Department for Business, Energy & Industrial Strategy

Nuclear Decommissioning Authority

Radioactive Wastes in the UK:

Summary of Data for International Reporting

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2016 UK RADIOACTIVE WASTE & MATERIALS INVENTORY: SUMMARY OF DATA FOR INTERNATIONAL REPORTING

Report prepared for the Department for Business, Energy & Industrial Strategy (BEIS) and the Nuclear Decommissioning Authority (NDA)
by Pöyry Energy Limited and Amec Foster Wheeler plc.

PREFACE

The 2016 United Kingdom Radioactive Waste & Materials Inventory (the 2016 Inventory) provides detailed information on radioactive wastes and materials in the United Kingdom (UK). It is produced by the Department for Business, Energy & Industrial Strategy (BEIS) and the Nuclear Decommissioning Authority (NDA).

The 2016 Inventory provides information on radioactive waste stocks (at 1 April 2016) and forecasts of future waste arisings. Information on radioactive materials that may be classed as waste in the future is also presented. The 2016 Inventory aims to provide data in an open and transparent manner for those interested in radioactive wastes and materials.

Information collected for the 2016 Inventory is presented in a suite of five reports:

- Summary Brochure
- Context and Methodology
- UK Radioactive Waste Inventory
- Radioactive Materials Not Reported
- Summary for International Reporting

All documents have been prepared using information supplied to the 2016 Inventory contractors, Pöyry Energy and Amec Foster Wheeler. This information was verified in accordance with arrangements established by Pöyry Energy and Amec Foster Wheeler.

This report presents summary information in support of the UK's international reporting obligations on radioactive waste and nuclear materials.

Conditions of Publication

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Feedback

We welcome feedback on the content, clarity and presentation of the UK Inventory reports. Please do not hesitate to contact us if you would like to provide feedback or if you would like further information about radioactive waste issues:

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GLOSSARY

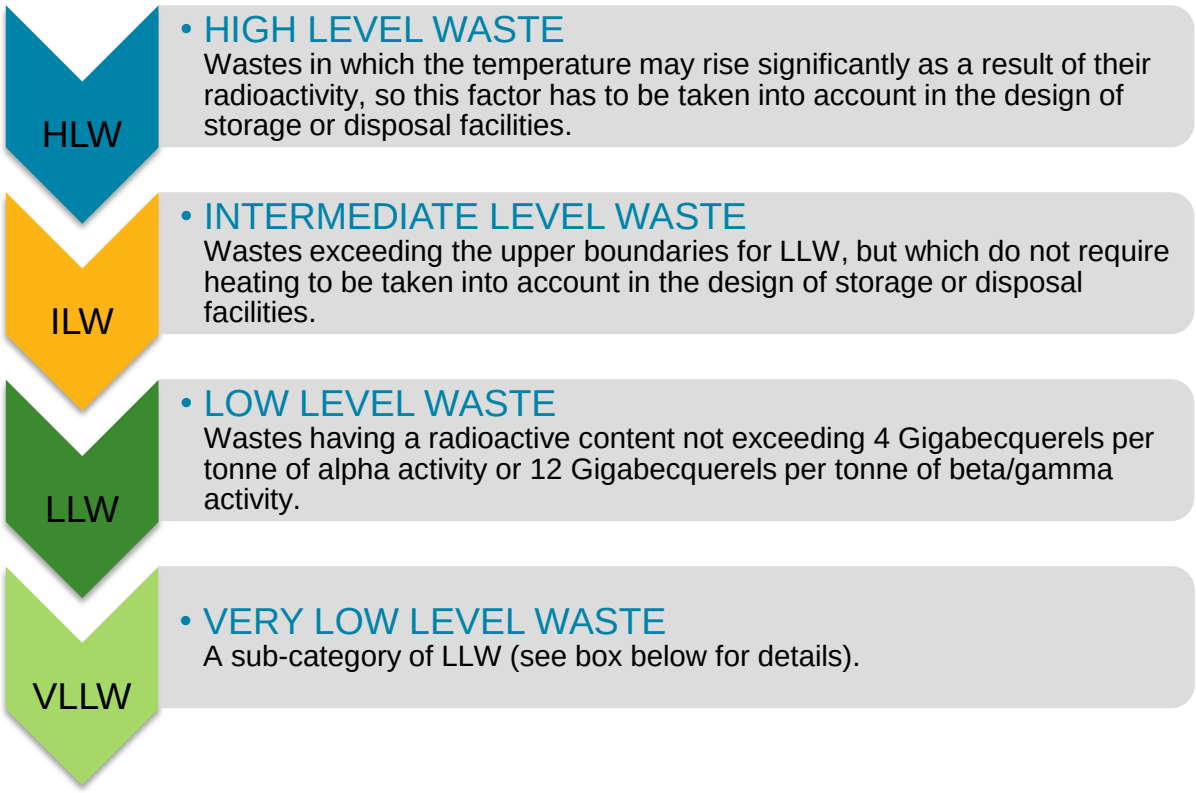
A ▸	**AGR**	Advanced Gas-cooled Reactor.
B ▸	**Becquerel (Bq)**	The standard international unit of measurement of radioactivity – corresponding to one disintegration per second (see also kBq, MBq and GBq).
	BEIS	The Department for Business, Energy & Industrial Strategy is a ministerial department that brings together responsibilities for business, industrial strategy, science, innovation, energy, and climate change.
D ▸	**DFR**	Dounreay Fast Reactor (shut down in 1977).
E ▸	**ENSREG**	European Nuclear Safety Regulators Group.
	EU	European Union.
G ▸	**GBq**	Gigabecquerel (equal to 1,000,000,000 Becquerels).
H ▸	**HLW**	High Level Waste.
I ▸	**IAEA**	International Atomic Energy Agency.
	ILW	Intermediate Level Waste.
K ▸	**kBq**	Kilobecquerel (equal to 1,000 Becquerels)
L ▸	**LLW**	Low Level Waste.
	LLWR	Low Level Waste Repository. The LLWR, south of Sellafield in Cumbria, has operated as a national disposal facility for LLW since 1959.
M ▸	**Magnox**	An alloy of magnesium used for fuel element cladding in natural uranium fuelled gas-cooled power reactors, and a generic name for this type of reactor.
	MBq	Megabecquerel (equal to 1,000,000 Becquerels).
N ▸	**NDA**	Nuclear Decommissioning Authority. A non-departmental public body responsible for overseeing the decommissioning and cleanup of 17 of the UK's civil public sector nuclear sites.
	NEA	Nuclear Energy Agency.
	NORM	Naturally Occurring Radioactive Material. These are materials that typically accumulate as scale on pipework during the extraction of oil and gas, and have raised levels of naturally occurring radioactivity.
O ▸	**OECD**	Organisation for Economic Co-operation and Development.
P ▸	**PFR**	Prototype Fast Reactor (at Dounreay site; shut down in 1994).
	PWR	Pressurised Water Reactor.
S ▸	**SGHWR**	Steam Generating Heavy Water Reactor (at Winfrith site; shut

		down in 1990).
T ▸	**Thorp**	Thermal Oxide Reprocessing Plant (at Sellafield site).
V ▸	**VLLW**	Very Low Level Waste.
W ▸	**WAGR**	Windscale Advanced Gas-cooled Reactor (at Sellafield site; shut down in 1981).

1 INTRODUCTION

1.1 UK categories of radioactive waste

In the UK radioactive wastes are classified in terms of the nature and quantity of radioactivity they contain and their heat-generating capacity:



Very Low Level Waste comprises:

- *High Volume VLLW (bulk disposals) – wastes with maximum concentrations of 4MBq (megabecquerels) per tonne of total activity that can be disposed to specified landfill sites. There is an additional limit for tritium in wastes containing this radionuclide.*
- *Low Volume VLLW ('dustbin loads') - wastes that can be safely disposed of to an unspecified destination with municipal, commercial or industrial waste, each 0.1 cubic metre of material containing less than 400 kBq (kilobecquerels) of total activity, or single items containing less than 40k Bq of total activity. There are additional limits for carbon-14 and tritium in wastes containing these radionuclides.*

The principal difference between the two categories of VLLW is the need for controls on the total radioactivity and volumes of High Volume VLLW that can be disposed of at any one particular landfill site[1].

[1] *The Environment Agency has issued permits to the operators of certain landfill sites for the disposal of LLW with an activity of up to 200 MBq per tonne.*

1.2 The Inventory

An inventory of radioactive waste in the UK is compiled periodically by the Department for Business, Energy & Industrial Strategy (BEIS) and the Nuclear Decommissioning Authority (NDA).

The inventory provides up-to-date information about radioactive waste to:

- Enable the UK to meet international reporting obligations;
- Inform policy and strategy development;
- Aid radioactive waste and material management planning; and
- Support stakeholder engagement.

The 2016 UK Radioactive Waste & Materials Inventory (the 2016 Inventory) is the latest public record on the sources, quantities and properties of radioactive waste and materials in the UK at 1 April 2016 and predicted to arise after that date.

The 2016 Inventory includes detailed numerical and descriptive information for over 1,300 waste and material streams. Estimates of future arisings have been based on assumptions around the nature and scale of radioactive waste and material producer operations and activities. These forecasts may change due to policy, commercial, technological or regulatory reasons.

The 2016 Inventory includes HLW, ILW, LLW, and some High Volume VLLW where there is reasonable certainty of the total waste arisings.

The 2016 Inventory includes information on quantities of spent nuclear fuel and nuclear materials (plutonium, uranium and thorium) in the UK. This information informs the development of management strategies and the planning of systems and facilities for managing radioactive materials for the UK.

The 2016 Inventory does not include:

- Liquid and gaseous wastes containing very low concentrations of radioactivity that are routinely discharged to the environment in accordance with statutory regulations;
- Small quantities of solid wastes with very low concentrations of radioactivity typically from hospitals, universities and the non-nuclear industry (small users) that can be disposed of with domestic refuse to landfill, either directly or after incineration;
- Naturally-occurring radioactive materials (NORM) that accumulate as scale on pipework during the extraction of oil and gas; and
- Nuclear materials outside safeguards for national security and/or defence reasons, and small quantities of nuclear materials with very low concentrations of radioactivity typically from research establishments, universities and the non-nuclear industry.

1.3 Inventory documents

The 2016 Inventory comprises five reports:

- ***Summary Brochure*** – gives a high level overview of radioactive waste in the UK, waste quantities and waste management;
- ***Context and Methodology*** – provides information on how the Inventory was produced, including the scope of the Inventory and the terms and conventions used in reporting Inventory data;
- ***Radioactive Waste Inventory*** – describes the volume, radioactivity and composition of radioactive waste in the UK;
- ***Radioactive Materials Inventory*** – summarises information on UK civil nuclear materials that might have to be managed as waste in the future; and
- ***Summary for International Reporting*** – gives a summary of information to meet the UK's international reporting obligations in the field of radioactive waste.

As part of the commitment to openness, NDA has created a website dedicated to the Inventory, www.nda.gov.uk/ukinventory, where all of the 2016 Inventory reports can be found together with other information about radioactive waste.

2 INTERNATIONAL REPORTING ON RADIOACTIVE WASTES

2.1 European Union

As a Member State of the European Union (EU), most UK activities involving radioactive substances are governed by legislation set down under the Euratom Treaty. The Euratom Treaty established the European Atomic Energy Community. The UK became a signatory of the Treaty on its accession to the European Union in 1972.

EU activities in the field of radioactive waste have been guided to a large extent by the 'Community Plan of Action in the Field of Radioactive Waste' prepared initially in 1980 and renewed in 1992. A later Council[2] Resolution in December 1994 helped to define the EU strategy in this field.

Although the Plan is no longer in force, the requirement for continuous analysis of the situation regarding radioactive waste in the EU remains, and the Commission[3] is requested to provide the Council periodically with a report of the situation and prospects in the Member States (the Situation Report). The 7th Situation Report [1] is the latest to be published and reports the position in 2011. It includes radioactive waste and spent fuel quantities, a summary of national strategies and other pertinent information.

Council Directive 2011/70/Euratom requires Member States to include details of their inventory, of all spent fuel and radioactive waste and estimates for future quantities including those from decommissioning, within their national programme (under Article 12(1)(c)); and for Member States to submit national reports to the Commission every three years (under Article 14(1)).

The UK's first national report was issued in August 2015 [2]. Due to the complexity of the UK programme the UK has issued, at the same time, a 'lead document' providing information and guidance that establishes the UK's programme [3]. This lead document covers the inventory of spent fuel and radioactive waste.

2.2 Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management was negotiated under the auspices of the International Atomic Energy Agency (IAEA). Its primary objective is to achieve and maintain a high level of safety worldwide in spent fuel and radioactive waste management. The Joint Convention came into force on 18 June 2001.

[2] *The Council of the EU represents the governments of the member states and is the main decision making body of the EU.*
[3] *The European Commission is the executive body of the EU.*

Article 32 includes an obligation to submit *"an inventory of radioactive waste that:*

- *Is being held in storage at radioactive waste management and nuclear fuel cycle facilities;*
- *Has been disposed of; or*
- *Has resulted from past practices.*

This inventory shall contain a description of the material and other appropriate information available, such as volume or mass, activity and specific radionuclides."

Article 32 also includes an obligation to submit

"an inventory of spent fuel that is subject to this Convention and that is being held in storage and of that which has been disposed of. This inventory shall contain a description of the material and, if available, give information on its mass and its total activity".

The UK's latest national report, demonstrating compliance with the Joint Convention, was provided in October 2014 [4]. National reports are subject to a process of peer review by the Contracting Parties and are updated every three years. The report includes the following data on radioactive wastes and spent fuel:

- Volumes of HLW, ILW and LLW in stocks (including wastes that are packaged and not yet packaged[4]);
- Expected total volumes of HLW, ILW and LLW (in terms of final packaged volume) for stocks and projected future arisings;
- Annual disposals of LLW in the period 2011-2015; and
- Mass of spent fuel in stocks, reported as either fuel still within reactor cores or fuel that has been removed from reactor cores and transferred to storage facilities.

2.3 Organisation for Economic Co-operation and Development / Nuclear Energy Agency

The UK is also a Member State of the Organisation for Economic Co-operation and Development (OECD) Nuclear Energy Agency (NEA).

The NEA seeks to assist its member countries in developing safe, sustainable and societally acceptable strategies for the management of all types of radioactive materials, with particular emphasis on the management of long-lived waste and spent fuel and on decommissioning of disused nuclear facilities.

The NEA does not currently compile or maintain information on the quantities of radioactive wastes generated in the member countries.

[4] *Wastes that are not yet packaged exist in an untreated or partly treated state. Packaging is the preparation of waste for long-term management or disposal. The packaged waste volume is the total volume taken up by the waste, the immobilising medium and the waste container.*

2.4 Status and Trends Project

In June 2014 the IAEA, the OECD/NEA and the European Commission established a Joint Working Group to co-ordinate and support the preparation of a report providing a global perspective on radioactive waste and spent fuel management, including information on current inventories and future arisings. This initiative is known as the "*Status and Trends Project*". It is envisaged that the planned report will serve as a comprehensive and authoritative reference for worldwide status and trends concerning arisings of spent fuel and radioactive waste and provisions for the long-term management of these materials. The reporting of inventories should be compatible with that provided in reports required by the Joint Convention and the European Council Directive 2011/70/Euratom.

The first project report is scheduled for publication in 2017. Beyond this, further reporting cycles are envisaged in line with the reporting cycles under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management and the reporting cycle under the Council Directive 2011/70/Euratom.

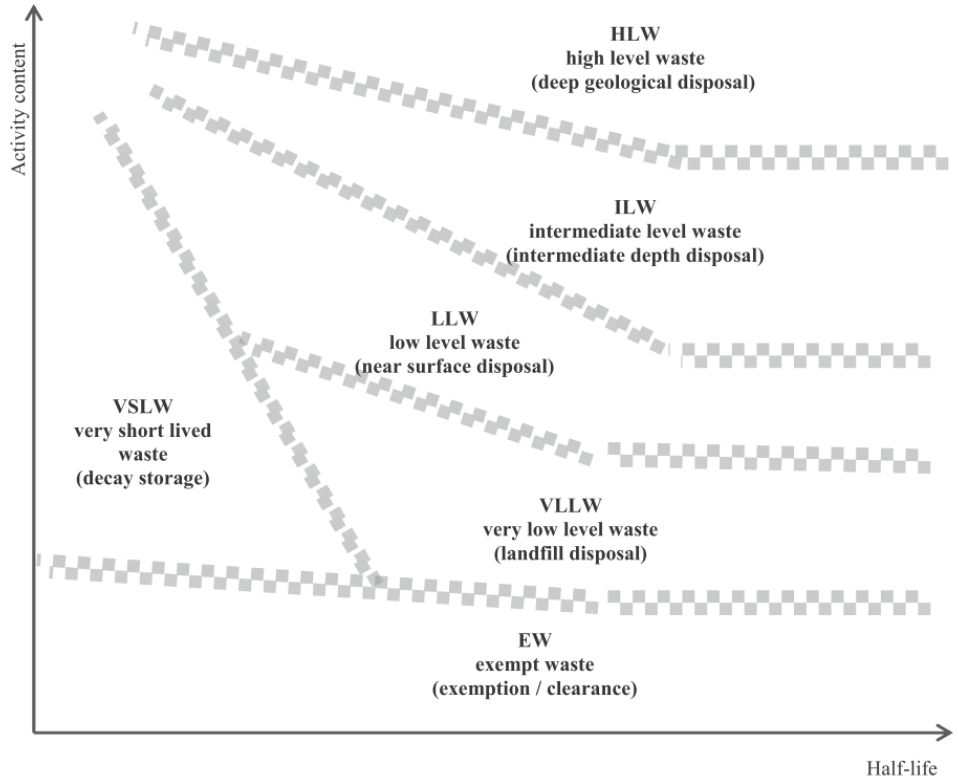
3 2016 INVENTORY DATA

3.1 Reporting to the European Union

The Commission has requested that Member States use a unified radioactive waste classification system solely for the purposes of reporting to them. This applies to reporting under Article 14(1) of Council Directive 2011/70/Euratom.

As a result, the Commission has asked the European Nuclear Safety Regulators Group (ENSREG) Working Group on Improving Radioactive Waste Management, Spent Fuel and Decommissioning Arrangements (WG2) to look at the classification of radioactive waste for the purposes of reporting under the Directive. ENSREG WG2 proposes to base the unified radioactive waste classification on the 2009 IAEA classification [5][5]. A conceptual illustration of the classification scheme is illustrated in Figure 1.

Figure 1: IAEA conceptual illustration of the waste classification scheme



BEIS and NDA have indicated that they broadly support this proposal as it aligns more closely with the UK's classification system than European Commission Recommendation 1999/669/EC, which has been used at the EU level.

While ENSREG WG2 is in the process of revising its guidelines, with a view to completing this work in 2017, the parties to the '*Status and Trends Project*' (see Section 2.4) are

[5] *The IAEA classification scheme is based on consideration of long-term safety provided by the different disposal options currently adopted or envisaged for radioactive waste. Six classes of waste are derived: Exempt Waste (EW); Very Short Lived Waste (VSLW), Very Low Level Waste (VLLW); Low Level Waste (LLW); Intermediate Level Waste (ILW); High Level Waste (HLW). Information on EW and VSLW is not collected for the UK Inventory. EW is out of scope of regulatory control (i.e. not radioactive for the purposes of UK legislation). VSLW requires limited storage time before it is out of scope of regulatory control. All other classes of waste remain subject to regulatory control as radioactive waste and so are recorded in the UK Inventory.*

working together on common reporting requirements to reduce the burden of international radioactive inventory reporting.

The following data tables provide information from the 2016 Inventory based on the 2009 IAEA classification scheme. The criteria used to allocate individual waste streams within the classification are determined by known or planned disposal routes (see Table 1).

Table 1: Waste classification

Class	Criteria (UK classification)
Very Low Level Waste (VLLW)	VLLW stream expected to be consigned for disposal at an appropriately permitted landfill site
Low Level Waste (LLW)	LLW stream expected to be consigned for disposal to the LLWR or the Dounreay LLW facility LLW stream expected to be consigned for incineration or to a metal treatment facility LLW stream expected to be recycled LLW stream where the disposal route is not yet known ILW stream decay stored / reclassified for disposal as LLW
Intermediate Level Waste (ILW)	ILW stream LLW stream unsuitable for disposal to the LLWR or the Dounreay LLW facility
High Level Waste (HLW)	HLW stream

Table 2: Waste quantities either disposed of or in interim storage at 1 April 2016 for which a disposal route exists

Quantity (m^3)	Period	Type of disposal	Site	In use[(1)]
20,000	Until 1983	Sea	North Atlantic	No
13,000	Until 1976	Sea	UK coastal waters	No
~800,000	Up to 1995	Near-surface (trenches)	LLWR	No
226,000	Up to 2016	Near-surface (vaults)		Yes
33,600[(2)]	Up to 2005	Near-surface (pits)	Dounreay	No
3,100	Up to 2016	Near-surface (vaults)	Dounreay	Yes

(1) The UK currently operates a national LLW disposal facility, the Low Level Waste Repository (LLWR). This is a near-surface facility owned by the NDA and run by LLWR Ltd. This takes waste that meets the site's Waste Acceptance Criteria. A LLW disposal facility at Dounreay, which opened in 2015, receives LLW from decommissioning the Dounreay site, as well as retrieved and repackaged LLW from the historical disposal pits. It will also receive waste from the neighbouring Vulcan nuclear site that cannot be recycled. There are currently no facilities for disposal of ILW and HLW in the UK. Disposal of waste to sea no longer takes place. Does not include disposals at appropriately permitted landfill sites.

(2) Waste is to be retrieved, repackaged and consigned to the new LLW disposal facility at Dounreay.

Table 3: Waste quantities in interim storage at 1 April 2016 for which no disposal route is currently available Volumes when packaged

Quantity of waste in storage[1]				
VLLW (m^3)	LLW (m^3)[2]	ILW (m^3)	HLW (m^3)	Comments
0	1,450	148,000	1,660	ILW and HLW volumes include waste from reprocessing overseas spent fuel.

(1) Volumes are for wastes when packaged for long-term management based on the probable conditioning method and container type. The packaged waste volume is the total volume taken up by the waste, the immobilising medium and the waste container. Volumes are given to three significant figures.

(2) Comprises waste classified as LLW (1,450 m^3) not suitable for disposal at the LLWR or Dounreay LLW facility and ILW (~5 m^3).

Table 4: Estimated arisings of waste Volumes when packaged

Period[1]	Quantity of waste arising during period (m^3)[2]				Notes
	VLLW[3]	LLW[4]	ILW[5]	HLW	
2016	17,900	19,400	2,310	See Note 6	Spent fuel reprocessing is assumed to end in 2020.
2017-2019	55,300	61,700	8,840		
2020-2024	52,400	99,100	14,700		
2025-2029	53,500	45,800	13,800		
2030-2039	132,000	62,800	27,600	0	
2040-2049	376,000	71,500	33,300	0	
2050-2059	196,000	23,900	16,200	0	Principally large volumes of building rubble and soil from decommissioning.
2060-2099	1,040,000	776,000	125,000	0	
Post-2099	1,010,000	186,000	62,800	0	
Total	**2,930,000**	**1,350,000**	**305,000**	**See Note 6**	

(1) Financial years 1 April to 31 March.

(2) Volumes are for wastes when packaged for long-term management based on the probable conditioning method and container type. The packaged waste volume is the total volume taken up by the waste, the immobilising medium and the waste container. Volumes are given to three significant figures.

(3) Comprises waste classified as VLLW (2,720,000 m^3) and LLW (213,000 m^3).

(4) Comprises waste classified as LLW (1,310,000 m^3), ILW (6,750 m^3) and mixed LLW/VLLW (29,500 m^3).

(5) Comprises waste classified as ILW (292,000 m^3) and LLW (12,600 m^3).

(6) There is a net decrease in the quantity of HLW over the period 2016-2029 because accumulated HAL is being conditioned, which reduces its volume by about two-thirds, and also because vitrified HLW is being exported to overseas customers.

Table 5: Estimated waste production for reactor types as a function of electrical power output Volumes when packaged

Reactor type	Quantity of waste (m^3 per GW(e).y)[1]				Comments
	VLLW	LLW	ILW	HLW	
AGR	0	334	202	0	Based on average reactor lifetime of 43.5 years and deferred decommissioning strategy.
PWR	0	593	260	0	Based on Sizewell B reactor lifetime of 40 years and early decommissioning strategy.

(1) Volumes are for wastes when packaged for long-term management based on the probable conditioning method and container type. The packaged waste volume is the total volume taken up by the waste, the immobilising medium and the waste container. Station operational and decommissioning wastes are included. Wastes from spent fuel storage and spent fuel reprocessing are excluded. Volumes are given to three significant figures.

3.2 Reporting to the Joint Convention

The following tables provide information from the 2016 Inventory in a form compliant with the obligations of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. The waste types listed use the 2009 IAEA classification system.

Table 6: Radioactive wastes existing at 1 April 2016 from all sources Packaged and unpackaged volumes

Waste type	At 1.4.2016	Volume (m^3)[1]
HLW	**Total**	**2,230**
	Packaged	1,130
	Unpackaged	1,100
ILW	**Total**	**108,000**
	Packaged	41,400
	Unpackaged	66,300
LLW	**Total**[2]	**34,600**
	Packaged	14,300
	Unpackaged	20,300
VLLW	**Total**[3]	**1,690**
	Packaged	0
	Unpackaged	1,690

(1) The packaged waste volume is the total volume taken up by the waste, the immobilising medium and the waste container. Volumes are given to three significant figures.

(2) Can be categorised as 1,550 m^3 of ILW, 28,900 m^3 of LLW and 4,220 m^3 of mixed LLW/VLLW.

(3) Can be categorised as 752 m^3 of LLW and 936 m^3 of VLLW.

Table 7: Expected total waste volumes from existing facilities to end of life Volumes when packaged (1)

Waste type	At 1.4.2016	Future arisings (m^3)	Total (m^3)
HLW	1,660	See Note 2	1,500
ILW(3)	148,000	305,000	453,000
LLW(4)	36,100	1,350,000	1,380,000
VLLW(5)	1,510	2,930,000	2,930,000
Total	**188,000**	**4,580,000**	**4,770,000**

(1) The packaged waste volume is the total volume taken up by the waste, the immobilising medium and the waste container. Volumes are given to three significant figures.

(2) There is a net decrease in the quantity of HLW after 1 April 2016 because accumulated HAL is being conditioned, which reduces its volume by about two-thirds, and also because vitrified HLW is being exported to overseas customers.

(3) Can be categorised as 441,000 m^3 of ILW and 12,600 m^3 LLW unsuitable for disposal at the LLWR or Dounreay LLW facility.

(4) Can be categorised as 8,730 m^3 of ILW and 1,134,000 m^3 of LLW and 32,300 m^3 of mixed LLW/VLLW.

(5) Can be categorised as 213,000 m^3 of LLW and 2,720,000 m^3 of VLLW.

Table 8: Annual consignments of LLW to disposal facilities (2011-2016) (1)

Year	Total volume (m^3)(2)
2011	6,700
2012	4,820
2013	5,090
2014	3,280
2015	5,680
2016(3)	2,300

(1) Total volume of waste packages consigned to the LLWR and Dounreay LLW facility.

(2) Volumes are given to three significant figures.

(3) Up to 31 March 2016.

Table 9: Inventory of spent fuel at 1 April 2016

Location	Description	Approximate quantity of UK-owned irradiated fuel (tonnes)[1]	
		In reactor	In storage
Magnox power stations[2]	Magnox fuel	1,200	49
AGR power stations	AGR fuel[4]	~1,600	40
PWR power station	PWR fuel[4]	90	550
Sellafield	Magnox fuel		750
	AGR fuel		~2,400
	SGHWR fuel		120
	WAGR fuel		31
	Other fuel		~850[3]
Dounreay	DFR breeder fuel	32	1
	PFR		10
	Other fuels		<1
Harwell	Various[5]		~1

(1) Fuel 'In reactor' is that in reactor cores; fuel 'In storage' has been removed from reactor cores to storage facilities.

(2) Includes Calder Hall on the Sellafield site.

(3) Includes former overseas LWR fuel transferred to UK ownership and 1.6 tHM DFR breeder fuel transferred from Dounreay.

(4) From data provided by EDF Energy and from best available public domain information.

(5) Comprises low irradiated fuels.

3.3 Reporting to the Status and Trends Project

The tables in the Appendix provide information from the 2016 Inventory in a form for the Status and Trends Project. The waste types listed use the 2009 IAEA classification system.

4 REFERENCES

[1] European Commission, “Seventh Situation Report on Radioactive Waste and Spent Fuel Management in the European Union,” SEC(2011)1007, August 2011.

[2] Department of Energy and Climate Change, “United Kingdom's National Report on Compliance with European Council Directive (2011/70/Euratom),” URN 15D/390, August 2015.

[3] Department of Energy & Climate Change, “Lead Document setting out the United Kingdom's National Programme for the Responsible and Safe Management of Spent Fuel and Radioactive Waste,” URN 15D/389, August 2015.

[4] Department of Energy & Climate Change, “The United Kingdom’s fifth national report on compliance with the obligations of the Joint Convention on the safety of spent fuel management and on the safety of radioactive waste management,” URN 14D/471, October 2014.

[5] International Atomic Energy Agency, “IAEA Safety Guide Classification of Radioactive Waste,” GSG-1, 2009.

APPENDIX INFORMATION FOR THE STATUS AND TRENDS PROJECT

Radioactive waste classification, waste and spent fuel quantities (inventory) (including disused sources that are declared radioactive waste)

Table A1: Radioactive waste in storage at 1 April 2016 (including spent fuel that is considered waste)

Route waste class	Processed (type)/ Unprocessed)	Total current volume (m^3)	Estimated disposal volume (m^3)	Distribution (%)							Planned disposal route (if known) (1)
				RO	FFE	RP	NA	DF	DC / RE	ND	
Total of all Classes		**132,000**	**188,000**	**17.4**	**0.1**	**57.7**	**11.7**	**2.0**	**11.0**	**0**	
HLW		1,960	1,660	0	0	0.9	0	0	0	0	GDF
ILW		97,500	148,000	15.0	<0.001	56.4	4.9	0.7	2.1	0	GDF
LLW		30,900	36,100	2.4	<0.01	0.4	6.9	1.2	8.4	0	Near surface
VLLW		1,690	1,510	<0.1	0.1	0	<0.1	0.1	0.5	0	VLLW landfill

(1) Discrete items of short-lived ILW may be suitable for near-surface disposal after a period of decay storage. Some LLW will not be suitable for near-surface disposal in current facilities.

NEWMDB waste origin type codes:
RO – reactor operations
FFE – fuel fabrication & enrichment
RP – fuel reprocessing
NA – nuclear applications
DF - defence
DC/RE – decommissioning & remediation
ND – not determined

Table A2: Radioactive waste disposed (as disposed volume)

Waste class	Processed (not)	Total volume (m^3)	Distribution (%)							Disposal route used
			RO	FFE	RP	NA	DF	DC / RE	ND	
Total of All Classes		**~1,000,000**							**100**	
HLW		0								
ILW		~33,000							100	N Atlantic and UK coastal waters(1)
LLW		~1,000,000							100	Near surface(2)
VLLW		Not reported in UK Inventory							100	Landfill

(1) 1949 – 1982

(2) Comprises ~1,000,000 cubic metres at LLWR and ~ 3,100 cubic metres at Dounreay.

(Note: abbreviations as in Table A1)

Table A3: Spent fuel in storage (MtHM)

Type	Current amount (NPPs) (MtHM)	Current amount (research reactors) (MtHM)
Total Spent Fuel Storage:	**~3.8**	**~0.89**
Wet storage (AR)	~0.59	0
Wet storage (AFR)	~3.2	~0.88
Dry storage (AR)	~0.05	0
Dry storage (AFR)	0	0.01
Total spent fuel held in storage for other countries (amounts also included above)	~0.12	Not known

AR = "at reactor site", including fuel pools at NPP

AFR = "away from reactor site"

Table A4: Spent fuel sent for reprocessing (in the country or sent to another country)[6] (MtHM)

Type	Current amount (NPPs) (MtHM)	Current amount (research reactors) (MtHM)
Total amount of Spent Fuel sent to Reprocessing (in your country)	~60	Not known
Total amount of Spent Fuel sent to Reprocessing (in another country)	0	Not known
Total amount of Spent Fuel received from another country for reprocessing and recycling	4.4	Not known
Total amount of Spent Fuel (MtHM) or radioactive waste (cubic metres) returned to country of origin for storage/disposal	~236 m^3 (1)	Not known

(1) Total (already returned plus future scheduled). Comprises vitrified HLW, including an additional amount that is smaller in volume but equivalent in radiological terms to customers' ILW and LLW that would otherwise be returned (in line with the UK's policy of waste substitution).

[6] *All years.*

Table A5: Translation of waste volumes from UK classification system to IAEA classification system

National waste classification name	IAEA classification [1]			
	VLLW	LLW	ILW	HLW
Very Low Level Waste	100%			
Low Level Waste	16.6%	82.7%	0.7%	
Intermediate Level Waste		2.6%	97.4%	
High Level Waste				100%

(1) Percentages in terms of actual reported volumes in stocks and forecast future arisings.

Table A6: Overview of waste and materials management facilities [1]

Type	Planned	Construction	Commissioning	In Operation	Shutdown	Decomm	Other	Total
Spent Fuel storage [2]			1	14		11		**26**
Spent Fuel reprocessing and recycling [3]				2		3		**5**
Spent Fuel conditioning	1 [4]							**1**
Spent Fuel disposal	1 [5]							**1**
Waste processing:								
HLW				1 [6]				**1**
ILW [7]	17	2	2	14	2			**Not quantified**
LLW				See Note 8				**Not quantified**
VLLW								
Waste storage:								
HLW [9]	1			2				**3**
ILW [10]	21	4		>35	3			**Not quantified**
LLW				See Note 11				**Not quantified**
VLLW								
Waste disposal:								
HLW	1 [5]							**1**
ILW	1 [5]							**1**
LLW [12]				2	1			**3**
VLLW				4 [13]	See Note 14			**4**

Notes for Table A6:

(1) The table does not include all UK radioactive waste and material management facilities. The number of facilities is subject to future change.

(2) Commissioning: Sizewell B Dry Store. In operation: Storage ponds at Advanced Gas-cooled Reactors (AGRs) (7); Sizewell B PWR (1); Magnox Wylfa (1); Sellafield (4); Dounreay (1). Decommissioning: Magnox stations (11).

(3) In operation: Magnox reprocessing plant and Thorp reprocessing plant at Sellafield. Decommissioning: First Generation Reprocessing Plant at Sellafield; Prototype Fast Reactor (PFR) Reprocessing Plant and Materials Testing Reactor (MTR) Reprocessing Plant at Dounreay.

(4) AGR Fuel Final Conditioning Plant at Sellafield.

(5) Geological Disposal Facility (GDF).

(6) Waste Vitrification Plant (WVP) at Sellafield.

(7) Planned: There are plans for 15 waste processing plants at Sellafield; Berkeley Encapsulation Plant; Dungeness A Conditioning Plant. Construction: Sellafield Box Encapsulation Plant (BEP); Hunterston A Solid ILW Encapsulation Plant. Commissioning: Harwell Waste Encapsulation Plant; Trawsfynydd Fuel Element Debris (FED) Retrieval & Processing Plant. In operation: Magnox Encapsulation Plant (MEP), Waste Encapsulation Plant (WEP), Waste Packaging & Encapsulation Plant (WPEP), Waste Treatment Complex (WTC) 1, AGR Dismantler Drum Packaging Plant and Pile Fuel Storage Pond (PFSP) Drum Filling Plant at Sellafield; Dounreay Cementation Plant (DCP); ILW Solid Waste Complex at Harwell; FAVORIT, AVDS and FED Dissolution Plant at Bradwell; Waste Conditioning Plant at Berkeley; Resin Solidification Plant and Miscellaneous Activated Components (MAC) Encapsulation Plant at Trawsfynydd. Shutdown: Windscale Advanced Gas-cooled Reactor (WAGR) Packaging Plant at Sellafield; FED Dissolution Plant at Dungeness A.

(8) LLW producers use a range of processes to minimise waste volumes – size reduction; decontamination; compaction (low force and high force). There are three high force compaction facilities in the UK (Dounreay; Sellafield; Winfrith), a metal recycling facility (Lillyhall) and a number of incinerators available to the nuclear industry.

(9) Planned: Vitrified Product Store (VPS) 2 at Sellafield. In operation: VPS1 and Highly Active Liquor (HAL) tanks at Sellafield.

(10) Planned: BEP Product Stores 2, 3 & 4, Class 2 Store & Extension, Engineered Drum Stores (EDS) 4 & 5 at Sellafield; DCP Store Extension 2, Unshielded ILW Store at Dounreay; Dungeness Interim Storage Facility (ISF); Oldbury ISF; Sizewell A ISF; Wylfa ISF; Harwell ILW Store; ILW stores at AGR reactor sites (7). Construction: BEP Product Store Direct Import Facility, First Generation Magnox Storage Pond (FGMSP) Interim Storage facility at Sellafield; Chapelcross ISF; Hinkley Point A ISF. In operation: Encapsulated Product Stores (EPS) 1-3, EDS 1-3, WPEP Store, Miscellaneous Beta Gamma Waste Store (MBGWS), WAGR Store at Sellafield; DCP Store & Extension at Dounreay; Harwell Vault Store; Winfrith Treated Radioactive Waste Store; Trawsfynydd ILW Store; Hunterston A ILW Store; Berkeley ISF; Bradwell IFS; Aldermaston HAW Stores 1-4; Amersham ILW Store; Cardiff ILW Store.

There are legacy ILW stores in operation: including Magnox Swarf Storage Silos (MSSS), FGMSP, Pile Fuel Storage Pond (PFSP), Pile Fuel Cladding Silo (PFCS), Solid Waste Storage Cells (SWSC), Plutonium Contaminated Materials (PCM) stores and Floc Storage Tanks at Sellafield; Shielded Drum Store and Unshielded Drum Store at Dounreay. Shutdown: Legacy PCM stores at Sellafield; Wet silo and shaft at Dounreay.

At reactor station sites untreated waste storage facilities include underground/above-ground vaults, reactor voids, tanks, drum stores.

(11) LLW is held in short-term storage at sites before consignment for disposal or other management routes.

(12) In operation: LLWR in West Cumbria; Dounreay LLW disposal facility in Caithness. There are plans to construct further disposal vaults at these sites. Shutdown: Dounreay LLW pits.

(13) Clifton Marsh, Lillyhall, East Northants, Calder Landfill Extension Segregated Area (CLESA).

(14) There have been on-site disposals to pits and trenches at several sites.

Table A7: Summary of major sources of waste – number of facilities [1]

Type	Planned	Construction	Commission	In Operation	Shutdown	Decomm	Other	Total
Research reactors* [2]				1		10		**11**
Nuclear power reactors [3]	9			15		26		**50**
Spent Fuel Reprocessing and Recycling [4]				2		3		**5**
Other (define)**								
Uranium enrichment [5]				1		1		**2**
Fuel manufacture [6]				3	2			**5**
Defence activities [7]				6		1		**7**
Medical & industrial [8]				1	1			**2**

(1) The table does not include all sources of UK radioactive waste. The number of facilities is subject to future change.

(2) In operation: Joint European Torus (JET) in operation. Decommissioning: PFR; Dounreay Fast Reactor (DFR); Dounreay MTR; Piles 1&2; Windscale Advanced Gas-cooled Reactor (WAGR); Steam Generating Heavy Water Reactor (SGHWR); Dragon; DIDO; PLUTO.

(3) Planned: Hinkley Point C (2); Moorside (3); Anglesey (2); Oldbury (2). In operation: Advanced Gas-cooled Reactors (AGRs) (14); Pressurised Water Reactor (PWR) (1). Decommissioning: Magnox reactors.

(4) In operation: Magnox reprocessing plant and Thorp reprocessing plant. Decommissioning: First Generation Reprocessing Plant; PFR Reprocessing Plant; MTR Reprocessing Plant.

(5) In operation: Centrifuge plant. Decommissioning: Diffusion plant incl. associated facilities.

(6) In operation: Oxide Fuels Complex; uranium conversion plants. Shutdown: Magnox Canning Plant; U Metal Plant.

(7) In operation: Aldermaston; Burghfield; Devonport; Clyde, Rosyth; Derby. Decommissioning: Vulcan.

(8) In operation: Amersham. Shutdown: Cardiff.

** Note: research reactors with medium or high power from RRDB.*
Note: "Planned" means it has been identified in a national report, strategy, or formal plan. It includes: Planned, Under Study-Assessment, Siting-Design phases.
*** If applicable, where included in national inventory, e.g. decommissioning of contaminated facilities, clean-up of accident related sites.*

Table A8: Trends and future prospects (estimation of volumes of waste and spent fuel arising, waste and spent fuel management facilities)

Type	Current amount (MtHM)	Estimated current amount when prepared for disposal	Current disposal capacity	Total forecast at 2030 (MtHM)	Total forecast at 2050 (MtHM)
Spent Fuel Storage:					
Wet storage (AR)	~0.59	Unknown		Unknown	Unknown
Wet storage (AFR)	~4.1	Unknown		Unknown	Unknown
Dry storage (AR)	0.05	Unknown		Unknown	Unknown
Dry storage (AFR)	0.01	Unknown		Unknown	Unknown
Total amount of Spent Fuel sent to reprocessing and recycling	~62 (Sellafield only, includes overseas LWR)	Unknown		~65	~65
Total amount of Spent fuel disposed	0	0		Unknown	Unknown
Waste in storage:	**Reported volume (m^3)**	**Packaged volume (m^3)**		**Packaged volume (m^3)**	**Packaged volume (m^3)**
HLW	1,960	1,660		1,500	1,500
ILW	97,500	148,000		188,000	249,000
LLW	30,900	36,100		262,000	397,000
VLLW	1,690	1,510		181,000	688,000
Waste disposal:	**(m^3)**	**(m^3)**	**(m^3)**	**(m^3)**	**(m^3)**
HLW	0	0	0	0	Unknown
ILW	0	0	0	0	Unknown

Type	Current amount (MtHM)	Estimated current amount when prepared for disposal	Current disposal capacity	Total forecast at 2030 (MtHM)	Total forecast at 2050 (MtHM)
LLW	0	0	310,000 (1)	Unknown	Unknown
VLLW	Unknown	Unknown	Unknown	Unknown	Unknown

(1) Capacity (in cubic metres) for Vault 8 and Vault 9 at the LLWR. Excludes disposal capacity at Dounreay LLW facility (sufficient capacity will be constructed to dispose of the site's LLW, forecast to be about 100,000 m^3 reported volume.

AR = "at reactor site".

AFR = "away from reactor site".

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