



The management of higher activity radioactive waste on nuclear licensed sites

Overview and glossary

Joint guidance from the Health and Safety Executive, the Environment Agency and the Scottish Environment Protection Agency to nuclear licensees

February 2010

Introduction

The Health and Safety Executive (HSE), the Environment Agency and the Scottish Environment Protection Agency (SEPA) (together referred to as 'the regulators') have issued jointly a suite of guidance documents under the heading 'the management of higher activity radioactive waste on nuclear licensed sites'. This document gives an oversight of the complete suite of documents and includes the common glossary.

Audience for the guidance

The guidance is directed at nuclear site licensees unless otherwise specified.

The guidance has been written such that it can also inform a wide range of other stakeholders; other persons or companies working on nuclear licensed sites; national and local government bodies; and any other interested individuals or groups.

The guidance will be used by the regulators to assist in undertaking assessment of licensees' proposals and plant as part of normal regulatory activities.

Scope

The guidance covers the management of higher activity radioactive waste on nuclear licensed sites. In this context:

- Management of radioactive waste means the whole process of managing waste from its generation to (but not including) its disposal.
- Higher activity radioactive waste means HLW, ILW, and such LLW as cannot be disposed of at present. If there is doubt over how to regard a particular waste stream, the owner of that waste stream should consult the regulators.

Policies for the disposal of higher activity radioactive waste differ in Scotland and in England/Wales. We consider that packages conditioned in anticipation of geological disposal are also suitable for long-term storage, as required by government policy in Scotland. On this basis the following guidance can be used equally in England, Scotland and Wales, but any references to geological disposal will mean long-term storage when applied to Scotland. We will keep the packaging advice being developed by the Nuclear Decommissioning Authority's (NDA's) Radioactive Waste Management Directorate (RWMD) under review and if any developments mean that this assertion is no longer valid, we will provide further guidance.

Relationship to legislation and other guidance

Nuclear Installations Act 1965 and Radioactive Substances Act 1993

Management of radioactive waste on nuclear licensed sites is regulated by conditions attached to nuclear site licences granted under the Nuclear Installations Act 1965.

The primary role of the Environment Agency and SEPA in the regulatory process covered by this guidance is to advise HSE on the long-term protection of the public and the environment. Some conditions attached to authorisations under the Radioactive Substances Act 1993 also apply to on-site management – for example requirements relating to waste minimisation and the long-term disposability of conditioned waste.

In England and Wales, it is anticipated that radioactive substances regulation will be incorporated into the Environmental Permitting Regulations (EPR) from April 2010. This legislative change will not affect the applicability of this guidance and references to RSA93 can be taken to include the EPR.

Government maintains and continues to develop a policy and regulatory framework, which ensures that:

- radioactive wastes are not unnecessarily created;
- such wastes as are created are safely and appropriately managed and treated;
- they are then safely disposed of at appropriate times and in appropriate ways.

The fundamental aim is to ensure that radioactive waste is managed in a way that protects the health and interests of people and the integrity of the environment, both now and in the future, inspires public confidence and takes account of costs.

The Government requires that the regulators ensure that the policy and regulatory framework is properly implemented in accordance with their statutory powers. Within the framework, the producers and owners of radioactive waste are responsible for developing their own waste

management strategies, consulting the Government, regulatory bodies and disposal organisations as appropriate.

In managing radioactive waste it is also necessary to consider future legislative requirements, in particular where current management may affect future authorisations or permits for disposal.

The intent of the guidance is to advise licensees how the requirements of both safety and environmental legislation can be met.

Safety Assessment Principles and Environmental Principles

HSE's Safety Assessment Principles and the Environment Agency's Radioactive Substances Regulation Environmental Principles each set out the basic principles supporting their respective permissioning activities. The Joint Guidance takes account of these documents and aims to support and, where appropriate, expand on them with guidance compatible with both.

International Standards

During their production, the modules of the Joint Guidance have been benchmarked against the key international standards that, under international treaties and agreements, the UK is committed to implementing. In particular, the guidance has been written to ensure that the following standards are covered:

- IAEA safety requirements 'predisposal management of radioactive waste'; and
- WENRA safety reference levels for storage of radioactive waste.

Status

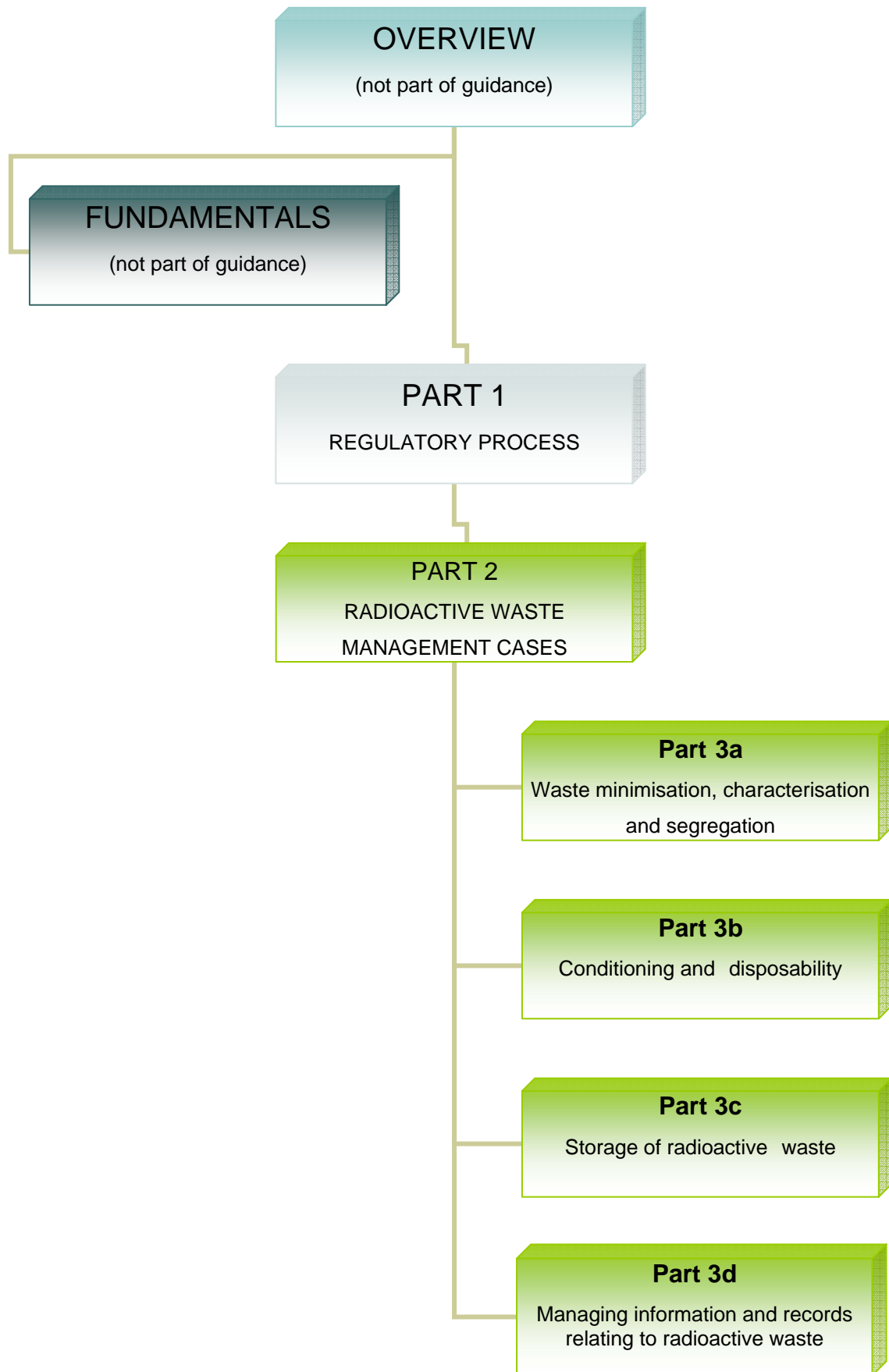
Nuclear site licensees who follow this guidance will normally be doing enough to comply with the relevant law as interpreted by the regulators at the time of writing, and the regulators may refer to this guidance as illustrating relevant good practice. However, licensees are not required to follow this guidance and compliance with it does not automatically mean that we will approve an application for a nuclear site licence, a consent or agreement under the licence, or an authorisation.

The guidance provides information to other parties who may be stakeholders in how radioactive waste is managed on a nuclear licensed site.

Given the long timescales involved in radioactive waste management, you should be aware that standards, legislation and national policy might change. While this guidance forms the best advice that the regulators can give at present, nothing in this guidance overrides, or is intended to pre-empt, the ability of the regulators to discharge their statutory powers and duties in accordance with legislation, standards and policy applicable at any time.

We will review this guidance periodically to ensure that it continues to provide sound advice.

The Joint Guidance suite of documents



Fundamentals

In producing guidance to nuclear site licensees on the management of higher activity radioactive wastes, the regulators received comments that it would be useful to have an introductory document explaining the context of radioactive waste management.

The fundamentals document aims to fulfil that role by explaining:

- what radioactive waste is;
- what happens to radioactive waste;
- who is involved in radioactive waste management;
- what their roles are; and
- how radioactive waste management is regulated.

The fundamentals document does not form part of the guidance.

Part 1 – Regulatory process

The objective of Part 1 is to explain the regulatory process associated with the management of higher activity radioactive waste on nuclear licensed sites in the UK.

The main aims are to:

- provide a comprehensive source of information that can be used by nuclear site licensees and the regulators' staff, and referred to by other stakeholders; and
- advise licensees on how to obtain regulatory acceptance of their proposals for radioactive waste management.

Part 2 – Radioactive waste management cases

This guidance describes regulatory expectations with respect to the production, content, maintenance and review of radioactive waste management cases (RWMCs) as described in Part 1, and provides links to Part 3 guidance on the contents that are expected to be covered by a RWMC or in its supporting documentation.

A RWMC should provide in transparent summary form how the key elements of long-term safety and environmental protection will be delivered for the management of the waste stream or streams covered.

Part 3 – Technical guidance

Part 3a	Waste minimisation, characterisation and segregation
Part 3b	Conditioning and disposability
Part 3c	Storage of radioactive waste
Part 3d	Managing information and records relating to radioactive waste

The objective of these documents is to provide guidance on complying with legislation by:

- describing regulatory expectations in relation to their subject matter; and
- indicating how a RWMC case that adequately covers the subject matter may be produced.

Glossary

Where possible, in the Joint Guidance documentation the following standard definitions have been taken from:

IAEA – from the IAEA Safety Glossary

UK LLW Policy – Policy for the Long Term Management of Solid Low Level Radioactive Waste in the United Kingdom*

Archive a facility specifically identified, equipped and resourced to store records which have been selected for long-term preservation due to their continuing value as evidence of the work of the creating organisation.

As low as reasonably achievable (ALARA) see 'optimisation'.

As low as reasonably practicable (ALARP) see 'optimisation'.

Avoidance (waste) the first step of the waste hierarchy, which states that the production of waste should be avoided, in particular waste that cannot be managed using current techniques or techniques under development.

Best available techniques (BAT) see 'optimisation'.

Best practicable means (BPM) see 'optimisation'.

Best practicable environmental option (BPEO) see 'optimisation'.

British radwaste information management system a database and client application used to record data and information about unconditioned radioactive waste, waste packages and waste management facilities.

Characterisation determination of the nature and activity of radionuclides present in a specified place. Characterisation of radioactive waste involves determining its physical, chemical and radiological properties. It may be carried out in association with several of the other basic steps, such as during segregation. It may be required for record keeping, moving waste between steps and also to determine the best method of managing waste.

Conditioning those operations that produce a waste package suitable for handling, transport, storage and/or disposal. Conditioning may include the conversion of the waste to a solid waste form, enclosure of the waste in containers and, if necessary, provision of an overpack. Conditioning involves transforming radioactive waste into a form suitable for handling, transportation, storage and disposal. This may include immobilisation of radioactive waste, placing waste into containers and providing additional packaging. Common immobilisation methods include solidification of LLW and ILW liquid radioactive waste, for example in cement, and vitrification of HLW in a glass matrix. Immobilised waste may be placed in steel drums or other engineered containers to create a waste package.

Context the qualitative element of a record that enables a reader to accurately interpret and use 'raw' data. This qualitative element should not be confused with metadata (see below). In general terms, raw data when combined with relevant context can be regarded as information.

Data are numbers, words or images that have yet to be organised or analysed to answer a specific question. Data in their raw form are likely to have little value to uninformed recipients because their unique relevance to an event cannot be determined when viewed in isolation.

Disposal (for the purpose of this guidance) is the emplacement of waste in a specialised land disposal facility without intent to retrieve it at a later time; retrieval may be possible but, if intended, the appropriate term is storage. We shall regard the time of emplacement as the time of disposal, even if the facility is eventually closed many years later.

Disposability is the compatibility of conditioned waste with the standards necessary for eventual disposal in a specialised land disposal facility. It requires the conditioned waste to maintain its integrity so as to achieve safe and efficient storage, handling, transport and disposal.

Exempt (from regulatory control) waste waste below the lower activity limit for LLW, below which waste is not required to be subject to specific regulatory control. Exempt waste includes:

- for certain natural radionuclides in the uranium and thorium decay chains, the levels specified in Schedule 1 of RSA93, below which the substances are outside the scope of the Act; and

- for artificial or man-made radionuclides, the levels laid down in the current suite of Exemption Orders issued under RSA93, below which controls additional to those specified in the Exemption Order are not required. The most notable of these is the Substances of Low Activity (SoLA) Exemption Order. This specifies a level for exemption from regulatory control of 0.4 becquerels (Bq)/g for wastes which are substantially insoluble in water. (Different exemption thresholds may apply for the transport of radioactive waste.)

Geological disposal facility a long-term management option involving the disposal of radioactive waste in an engineered underground facility, where the geology (rock structure) provides a barrier against escape of radioactivity and where the depth, taken in the particular geological context, substantially protects the waste from disturbances arising at the surface. Such disturbances include those produced by weather and climate change and by people. In this context, 'depth' could imply horizontal as well as vertical distance – for example, in the case of a disposal facility sited deep within a mountain. A geological disposal facility is a facility that meets the requirements for geological disposal. Such a facility could be entirely on land or could be constructed under the seabed but accessed from land.

Higher activity radioactive waste means HLW, ILW, and such LLW as cannot be disposed of at present. If there is doubt over how to regard a particular waste stream, the owner of that waste stream should consult the regulators.

High level waste or heat-generating waste radioactive waste that is sufficiently radioactive that the decay heat significantly increases its temperature and the temperature of its surroundings. Typical characteristics of high-level waste are thermal power above about 2 kW/m³. The radioactive liquid containing most of the fission products and actinides present in spent fuel – which forms the residue from the first solvent extraction cycle in reprocessing – and some of the associated waste streams; this material following solidification; spent fuel (if it is declared a waste); or any other waste with similar radiological characteristics.

Immobilise/ed conversion of waste into a waste form by solidification, embedding or encapsulation. Immobilisation reduces the potential for migration or dispersion of radionuclides during handling, transport, storage and/or disposal.

Information is produced through processing, manipulating and organising data to answer questions, adding to the knowledge of the receiver.

Information management an active process where specific actions (over and above those associated with records management) are undertaken to ensure information can be accessed, interpreted and understood by a user. The principal objective is to ensure meaningful information is communicated, rather than simply preserving the recording media.

Institutional control control of a radioactive waste site by an authority or institution designated under the laws of a state. This control may be active (monitoring, surveillance, remedial work) or passive (land use control) and may be a factor in the design of a nuclear facility (eg near-surface repository).

Integrated waste strategy is an overview of the approach to the current and future management of all wastes generated on or received by sites. It should integrate and optimise all waste-related activities on a site ranging from operational activities through to decommissioning activities and wastes arising from contaminated land management. This includes demonstration that the waste can be appropriately managed at the time and rate at which it will arise.

ILW (intermediate level waste) radioactive waste with radioactivity levels exceeding the upper boundaries for low-level waste, but which does not require heating to be taken into account in the design of storage or disposal facilities. IAEA guidance is that ILW thermal power is below about 2 kW/m³.

Knowledge is what is known by a person or persons. Involves interpreting information received, adding relevance and context to clarify the insights the information contains. Current and future generations of waste custodians will have to acquire and develop their knowledge in order to safely manage radioactive waste.

Licence condition a condition attached to a licence issued under the Nuclear Installations Act 1965.

LLW low level waste. Radioactive waste having a radioactive content not exceeding 4 gigabecquerels per tonne (GBq/te) of alpha or 12 GBq/te of beta/gamma activity.

LLWR low-level waste repository.

LoC letter of compliance.

Minimisation the process of reducing the amount and activity of radioactive waste to a level as low as reasonably practicable (ALARP) at all stages, from the design of a facility or activity to decommissioning, by reducing waste generation and by means such as recycling and reuse and treatment, with due consideration for secondary as well as primary waste. Minimisation of waste is fundamental good practice in radioactive waste management. It should be considered during the design of facilities and applied during all of the basic steps of managing waste, for example during segregation and processing. Effective methods of minimising the accumulation of radioactive waste include the clearance of waste that is exempt from regulatory control and the reuse or recycling of radioactive material.

Management of radioactive waste see 'radioactive waste management'.

Metadata are 'data about data'. Metadata enables a resource to be found by indicating what the resource is about and how it can be accessed with a series of structured descriptions.

Nuclear Decommissioning Authority a non-departmental public body set up, under the Energy Act 2004, by the Government in 2005 with a vision to ensure the safe, accelerated and affordable clean-up of the UK's civil nuclear legacy.

Pretreatment any or all of the operations prior to waste treatment, such as collection, segregation, chemical adjustment and decontamination.

Optimisation is the process by which the management option is selected, and the practices applied, that best meet the full range of relevant health, safety and environmental principles and criteria taking into account all relevant (e.g. social and economic) factors. Different regulatory regimes use different terminology and have their own guidance on this topic, ie reducing risks to ALARP, best practicable environmental option (BPEO), use of best practicable means (BPM) and use of best available techniques (BAT). (In statutory guidance the Environment Agency is required to ensure that BAT is applied in place of the current techniques of BPM and best practicable environmental option (BPEO). It also states that operators who currently meet the requirements of BPM and BPEO will satisfy the current requirements of BAT.) However, all of the above involve the same process, ie making a judgement between options by comparing benefits in terms of safety/environmental protection and costs in terms of time, effort or money.

Optioneering an appraisal of a range of possible options for achieving a specified objective.

Overpack a secondary (or additional) outer container for one or more waste packages, used for handling, transport, storage and/or disposal.

Passive safety providing and maintaining a safety function by minimising the need for active safety systems, monitoring or prompt human intervention.

Radioactive waste management the whole process of managing waste from its generation to (but, for the purposes of this guidance, not including) its disposal.

Radioactive waste management case a RWMC comprises document(s) that demonstrate the longer term safety and environmental performance of the planned management of specific wastes from its generation to its conditioning into the form in which it will be suitable for storage and (in England and Wales) eventual disposal. It should provide a complete picture of the management of waste streams that cannot necessarily be seen from examination of the individual plant safety cases.

Record in the context of this document, a record is the means used to store documented data or information. A record can exist in a number of forms, some of which allow direct access to the information (for example, a photograph), while for others some type of processing will be necessary (for example, a computer file). Defined as 'Recorded information, regardless of media or format, created or received in the course of individual or organisational activity, which provides evidence of policy, actions and decisions' in finding a balance.

Records management the function of creating, organising and maintaining records to ensure they provide evidence of activity, decision-making and policy. It includes the establishment of links between related records, swift and accurate filing and accessibility when required and scheduled destruction or transfer to an archive as appropriate in a timely fashion.

Safety cases documentation to substantiate the safety, including the identification of the conditions and limits necessary in the interests of safety, of proposals to construct or install new plant, to modify the design of plant under construction, commission plant, or to modify or conduct tests on existing plant.

Segregation an activity where types of waste or material (radioactive or exempt) are separated or are kept separate on the basis of radiological, chemical and/or physical properties, to facilitate waste handling and/or processing.

Storage the holding of radioactive sources, spent fuel or radioactive waste in a facility that provides for their/its containment, with the intention of retrieval. Storage of radioactive waste may take place at any stage in the radioactive waste management process and aims to isolate the radioactive waste and protect people and the environment from the hazards presented by the waste, while keeping the waste in a controlled state that will ultimately make it amenable to safe disposal. Storage may be used to make the next step in the management process more straightforward, or to act as a buffer between or within steps. Waste might be stored for many years before it undergoes further processing and disposal. Some storage facilities are located with a nuclear power plant or a licensed disposal facility; others are separate facilities.

Treatment operations intended to benefit safety and/or economy by changing the characteristics of the waste. Three basic treatment objectives are:

- volume reduction;
- removal of radionuclides from the waste; and
- change of composition.

Typical treatment operations include incineration or compaction of dry solid waste or organic liquid wastes (volume reduction), filtration or ion exchange of liquid waste (radionuclide removal) and precipitation or flocculation of chemical species (change of composition).

VLLW very low-level waste. In the case of low volumes ('dustbin disposal'), this is categorised as low-volume VLLW:

Radioactive waste which can be safely disposed of to an unspecified destination with municipal, commercial or industrial waste ('dustbin disposal'), each 0.1 m³ of waste containing less than 400 kilobecquerels (kBq) of total activity or single items containing less than 40 kBq of total activity. For wastes containing carbon-14 or hydrogen-3 (tritium):

- in each 0.1 m³, the activity limit is 4000 kBq for carbon-14 and hydrogen-3 (tritium) taken together; and
- for any single item, the activity limit is 400 kBq for carbon-14 and hydrogen-3 (tritium) taken together.

Controls on disposal of this material, after removal from the premises where the wastes arose, are not necessary.

Waste container the vessel into which the waste form is placed for handling, transport, storage and/or eventual disposal; also the outer barrier protecting the waste from external intrusions. The waste container is a component of the waste package.

Waste form the physical and chemical form of the waste, in particular used to refer to the waste after treatment and/or conditioning (resulting in a solid product) prior to packaging. The waste form is a component of the waste package.

Waste generation (waste creation) occurs during the operation and decommissioning of nuclear facilities. Waste generation can give rise to solid, liquid and/or gaseous wastes.

Waste management hierarchy (waste hierarchy) the waste management hierarchy encourages the adoption of options for managing waste in the following order of priority: avoid; prepare for reuse; recycle; other recovery (eg energy recovery); dispose.

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

Acronyms

ALARA	As low as reasonably achievable
ALARP	As low as reasonably practicable
BAT	Best available techniques
BPM	Best practicable means
BPEO	Best practicable environmental option
Bq	Becquerel
BRIMS	British Radwaste Information Management System
CoRWM	Committee on Radioactive Waste Management
EA	Environment Agency
GDF	Geological disposal facility
HLW	High-level waste
HSW Act	Health and Safety at Work Act 1974
HSE	Health and Safety Executive
IAEA	International Atomic Energy Agency
ILW	Intermediate level waste
IWS	Integrated waste strategy
LC	Licence condition
LLW	Low-level waste
NDA	Nuclear Decommissioning Authority
NDA(RWMD)	Radioactive Waste Management Directorate of NDA
NII	Nuclear Installations Inspectorate
OLC	Operational limits and conditions
OCNS	Office for Civil Nuclear Security
PIE	Postulated initiating events
PSR	Periodic Safety Review
RSA93	Radioactive Substances Act 1993
RWMC	Radioactive waste management case
SAPs	Safety Assessment Principles.
SEPA	Scottish Environment Protection Agency
SoLA	Substances of Low Activity
SSSCs	Safety Structures, Systems and Components
VLLW	Very low-level waste
WAC	Waste Acceptance Criteria
WENRA	Western European Nuclear Regulator's Association.
WMO	Waste management organisation