwise, generate or are capable of generating, toxic liquids, gases, vapours or fumes harmful to persons.

L2.13 Chemical Complexing or Chelating Agents

To fulfil regulatory requirements in relation to disposals at the *Low Level Waste Repository*, radioactive waste containing *Chemical Complexing and Chelating Agents* must be controlled. Such wastes are managed using the following categories:

Category 1: Materials requiring control but not requiring an allocation; the quantities of the materials must be recorded in the relevant section of the Waste Consignment Information Form (Reference: WSC-FOR-WCI). These materials are:

- Carboxylic acids: examples include citrate, picolinate, oxalate and formate;
- Inorganic compounds: for example tri-polyphosphates.

Category 1 materials will only be permitted in quantities less than *Bulk Chemical Compound* quantities in waste.

Category 2: Materials requiring an allocation. These may be accepted for disposal subject to there being sufficient capacity for these materials at the *Low Level Waste Repository*. This will be assessed based on information in Waste Characterisation documents (Reference WSC-FOR-WCH) and in the *UK Radioactive Waste Inventory*. In cases for which there is not sufficient capacity, or in which the usage of the capacity would be grossly disproportionate to the volume of waste, this will be discussed with customers including the potential need for additional information. Customers shall ensure that the total disposal of such materials for each *Wastestream* does not exceed the allocation given by *LLW Repository Ltd*. These materials are:

- EDTA (ethylene-diamine tetra-acetic acid and salts thereof);
- DTPA (diethylene-triamine penta-acetic acid and salts thereof);
- NTA (nitrilo-acetic acid and salts thereof).

Customers shall ensure that *Best Available Techniques* have been adopted in the management of wastes to minimise the quantity of *Chemical Complexing and Chelating Agents,* described in Category 1 and Category 2 above, requiring disposal at the *Low Level Waste Repository*.

Some materials, which may be complexing by virtue of their chemical mode of action, are specifically excluded from control as *Chemical Complexing and Chelating Agents*. These materials are:

- Ion-exchange materials;
- Superplasticisers (as a component of cured cement, concrete or grout);
- Coagulants and flocculants;
- Low molecular weight ions that are commonly occurring or ubiquitous in the natural environment (e.g. ammonium ions).

Other proprietary chemicals and reagents containing *Chemical Complexing and Chelating Agents* not listed may be accepted for disposal but only on approval by *LLW Repository Ltd* of a Waste Consignment Variation Form (Reference: WSC-FOR-WCV) and *Suitable Supporting Justification*. Such materials may need to be fixed, prior to *Consignment*, in a *Suitable Solid Matrix* that will not readily release that component as demonstrated using a *Leach Test* agreed with *LLW Repository Ltd*.

L2.14 Ion Exchange Materials

Waste shall not contain *Ion Exchange Material* unless conditioned using a method approved in advance by *LLW Repository Ltd*. This is likely to involve the *Ion Exchange Material* being fixed, prior to *Consignment*, in a *Suitable Solid Matrix* approved in advance by *LLW Repository Ltd*.

L2.15 Biological, Infectious and Pathogenic Materials

Waste shall not contain biological, pathogenic or infectious materials, as listed within Hazard Groups 2, 3 or 4 in the Approved List of biological agents produced by The Advisory Committee on Dangerous Pathogens, unless treated such that no viable micro-organism(s) from Hazard Groups 2, 3 or 4 exist by a method approved in advance by *LLW Repository Ltd*.

Customers shall use reasonably practicable means to limit the quantity of *Putrescible Materials* within a *Waste Consignment* and if present *Putrescible Materials* must not exceed 1% of the *Internal Volume* of the *Disposal Container*. Amounts exceeding this may be accepted for disposal but only on approval of a Waste Consignment Variation Form (Reference: WSC-FOR-WCV) with *Suitable Supporting Justification* by *LLW Repository Ltd*. The supporting justification must include:

- A *Best Available Techniques* assessment of potential treatment options;
- An assessment to consider potential human health implications.

L2.16 Waste Degradation, Voidage and Settlement Properties

It is important to control *Total Potential Voidage* in wastes to limit the settlement of wastes and hence the final cap of the *Low Level Waste Repository*. *Total Potential Voidage* is the sum of *Inaccessible Voidage*, *Compression Voidage* and *Biodegradation Voidage*.

Customers shall use *Best Available Techniques* in order that wastes are treated so as to minimise the *Total Potential Voidage* in each *Waste Consignment* and in any case the *Total Potential Voidage* shall not exceed 20% of the *Internal Volume* of the *Disposal Container* unless approved in advance by *LLW Repository Ltd*.

L2.17 Hazardous Waste, Hazardous Substances and Non-Hazardous Pollutants

To fulfil regulatory requirements in relation to disposals at the *Low Level Waste Repository*, radioactive wastes that would be categorised as *Hazardous Waste* if they were not deemed to be radioactive waste, *Hazardous Substances* or *Non-Hazardous Pollutants* must be controlled. Such wastes are managed using the following categories:

Category 1: Materials not requiring control but the quantities of which must be recorded in the relevant section of the Waste Consignment Information Form (Reference: WSC-FOR-WCI). These materials are:

- Aluminium metal/alloy
- Asphalt or Tarmac not containing coal tar (generally that laid down post-1980)
- Bitumen
- Chromium metal/alloy
- Cobalt metal/alloy
- Copper metal/alloy
- Fluoride (inorganic)
- Iron metal/alloy
- Magnesium metal/alloy
- Mild steel
- Molybdenum metal/alloy
- Nickel metal/alloy
- Phenol
- Phosphate
- Plastics (halogenated)
- Plastics (non-halogenated)
- Stainless steel
- Tin metal/alloy
- Titanium metal/alloy
- Vanadium metal/alloy
- Vinyl chloride (un-polymerised)
- Zinc metal/alloy.

Category 2: Materials requiring an allocation. An allocation of the capacity of the *Low Level Waste Repository* will be given for each approved *Wastestream*. The allocation will be for a given volume of the waste and the contaminant quantities as described in the corresponding Waste Characterisation Form (Reference WSC-FOR-WCH). In cases for which there is not sufficient capacity, or in which the usage of the capacity would be grossly disproportionate to the volume of waste, this will be discussed with customers including the potential need for additional information. Customers shall ensure that the total disposal of such materials for each *Wastestream* does not exceed the allocation given by *LLW Repository Ltd*. These materials are:

- Arsenic all forms
- Asphalt or Tarmac containing coal tar (generally that laid down pre-1980)
- Beryllium all forms
- Boron all forms
- Cadmium metal/alloy
- Cyanide
- Lead metal/alloy

- Mercury metal/alloy
- Selenium all forms
- Tributyl phosphate (TBP)
- Electronic and Electrical Equipment (EEE);
    - Type 1: Equipment with printed circuit boards (e.g. computers, telephones and stripped down circuit boards)
    - Type 2: Plant items (e.g. electrolytic capacitors and transformers)
    - Type 3: Electrical and electronic tools (e.g. corded drills and cordless drills)
    - Type 4: Mercury-containing items (e.g. fluorescent light tubes, vapour lamps and mercury switches)
    - Type 5: Rechargeable batteries (e.g. nickel-cadmium, nickel-metal hydride and lithium-ion).

Category 3: All other radioactive wastes that would be categorised as *Hazardous Waste* if they were not deemed to be radioactive waste, *Hazardous Substances* and *Non-Hazardous Pollutants* (with the exception of asbestos and *Man-Made Mineral Fibres,* see L2.18). These may be accepted for disposal but only on approval of a Waste Consignment Variation Form (Reference: WSC-FOR-WCV) by *LLW Repository Ltd*. The Form must include:

- Details of the components that make the waste hazardous, their physical form and the levels at which they are present;
- Total weight of each such component in each *Waste Consignment*;
- Any treatment, conditioning or packaging taken to reduce their potential environmental impact and the results of any *Leach Test* using a method agreed with *LLW Repository Ltd*.

L2.18 Asbestos and Man-Made Mineral Fibres

A *Waste Consignment* may include an unlimited amount of *Man-Made Mineral Fibres*. The presence, type and quantity of such materials must be recorded in the waste description section of the Waste Consignment Information Form (Reference: WSC-FOR-WCI).

A *Waste Consignment* may include amounts of asbestos and manufactured products containing asbestos as set out in Table 2.1 In all cases, the presence, physical form and quantity of such materials must be recorded in the relevant section of the Waste Consignment Information Form (Reference: WSC-FOR-WCI). All asbestos-bearing wastes shall be packaged for handling and transport as detailed in HSE regulations and guidance. As a minimum, asbestos wastes that have not been *Supercompacted* shall be *Double Wrapped*.

Table 2.1: Acceptability of Asbestos and Asbestos-containing Materials

Material type	Examples	Acceptability
Non-friable and low-friable asbestos-containing manufactured products	Brake shoes Low porosity, monolithic asbestos cement blocks and mouldings Asbestos cement sheeting in mainly good condition	A *Waste Consignment* may include an unlimited amount

Moderately friable asbestos-containing manufactured products	Fire doors and tiles Ceiling tiles Insulating boards Badly damaged or degraded asbestos cement sheeting	A *Waste Consignment* may include up to one tonne of asbestos containing material
Highly friable and loose asbestos forms	Asbestos cladding (e.g. pressed or sprayed cladding on pipework) and lagging Loose asbestos lagging or insulation	A *Waste Consignment* may include up to 10 kg of such material

Larger amounts than indicated above of moderately friable asbestos-containing manufactured products and highly friable and loose asbestos forms may be accepted for disposal but only on approval of a Waste Consignment Variation Form (Reference: WSC-FOR-WCV) by *LLW Repository Ltd*. The Form must include:

- Description of the material and its condition;
- Identification of the predominant mineral type, e.g. chrysotile (white), amosite (brown) and crocidolite (blue);
- Total weight of material and estimated of amount of asbestos mineral;
- Any treatment or packaging proposed to reduce the friability of the waste and/or reduce the potential environmental impact. Requests to *Consign* large amounts (several tonnes) of untreated asbestos in friable forms, especially of brown or blue asbestos, are liable to be refused.

L3 Radiological Properties

L3.1 Radioactive Contamination

The waste within a *Waste Consignment* for disposal at the *Low Level Waste Repository* must consist of waste deemed to be contaminated and not the primary contaminant itself. The weight of the *Radioactive Contaminant* shall not exceed 10% of the weight of the *Waste Consignment*. This limit may be exceeded but only on approval of a Waste Consignment Variation Form (Reference: WSC-FOR-WCV) with *Suitable Supporting Justification* by *LLW Repository Ltd*.

L3.2 Radioactivity Limits

L3.2.1 Total Activity

Customers shall ensure that *Best Available Techniques* have been adopted in the management of the waste.

An allocation of the *Radiological Capacity* of the *Low Level Waste Repository* will be given for each approved *Wastestream*. The allocation will be for a given volume of the waste and the radionuclide levels as described in the corresponding Waste Characterisation document (Reference WSC-FOR-WCH). In cases for which the *Radiological Capacity* is not sufficient to accept the wastes, or in which the usage of the *Radiological Capacity* would be grossly disproportionate to the volume of waste, this will be discussed with customers including the potential need for additional information. Customers shall ensure that the total *Activity* of each *Wastestream* does not exceed the allocation given by *LLW Repository Ltd*.

L3.2.2 Specific Activity of Consignments

The total *Specific Activity* of any *Waste Consignment Consigned* for disposal as *Low Level Waste* at the Low Level Waste Repository shall not exceed the following values:

- 4 GBq/t for all alpha-emitting radionuclides;
- 12 GBq/t for all other radionuclides.

Only immediate packaging required to safely manage the waste, which includes the *Disposal Container*, can be included in the calculation of *Specific Activity*.

L3.2.3 Activity Heterogeneity and Discrete Items

A *Waste Consignment* may include volumes of wastes or *Discrete Items* for which the *Specific Activities* exceed the maximum total *Specific Activities* for a *Waste Consignment* given in L3.2.2; however, the total *Specific Activities* averaged over the *Waste Consignment* must not exceed the maximum *Specific Activities* given in L3.2.2, waste must be managed in accordance with regulatory guidance, and the *Activity* of *Discrete Items* within a *Waste Consignment* must be limited.

Best Available Techniques must have been used to characterise, sort and segregate the waste to facilitate its management by optimal routes. Further guidance can be found in, 'The management of higher activity radioactive waste on nuclear licensed sites Section 4: Waste minimisation, characterisation and segregation', issued as Revision 2 of the Joint Guidance from the Health and Safety Executive, the Environment Agency and the Scottish Environment Protection Agency to nuclear licensees, February 2015.

While the *Specific Activity* may vary across a *Waste Consignment*, and in some volumes, or *Discrete Items* may exceed the maximum *Specific Activities* for a *Waste Consignment* given in L3.2.2, waste volumes or *Discrete Items* that are known to exceed the maximum *Specific Activities* given in L3.2.2 must not be mixed with other wastes solely for the purpose of re-categorisation of the waste as acceptable for disposal at the *Low Level Waste Repository*.

The total *Specific Activity* of a *Waste Consignment* must be a reasonable reflection of the *Activity* of the waste across the volume of the waste.

Activities and *Specific Activities* of individual *Discrete Items* must comply with the following sum of fractions:

$$Q_A/DIL_A + Q_{B1}/DIL_{B1} + Q_{B2}/DIL_{B2} + Q_C/DIL_C \leq 1$$

where Q_N is the total *Activity* or *Specific Activity* of group N radionuclides and DIL_N is the Discrete Item Limit for that group, depending on the mass of the *Discrete Item*. The Discrete Item Limits are shown In Table 3.1. The radionuclide groups in Table 3.1 are defined in Table 3.2.

Table 3.1: Discrete Item Limits

Radionuclide	Mass 1 kg or less	Mass between 1 and 100 kg	Mass 100 kg or greater
Group A	0.001 GBq	1 GBq/t	0.1 GBq
Group B1	0.01 GBq	10 GBq/t	1 GBq
Group B2	0.3 GBq	300 GBq/t	30 GBq
Group C	1 GBq	1000 GBq/t	100 GBq

Table 3.2: Radionuclide Groups for Limiting Discrete Items

Group A	Nb-94 Ag-108m Sn-126 Ra-226 Th-229 Th-230 Th-232 Pa-231 Np-237 Am-243 Cm-247 Cm-248 Cf-251
Group B1	I-129 Pu-238 Pu-239 Pu-240 Pu-242 Am-241 Am-242m All alpha-emitting uranium isotopes (1) Cm-245 Cm-246
Group B2	C-14 Cl-36 Ca-41 Sr-90 Zr-93 Mo-93 Tc-99 Cs-135 Cs-137 Pb-210 Ac-227 Pu-241 Cm-243 Cm-244 Cf-250
Group C	H-3 Co-60 Ni-59 Ni-63 Nb-93m Sm-151 Eu-152 All radionuclides with half-life shorter than 10 years. Most radionuclides with half-life shorter than 20 years (2).

(1) U-233, U-234, U-235, U-236, U-238 and all mixtures thereof

(2) The exceptions are radionuclides that have half-life shorter than 20 years but decay to moderately long-lived alpha emitters, notably Pu-241, Cm-244 and Cf-250.

The amount of *Activity* in a *Waste Consignment* associated with *Discrete Items* must also be limited. The sum of fractions for the *Activities* associated with all the *Discrete Items* in a *Consignment* must not exceed ten calculated using the Discrete Item Limits for *Discrete items* of mass 100 kg or greater.

Cutting up or dismantling of *Discrete Items* for disposal to produce a sum of fractions less than or equal to one is not allowed, even if the resulting items are placed in separate *Consignments*. Cutting up or dismantling is allowed to enable segregation of parts of a *Discrete Item* for management by different routes, including *Consignment* to the *Low Level Waste Repository*; or to reduce the size of a *Discrete Item* to fit into a *Disposal Container*.

L3.2.4 Low-activity Sources

Low Activity Sources may be *Consigned* to the *Low Level Waste Repository* subject to the following conditions.

Customers must have tried to return sources to the supplier or manufacturer and considered alternative uses before *Consigning* sources for disposal.

The *Activity* of any individual source shall not, at the date of *Consignment*, exceed the values set out in Table 3.3 where the radionuclide Groups are those specified in Table 3.2

Table 3.3 Limits for Control of Individual Sealed Sources

Radionuclide Group	Limit (MBq)
Group A	1
Group B1 and B2	10
Group C	100

In addition, the following conditions must be met:

- As much extraneous packaging and shielding must be removed from each source as possible and sources that might be potentially attractive should, as far as practicable, be disfigured;
- The sources should be disposed in a *Small Container*;
- Sources must be packaged together in the smallest container required. The sources shall be mixed with sufficient cement grout, in the container, to provide reasonable containment of each source, with at least 100 ml of grout surrounding each source and the container 'topped up' with grout so as to minimise any air space or voidage and the tin closed tight;
- Only one such container may be placed within a *Waste Consignment* and the overall *Waste Consignment* must be consistent with the 4 and 12 GBq/t LLW limits;
- A separate Waste Characterisation Form (Reference: WSC-FOR-WCH) must be approved by *LLW Repository Ltd* for *Low-activity Sources* and include the following information: source registration references, the radionuclides, the total activity per source, any radioactive decay calculations, the number of discrete sources and the amount of grout per source;
- Where more than one source is disposed, the total *Activity* of the *Small Container* must be such that:

$$[\ IA + IB/10 + IC/100\ ] / V \leq 5\ MBq/l$$

where IA, IB and IC are the total Activities (MBq) of radionuclides of Groups A, B and C respectively and V is the volume of the container (litre).

L3.2.5 Active Particles

Waste containing, or that may contain, *Active Particles*, or materials that may break down into *Active Particles*, may be accepted for disposal but only on approval of a Waste Consignment Variation Form (Reference: WSC-FOR-WCV) by *LLW Repository Ltd.*

L3.3 Fissile Radionuclides

Waste Consignments containing uranium or plutonium radionuclides shall not exceed the following values:

(a)150 g (U-233 + U-235 + Pu-239); or
(b) 300 g U-235 if the uranium enrichment does not exceed 5% U-235 with respect to total uranium; or

(c) 1000 g U-235 if the uranium enrichment does not exceed 1.6% U-235 with respect to total uranium; or
(d) unrestricted if the uranium enrichment does not exceed 0.93% U-235 with respect to total uranium.

Categories (b), (c) and (d) above may also contain up to 15g of (U-233 + Pu-239). The specific restrictions on U-233 are only applicable where the waste is derived from a plant or process that handled separated U-233.

Waste Consignments containing fissile materials must also meet the criteria set out in L4.9 and L4.10.

L3.4 Radiation

The maximum radiation level at any point on the external surface of the *Disposal Container* shall not exceed 2 mSv/h and 100 µSv/h at 2 metres.

L3.5 Contamination

External non-fixed contamination levels on the *Disposal Container* at the time of *Consignment* shall be as low as reasonably practicable and in any case not more than 0.4 Bq/cm^2 for all alpha-emitting radionuclides and 4 Bq/cm^2 for all other radionuclides averaged over an area of 300 cm^2.

L4 Packaging and Transport Requirements

L4.1 Approved Disposal Containers

Waste for disposal may be *Consigned* to the *Low Level Waste Repository* in any of the approved *Disposal Containers* listed in Table 4.1.

Waste must be *Consigned* for disposal in accordance with the latest edition of IAEA SSR-6 (Regulations for the Safe Transport of Radioactive Material), as required by SI 2009 No 1348 – The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment (Amendment) Regulations 2011 (known as the CDG Regulations), and the European agreement "Accord européen relatif au transport international des marchandises dangereuses par route" (known as the ADR) and RID (Regulations concerning the International Carriage of Dangerous Goods by Rail).

Table 4.1: Approved Disposal Containers

Disposal Container Type	Design Ref.	Column A (t)	Column B (t)	Column C (m^3)	Column D (m^3)
1/3 Height Disposal Container	TC03	35	40	11.3	13.0
1/2 Height Disposal Container	TC01	35	42	17.9	19.5
2/3 Height Disposal Container	TC06	40	42	22.3	26.8
3/4 Height Disposal Container	TC04	35	42	24.8	29.7
WAMAC Disposal Container	TC08	35	40	17.9	20.0
ISO Skip Disposal Container	TC05	17	22	8.5	11.4

Notes:
Column A: shows the maximum gross weight, in tonnes, for compliance with the Certificate of Approval for each container design. The maximum gross weight for any individual container is recorded in the Container Safety Convention approval plate on each container and shall be checked before the container is filled with waste.
Column B: shows the maximum gross weight of the container, in tonnes, after in-fill grouting that can be routinely handled at the *Low Level Waste Repository*. *Disposal Containers* exceeding this value prior to being completely filled with grout will be classed as *Overweight Grouted Containers* in accordance with L4.5.
Column C: shows the *Internal Volume* of each *Disposal Container* type, in m^3, which is used for the purposes of assessing volumetric concentrations of materials in accordance with the *Waste Acceptance Criteria*.
Column D: shows the *Package Volume* of each *Disposal Container* type, in m^3, which is used for the purposes of calculating the disposal charges, independent of the actual volume of waste in the container.

Disposal Containers damaged to the extent that they are required to be *Consigned* in an overpack container under an authorised *Operational Concession* (RSF 6.18.02_07) may be acceptable for disposal by *LLW Repository Ltd* but only on approval of a Waste Consignment Variation Form (Reference: WSC-FOR-WCV) with *Suitable Supporting Justification*.

L4.2 Other Containers

Waste that cannot be readily *Consigned* in one of the approved *Disposal Containers*, as detailed in L4.1, may be acceptable for disposal in other containers by *LLW Repository Ltd* but only on approval of a Waste Consignment Variation Form (Reference: WSC-FOR-WCV) with *Suitable Supporting Justification*.

L4.3 Non-containerised Waste

Non-containerised waste may be accepted for disposal at the *Low Level Waste Repository* but only on approval of a Waste Consignment Variation Form (Reference: WSC-FOR-WCV) with *Suitable Supporting Justification* by *LLW Repository Ltd*.

L4.4 Packing

Customers are responsible for loading the *Disposal Container* such that, as far as reasonably practicable, waste is packaged in such a way as to maximise the *Packing Efficiency* of the *Disposal Container*. Customers must, however, ensure sufficient grout penetration can still be attained to ensure compliance with the *Waste Acceptance Criteria*, in particular relating to voidage and settlement properties (L2.16).

Waste must be packed in the *Disposal Container* such that no free movement can occur during normal transport conditions and each *Consignment* requires a signed *Waste Loading Plan Information Form* (WSC-FOR-WLP), which must reference either a valid Waste Loading Plan detailing the restraint configuration for transport, or which references the applicable section of the containers Packing and Handling Instruction.

L4.5 Container Weights

The weight of a *Disposal Container* must not exceed 35 tonnes on receipt.

Customers are responsible for loading the *Disposal Container* such that when it is filled with grout, of nominal density 1,800 kg/m^3, the gross weight of the *Disposal Container* does not exceed the maximum gross weight in Column B of Table 4.1. Where customers calculate or anticipate that the *Disposal Container* will exceed the maximum gross weight after grouting, the *Waste Consignment* may still be accepted but only on approval of a Waste Consignment Variation Form (Reference: WSC-FOR-WCV) by *LLW Repository Ltd*.

L4.6 Disposal Container Venting

The *Disposal Container* shall not be left un-vented for more than thirty days in advance of receipt at the *Low Level Waste Repository*.

L4.7 Disposal Container Labelling

Each *Disposal Container* shall be uniquely marked or labelled, in accordance with the IAEA Transport Regulations SSR-6 and the container designs Design Safety Report (DSR), so as to be legible for at least five years after delivery such that the customer and a *Consignment* serial number can be identified.

L4.8 Photographic Records

Customers are responsible for ensuring that, as far as reasonably practicable, photographic records of the filling of the *Disposal Container* with waste are produced and retained by the customer. Photographs should be taken when the *Waste Consignment* is approximately 25% full, 50% full, 75% full and 100% full. File references for the photographs must be recorded in the relevant section of the Waste Consignment Information Form (Reference: WSC-FOR-WCI).

Photographic records are not required for *Disposal Containers* containing only *Supercompacted* pucks.

L4.9 Transport Regulations

Waste must be *Consigned* for treatment or disposal in accordance with the latest edition of IAEA SSR-6 (Regulations for the Safe Transport of Radioactive Material), as required by SI 2009 No 1348 – The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment (Amendment) Regulations 2011 (known as the CDG Regulations), and the European agreement "Accord européen relatif au transport international des marchandises dangereuses par route" (known as the ADR) and RID (Regulations concerning the International Carriage of Dangerous Goods by Rail) under one of the following classifications:

- Excepted Package;
- Low Specific Activity material (LSA I, LSA II);
- LSA III (subject to confirmation of a *Leach Test* using a method agreed with *LLW Repository Ltd*);
- Surface Contaminated Object (SCO I or SCO II).

Customers are responsible for ensuring compliance with the transport regulations and the Certificate of Approval for the specific Container Design including the requirements of any associated Packing and Handling Instructions.

In addition, any *Waste Consignment* or *Disposal Container* that does not, in its own right, comply with the requirements of the current transport regulations and requires additional shielding or an overpack to achieve compliance may be accepted for disposal but only on approval of a Waste Consignment Variation Form (Reference: WSC-FOR-WCV) and an authorised *Operational Concession* (RSF 6.18.02_07) by *LLW Repository Ltd*.

L4.10 Transport of Fissile Radionuclides

Waste transported in IP-2 containers may contain very low quantities or very low concentrations of fissile radionuclides when classified as Fissile Excepted Packages. In order to use the Fissile Excepted Package classification, one of the fissile exemption criteria in the Transport Regulations must be satisfied and the justification documented.

Note that the fissile excepted criteria do not always align with the criteria for Fissile Radionuclides in L3.3.

Customers must contact *LLW Repository Ltd* for advice if they intend to *Consign* waste to *LLW Repository Ltd* that contains fissile radionuclides above the fissile excepted criteria, prior to loading waste.

Customers must ensure they fulfil the requirements of both these *Waste Acceptance Criteria* and the Transport Regulations when *Consigning* fissile radionuclides to *LLW Repository Ltd*.

L4.11 Part Loads

A *Waste Consignment* may not be *Consigned* to *LLW Repository Ltd* if sent as a part-load with other materials that are not *Low Level Waste* on the same vehicle.

L4.12 Site Rules and Instructions

When delivering waste to *LLW Repository Ltd* for disposal, the customer's representatives must observe the site rules and instructions at the *Low Level Waste Repository*.

3 Glossary

Active Particle means a particle in the size range of 0.6 to 2.0 mm of high-specific activity material such that a single particle could bear of the order of 1 MBq or more of alpha-emitting radionuclides or 0.01 MBq or more of radium-226. This implies a fragment of a high-activity material, typically more than about 100 MBq/g of most alpha-emitting radionuclides or 10 MBq/g of radium-226. Examples of *Active Particles* include fragments of Admiralty specification radium-sulphide paint, fragments of irradiated nuclear fuel (especially PWR, MOX or highly-enriched uranium fuels) or plutonium.

Activity, expressed in Becquerels, means the number of spontaneous nuclear transformations occurring in a period of one second.

Best Available Techniques means the latest stage of development (state of the art) of processes, of facilities or of methods of operation which indicate the practical suitability of a particular measure for limiting discharges, emissions and waste. In determining whether a set of processes, facilities and methods of operation constitute the *Best Available Techniques* in general or individual cases, special consideration shall be given to:

- Comparable processes, facilities or methods of operation which have recently been successfully tried out;
- Technological advances and changes in scientific knowledge and understanding;
- The economic feasibility of such techniques;
- Time limits for installation in both new and existing plants; and
- The nature and volume of the wastes concerned.

"Techniques" include both the technology used and the way in which the installation is designed, built, maintained, operated and dismantled.

Biodegradation Voidage for the purpose of disposals at the *Low Level Waste Repository* is taken as equal to the total volume of paper, cardboard, cotton, *Putrescible Materials* and other readily degradable materials including vegetative plant materials (for example moss and algae). It excludes, for this purpose, wood and man-made polymers such as plastics and resins. *Biodegradation Voidage* is to be calculated based on the *Internal Volume* of the *Disposal Container*.

Bulk Chemical Compound means discrete (>1kg mass) specific purposeful accumulations in one space of (typically) manufactured salts of elemental combinations, usually having anionic and cationic components.

Complexing Agents means all organic or inorganic ligands, whether mono-, di-, tri- or poly-dentate in mode of action. *Chelating Agents* means di-, tri- or poly-dentate *Complexing Agents* only (i.e. excludes mono-dentate complexing agents).

Compression Voidage means the volume reduction that would occur in any materials present in the waste, other than those materials considered within *Biodegradation Voidage*, under applied loads of up to 400 kN/m^2. If the degree of compression under an applied load of 400 kN/m^2 is not known, the total volume of such materials shall be assumed as *Compression Voidage*. Examples of materials with significant *Compression Voidage* include unconditioned powders such as incinerator ash and soft wastes if present in very minor quantities because they cannot reasonably

practicably be treated as *Supercompactable Waste*. When assessing *Compression Voidage*, consideration should be given to the settlement of any soil disposed of within the *Disposal Container*. *Compression Voidage* is to be calculated based on the *Internal Volume* of the *Disposal Container*.

Consign, in the context of waste, means to transfer waste to *LLW Repository Ltd* for the purpose of disposal at the *Low Level Waste Repository.* ***Consigned, Consigning*** and ***Consignment*** have the corresponding meaning.

Decay Products means those radionuclides succeeding another radionuclide in the radioactive decay chain in which both, or all, occur.

Discrete Item means a distinct item of waste that, by its characteristics, is recognisable as unusual or not of natural origin and could be a focus of interest, out of curiosity or potential for recovery and recycling/re-use of materials, should the waste item be exposed after repository closure.

Examples of *Discrete Items* are:

- Hand tools, engineered items and equipment of durable materials;
- Grouted drums of waste;
- Large metal items, e.g. steel beams and plates, pipework, shielding, heavy equipment and flasks (but not general scrap metal).

Disposal Container(s) means those containers, as defined in L4.1, which are approved for use to *Consign* a *Waste Consignment* to the *Low Level Waste Repository* for disposal.

Double Wrapped means wrapped twice in 1000-gauge polythene, each layer of which is securely sealed with 50mm heavy-duty adhesive tape.

Environmental Permit means the *Environmental Permit* for the *Low Level Waste Repository* (Reference: EPR/YP3293SA) issued under the Environmental Permitting (England and Wales) Regulations 2010 by the Environment Agency.

Explosive means substances and preparations which may explode under the effect of flame or which are more sensitive to shocks or friction than dinitrobenzene.

Free Liquid means any liquid which is present as a separate phase including liquid which is physically absorbed onto a solid matrix rather than chemically combined.

Hazardous Substance(s) means any substance or group of substances that are toxic, persistent and liable to bioaccumulate. Further details can be found at the Joint Agencies Groundwater Directive Advisory Group (JAGDAG) website.

Hazardous Waste(s) means wastes categorised as *Hazardous Wastes* under European Council Directive 91/689/EEC. Guidance on the classification of *Hazardous Wastes* can be found in Technical Guidance WM3: Guidance on the classification and assessment of waste, environment agencies, 1st Edition 2015 (or as amended).

Inaccessible Voidage means the voidage within a *Disposal Container*, including within the waste, which will not be readily penetrated by grout during the conditioning process prior to disposal at the *Low Level Waste Repository*. Examples of *Inaccessible Voidage* include voidage within wrapped items, cavities within pumps and scaffolding poles, and void space within sealed containers. *Inaccessible Voidage* can also be significantly influenced by the loading of the *Disposal Container*, including wrapped items and soil that can hinder grout access to other wastes. *Inaccessible Voidage* is to be calculated based on the *Internal Volume* of the *Disposal Container*.

Internal Volume means the accessible space, in m^3, within a *Disposal Container*, used for the purposes of assessing volumetric concentrations of materials in accordance with the *Waste Acceptance Criteria*. This is given in Table 4.1, Column C, for approved *Disposal Containers*.

Ion Exchange Material means any material, whether synthetic or naturally occurring, that has the capability of interchanging ions from one substance to another by means of a reversible chemical or physical process.

Leach Test means a laboratory procedure used to determine the mobility of waste materials.

Low-activity Source means a prepared radioactive source with activity at the time of consignment not greater than specified in L3.2.4. This may include instrument test and calibration sources, which may be commercially produced or produced on any nuclear licensed site. It shall not include radiographic or radiology sources. Nor shall it include luminised items or equipment containing radioactive materials or sources.

LLW Repository Ltd means the waste management company that holds the Site Licence to manage and operate the *Low Level Waste Repository* under contract to the owner of the site, the Nuclear Decommissioning Authority.

Low Level Waste is defined as waste having a radioactive content not exceeding 4 GBq/t of alpha or 12 GBq/t of other activity. For consignment to the *Low Level Waste Repository* it must also comply with the requirements specified in this *Waste Acceptance Criteria* document. It typically includes metals, soil, building rubble and organic materials, which arise principally as lightly contaminated miscellaneous scrap. Metals are mostly in the form of redundant equipment. Organic materials are mainly in the form of paper towels, clothing and laboratory equipment that have been used in areas where radioactive materials are used, such as hospitals, research establishments and the nuclear industry. *Low Level Waste* contains radioactive materials other than those acceptable for disposal with municipal and general commercial or industrial waste.

Low Level Waste Repository means the national low level radioactive waste disposal facility situated near the village of Drigg in West Cumbria.

LSA means radioactive material which by its nature has a limited specific activity, or radioactive material for which limits of estimated average *Specific Activity* apply. *LSA* material shall be in one of three groups, LSA-I, LSA-II or LSA-III.

Man-Made Mineral Fibres means any of a range of inorganic materials made into fine fibres and used for structural strengthening or insulation. Types of *Man-Made Mineral Fibres* include mineral wool (for example rock wool, slag-wool and glass wool), continuous filament, superfine and refractory (or ceramic) *Man-Made Mineral Fibres*.

Non-Hazardous Pollutant means any substance liable to cause pollution other than a *Hazardous Substance*.

Non-radiological Capacity means the total permissible quantity of controlled materials in all *Waste Consignments* in the vaults at the *Low Level Waste Repository* as determined by the Environmental Safety Case. Usage of *Non-radiological Capacity* is controlled by *LLW Repository Ltd* by the allocation of material quantities for individual *Wastestreams*.

Operational Concession is an application to use a package outside of the base licence conditions and to authorise any repair**.**

Overweight Grouted Container(s) means any *Disposal Container* that, prior to being completely filled with grout at the *Low Level Waste Repository*, exceeds the maximum gross weight limit, in tonnes, that can be routinely handled. These containers require additional processing to make them suitable for disposal at the *Low Level Waste Repository*.

Package Volume means the volume represented by the maximum external dimensions of a disposal container. This is the cubic volume calculated from the maximum length, width and height. This is the volume that the container will occupy within the disposal facilities at the *Low Level Waste Repository*. It is used to calculate the volume charge for the Low Level Waste Disposal Service. This is given in Table 4.1, Column D, for approved *Disposal Containers*.

Packing Efficiency means the extent to which the *Internal Volume* in a *Disposal Container* is fully utilised. It is a ratio of the volume of waste to the accessible volume of the container expressed as a percentage. The *Packing Efficiency* is calculated based on the amount of grout required to fill the container at the *Low Level Waste Repository*.

Putrescible Materials means materials liable to be readily decomposed by micro-organisms that may give rise to a health hazard and include animal carcasses and sewage sludge but exclude vegetative plant materials (for example moss and algae), wood and paper.

Radioactive Contaminant means the proportion of the radionuclides in the waste that give rise to it being radioactive. The proportion of *Radioactive Contaminant* in the waste is based on the weight of the radionuclide causing the radioactivity. For most *Low Level Waste* it would be expected that the weight of the radionuclides compared with the weight of the contaminated materials would be very small and certainly less than 10%. For this limit to be excessively exceeded would imply that the radionuclide itself is a significant proportion of the waste, rather than materials contaminated by it. Examples of this are radioactive ores, process streams, and purified product, e.g. depleted uranium.

Radiological Capacity means the total permissible *Activity* of all *Waste Consignments* in the vaults at the *Low Level Waste Repository* as determined by the Environmental Safety Case and taking into account the relative impacts of radionuclides. Usage of *Radiological Capacity* is controlled by *LLW Repository Ltd* by the allocation of *Activity* for individual *Wastestreams*.

Reactive Metals and Materials means those metals and non-metals that react to produce either heat or flammable gases. Non-metals in this context includes minerals such as zeolites.

Small Container means a container used for the disposal of sealed sources in accordance with L3.2.4, such as a clean paint-tin-type container. A minimum container size of 1 litre is recommended. The maximum container size is 15 litres.

Soluble Solids means any solid chemical compound that is indicated as having a soluble or slightly soluble property in cold water (inorganic compounds) and water (organic compounds) in the solubility column of the latest edition of the CRC "Handbook of Chemistry and Physics".

Specific Activity of a *Waste Consignment* means the *Activity* divided by the gross weight of the consignment including both the waste and the *Disposal Container*. The *Specific Activity* in the context of conditioned wastes, including for example *Ion Exchange Materials,* means the *Activity* divided by the weight of the waste, grout and the containment. *Specific Activity* in the context of *Activity* heterogeneity means the *Activity* divided by the weight of the waste items. In accounting for *Activity* against these limits, the *Activity* of *Decay Products* with half-lives of less than three months shall not be accounted for unless they are not in equilibrium or if they form a major proportion of the total *Activity*.

Suitable Solid Matrix means the output of a conditioning process, approved by *LLW Repository Ltd*, to fix liquids or *Soluble Solids* in a form suitable for disposal. Typically, this will involve encapsulation of material in a cement-based grout, though other alternative solutions may be acceptable following approval by *LLW Repository Ltd*.

Suitable Supporting Justification means additional information that may be required to support an application to *Consign* waste to *LLW Repository Ltd* or to seek a variation to the *Waste Acceptance Criteria.* The form of justification required will be dependent upon the nature of the issue to be considered. In some cases, the justification will be in the form of a Best Practicable Environmental Option (BPEO) Assessment, a Best Practicable Means (BPM) Assessment or a *Best Available Techniques* (BAT) Assessment. Advice on the level of justification required should be sought from *LLW Repository Ltd*.

Supercompaction means the application of pressure of at least 20,000 kN/m^2 to reduce the volume of the waste by 30% or more. *Supercompacted* has a corresponding meaning.

Surface Contaminated Object (SCO) means a solid object which is not itself radioactive but which has radioactive material distributed on its surfaces. There are two types SCO-I and SCO-II.

Total Potential Voidage means that voidage that remains after grouting of *Waste Consignments* or that is subsequently formed by waste degradation and settlement which in total might be expected to have a significant effect on the performance of the cap above the wastes. It is the sum of *Inaccessible Voidage*, *Compression Voidage* and *Biodegradation Voidage*.

UK Radioactive Waste Inventory means the data published by the Nuclear Decommissioning Authority and Department of Energy and Climate Change that describes the stocks and predicted future amounts of radioactive waste and radioactive materials in the UK. The latest issue will be used for radiological and *Non-radiological Capacity* management.

Volumetric Capacity means the total disposal volume in the vaults at the *Low Level Waste Repository* as assumed by the Environmental Safety Case. Usage of *Volumetric Capacity* is controlled by *LLW Repository Ltd* by the allocation of disposal volume for individual *Wastestreams*.

Waste Acceptance Criteria means the requirements set out in this document and the Waste Acceptance Criteria Overview (Reference: WSC-WAC-OVR) and relevant Statutory Regulations applicable to the customer in respect of the transport, treatment and disposal of *Low Level Waste*.

Waste Consignment means one *Disposal Container* and its contents of waste and packaging with a maximum external volume of 40 m^3, received from a single customer on one road or rail vehicle as specified in the Waste Consignment Information Form (Reference: WSC-FOR-WCI).

Waste Emplacement Strategy means operational practices during emplacement of *Waste Consignments* in the vaults at the *Low Level Waste Repository* in order to ensure compliance with operational and safety requirements. Examples include the need to limit *Total Potential Voidage* in order to limit waste settlement and the need to exclude *Waste Consignments* from upper stack positions in the vaults if the levels of certain specified radionuclides exceed defined criteria.

Wastestream means waste or a collection of waste items at a particular site, usually in a particular facility and/or from particular processes or operations. It is often distinguishable by its radionuclide content and in many cases also by its physical and chemical characteristics. Whilst the characteristics of individual *Waste Consignments*, and components within *Waste Consignments*, may vary from the *Wastestream* average values, the overall nature of the *Wastestream* over its lifetime should be represented by the information and data provided in Waste Characterisation documents (Reference WSC-FOR-WCH) and in the *UK Radioactive Waste Inventory*.