Europaudvalget 2019
KOM (2019) 0632
Offentligt

EUROPEAN
COMMISSION

Brussels, 17.12.2019
SWD(2019) 435 final

COMMISSION STAFF WORKING DOCUMENT

Inventory of radioactive waste and spent fuel present in the Community's territory and the future prospects

Accompanying the document

REPORT FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT

on progress of implementation of Council Directive 2011/70/EURATOM and an inventory of radioactive waste and spent fuel present in the Community's territory and the future prospects

{COM(2019) 632 final} - {SWD(2019) 436 final}

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List of abbreviations

DSRS	Disused sealed radioactive sources
EU	European Union
HLW	High Level Waste
IAEA	International Atomic Energy Agency
ILW	Intermediate Level Waste
LLW	Low Level Waste
NORM	Naturally Occurring Radioactive Material
OECD-NEA	Nuclear Energy Agency of the Organisation for Economic Co-operation and Development
RAW	Radioactive waste
SF	Spent fuel
tHM	Tons of heavy metal
VLLW	Very Low Level Waste
VSLW	Very Short Lived waste

1. Introduction

According to Article 14(2)(b) of the Council Directive 2011/70/EURATOM[1] establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste (the "Directive"), the European Commission (the "Commission") is required to submit, on the basis of the Member States' reports on the implementation of the Directive, to the European Parliament and the Council an inventory of radioactive waste and spent fuel present in the Community's territory and the future prospects.

The goal of this Staff Working Document (SWD) is to present **an overview of spent fuel and radioactive waste inventory in the EU and the future prospects.** This document also provides background information to the inventory data presented in the Second Report from the Commission to the Council and the European Parliament on progress of implementation of Council Directive 2011/70/EURATOM and an inventory of radioactive waste and spent fuel present in the Community's territory and future prospects (COM(2019) 632).

This is the second SWD providing an updated overview of spent fuel and radioactive waste inventory in the EU and the future prospects. Its inventory reference date is end of 2016, although more than half of the Member States reported inventory as of end of 2017 or 2018 (more information on the inventory dates is provided in Section 2 – sources of information). This document is based on the information provided in the second national reports of EU Member States on the implementation of the Directive and it builds on the previous SWD document[2] with 2013 inventory data. This document provides an overview of:

- The total spent fuel and radioactive waste inventory on the EU territory as of 2016;
- The total inventory of spent fuel and radioactive waste owned by EU Member States (regardless of location);
- Forecast of national and EU inventory in 2030 based on available information reported by Member States;
- Updated trends of radioactive waste and spent fuel in the EU;
- National radioactive waste classification systems.

Previously the European Commission published a series of "Situation Reports"[3] which were developed in order to analyse, and inform stakeholders about, the situation of spent fuel and radioactive waste management in the EU. Since the Directive entered into the force, situation reports have been discontinued and replaced by the Commission report on implementation of the Directive and accompanying two SWDs. Nevertheless, data from the 6th Situation Report[4]

[1] Council Directive 2011/70/EURATOM of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste; OJ L 199/48, 2.8.2011.

[2] Commission SWD, Inventory of radioactive waste and spent fuel present in the Community's territory and the future prospects; SWD(2017) 161 final, 15.5.2017.

[3] The last one of the series was "Commission staff working paper, Seventh situation report, radioactive waste and spent fuel management in the European Union; SEC(2011) 1007 final, 22.8.2011".

[4] Report from the Commission to the European Parliament and the Council, Sixth situation report on radioactive waste and spent fuel management in the European Union; COM(2008) 542 final, 8.9. 2008 and accompanying document SEC(2008) 2416 final/2, 16.7.2010.

and the 7th Situation Report[5] have been used in this document as well as data from the first national reporting (2013) for comparison and identification of trends in the evolution of the EU inventory.

Updated information about the Member States' installations generating radioactive waste and spent fuel, national policies, programmes, concepts, plans and financing mechanisms is summarised in the SWD on progress of implementation of the Directive[6].

2. Sources of information

The EU spent fuel and radioactive waste inventory data presented in this document is based on the **national programmes for the management of spent fuel and radioactive waste submitted to the Commission since September 2016**[7] and the **second national reports** submitted by all Member States by March 2019.

Although Article 14(1) of the Directive indicates that Member States can take advantage of the review and reporting under the Joint Convention[8], less than half of the Member States did. Those Member States used inventory data reported in the last Joint Convention reporting cycle (using 2016 as a reference date for their inventories for the 6th Joint Convention meeting in May 2018). The remaining Member States have chosen to report newer inventory data. To summarize, the inventory situation was reported as of year-end 2016 by 12 Member States, as of year-end 2017 by 12 Member States and as of year-end 2018 by 4 Member States.

Looking at the size of the programmes it is clear that mainly Member States with small inventories reported newer data, while for larger inventories it takes more time to collect and process inventory data. If we look at the radioactive waste volumes distribution by reporting year – inventory with the reference date as of 2016 makes up 87.4% of the overall volume, and inventories with the reference dates of 2017 and 2018 make up 12.6% and 0.1% of the overall radioactive waste volume in the EU, respectively.

As the dominating volume of radioactive waste reported with 2016 as the reference date - we have chosen to use 2016 further in this document as the reference date for the overall EU radioactive waste and spent fuel inventory in order to simplify data presentation.

For the trend analysis, additional documents containing historical inventory data have been used. Most of the data was based on **data reported to the Commission by the Member States in 2010 and data from the first national reporting under the Directive in the 2015-2016 period.**

In the first Commission SWD some missing and inconsistent data from the above-mentioned sources were reviewed and updated. There were no additional updates to the historical

5 Commission staff working paper, Seventh situation report, radioactive waste and spent fuel management in the European Union; SEC(2011) 1007 final, 22.8.2011.

6 Commission Staff Working Document, Progress of implementation of Council Directive 2011/70/EURATOM; SWD(2019) 436.

7 Austria, Croatia, Estonia France, Ireland and Slovenia.

8 The IAEA Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, adopted on 5 September 1997, the "Joint Convention".

inventory data since the previous Commission report SWD(2017) 161 final. The national inventory summaries presented in this document have been verified by the respective Member States in 2019.

It needs to be noted that in preparation of this report, most of the **sources of uncertainty** identified in the document SWD(2017) 161 final, remained valid, i.e.:

- Member States are using **different radioactive waste classification schemes** (summary is given in Annex II of this document). For EU inventory aggregation purposes conversion to a common reporting basis is necessary (IAEA GSG-1 classification[9]; see Section 4 below). However, conversion from one classification scheme to another often introduces uncertainties, as the radioactive waste classes in different national classification schemes sometimes cannot be directly matched. In such situations, a conversion is carried out on a "best approximation" basis. In the second national reports most Member States reported their radioactive waste inventory using the IAEA GSG-1 classification scheme or provided a conversion matrix allowing conversion of waste inventory from their national classification scheme to IAEA GSG-1.
- Member States use **different units** (volume, mass, etc.) for unconditioned waste. Conversion from mass to volume without detailed knowledge of radioactive waste treatment/conditioning methods used can result in significant uncertainty[10].

  Reporting of disused sealed radioactive sources varies from country to country. Countries with large nuclear programmes generally integrate disused sealed radioactive sources into other large radioactive waste streams and do not report them separately. Countries where the disused sealed radioactive sources make significant part of the national inventory report them separately from the other radioactive waste. In such cases disused sealed radioactive sources are reported only as number of sources.
- Member States report differently volumes of unconditioned radioactive waste – **some report actual volumes in storage, while others report estimated volumes after conditioning to be placed in disposal.**

  For inventory aggregation purposes, the estimated volumes of radioactive waste to be placed in disposal are preferred since this represents the final step in management of radioactive waste. Use of actual radioactive waste volumes in storage can lead to significant uncertainties, especially when estimating the need for disposal capacities. Usually, the most significant volume changes (reduction) occur as a result of liquid radioactive waste and sludge treatment and conditioning for disposal. The same is true for combustible and compactible radioactive waste.

  In the second national reports, most of the Member States provided unconditioned waste estimated volumes for disposal. This allows to reduce uncertainties and to improve consistency and comparability of the data.

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9 Classification of Radioactive Waste. IAEA Safety Standards No. GSG-1, 2009, Vienna.

10 The simple approach is to use 1 t ≡ 1 m^3 equivalence.

- **Knowledge of radioactive contamination** of facilities subject to decommissioning plays important role in predicting amounts of decommissioning waste. The detailed characterization of a facility subject to decommissioning increases the precision in forecasting the amount of radioactive waste, however, only when decommissioning is well progressed will the actual categories and amounts of waste be fully known. This is also valid for the limited knowledge of characteristics of some legacy waste.

  Only about one in five national reports indicated estimated amounts of decommissioning waste separately.

- Future radioactive waste inventories highly depend on **various decisions** introducing additional uncertainties in the projection of future radioactive waste inventories**,** e.g.:
  - **Technological decisions,** such as the selection of treatment and conditioning options, choice between immediate or deferred decommissioning, decision to retrieve disposed radioactive waste might have significant impact on the projection of future radioactive waste inventories (e.g. volumes, classes);
  - **Political decisions and changes in the legal/regulatory framework,** such as development of new nuclear facilities, changes to the fuel cycle.

During the **assessment of the evolution of Member States' inventories with time**, the following additional sources of **uncertainties remained**:

- **Differences in the reference dates of Member States inventories** (please see above).
- **Change in radioactive waste status** – during the reporting period there were no retrievals reported of previously disposed of radioactive waste. However, some Member States plan in the future to recover previously disposed of radioactive waste, process and re-dispose of it in existing and/or newly constructed disposal facilities. Re-disposal activities might affect overall radioactive waste inventory as a result of subsequent retreatment and final disposal. There are already a few Member States that took decisions on the remediation of disposal sites, thus radioactive waste is considered as stored whilst awaiting retrieval.

3. Sources of spent fuel and radioactive waste

Radioactive waste is generated in all Member States of the EU, even though the quantities are very small in non-nuclear power Member States compared to those Member States operating nuclear power plants. Radioactive waste inventory in small countries usually consist of disused sealed radioactive sources or small amounts of orphan/legacy radioactive materials. Small volumes of radioactive waste are generated as a result of non-power uses of radioactive materials, such as the manufacturing of radioactive materials for use in medical and industrial applications, or research facilities such as laboratories, and research reactors. Most of the Member States with research reactors have an agreement in place to send back spent fuel to the suppliers.

Most of the radioactive waste comes from nuclear power plants and associated nuclear fuel cycle activities (i.e. from conversion of uranium through to fuel fabrication prior to electricity generation, and subsequent reprocessing of spent fuel). In the second national reports, 15 Member States declared spent fuel. Some of those Member States have chosen to reprocess spent fuel; some Member States have chosen the once-through fuel cycle option when spent fuel will be directly disposed of in deep geological disposal. A few Member States applied both approaches – part of their spent fuel is reprocessed and the remaining spent fuel will be directly disposed. Currently, spent fuel is stored in specialised storage facilities until final disposal facilities will be available. Most of the radioactive waste, in terms of activity, is generated during operation of nuclear facilities. However, in terms of volume, most of the waste comes from decommissioning of nuclear power plants and other nuclear facilities at the end of their useful lifetime (mainly low-level waste).

In some Member States waste from mining and milling of uranium is declared as radioactive waste. Usually, those activities generate significant amounts of waste. Some Member States report such material as part of radioactive waste inventory, whereas others do not. This approach is in line with the Directive.

4. Classification of spent fuel and radioactive waste

In line with Article 12(1)(c) of the Directive, Member States need to develop, as part of their national programmes, and notify to the Commission spent fuel and radioactive waste inventories in accordance with an appropriate classification. Correspondingly, Member States have notified their updated national programmes and second national reports on their spent fuel and radioactive waste inventories based on radioactive waste classifications that may differ from one Member State to another. A summary of the national classifications is presented in Annex II.

As in the previous report, in order to make spent fuel and radioactive waste inventories comparable among different Member States and in order to aggregate the overall inventory on the territory of the EU, Member States' inventories were converted into a common classification scheme. The IAEA GSG-1 classification system has been chosen for that purpose in order to facilitate Member States' reporting to various international organisations (e.g. IAEA) and instruments (e.g. Joint Convention).

The categories of radioactive waste used for data aggregation are as follows:

- **Very Low Level Waste** (VLLW): waste that does not need a high level of containment and isolation and, therefore, is suitable for disposal in near-surface, landfill-type facilities with limited regulatory control.
- **Low Level Waste** (LLW)**:** waste that is above clearance levels, but with limited amounts of long-lived radionuclides. Such waste requires robust isolation and containment for periods of up to a few hundred years and is suitable for disposal in engineered near-surface facilities. This class covers a very broad range of waste. LLW may include

short-lived radionuclides at higher levels of activity concentration, and also long-lived radionuclides, but only at relatively low levels of activity concentration.

- **Intermediate Level Waste** (ILW): waste that, because of its content, particularly of long-lived radionuclides, requires a greater degree of containment and isolation than that provided by near surface disposal. However, ILW needs no provision, or only limited provision, for heat dissipation during its storage and disposal. ILW may contain long-lived radionuclides, in particular, alpha emitting radionuclides that will not decay to a level of activity concentration acceptable for near surface disposal during the time for which institutional controls can be relied upon. Therefore, waste in this class requires disposal at greater depths, of the order of tens of metres to a few hundred metres.
- **High Level Waste** (HLW): waste with levels of activity concentration high enough to generate significant quantities of heat by the radioactive decay process or waste with large amounts of long-lived radionuclides that need to be considered in the design of a disposal facility for such waste. Disposal in deep, stable geological formations, usually several hundred metres or more, below the surface is the generally recognized option for disposal of HLW.

Spent fuel (SF) is also considered in its entirety, whether it might be intended for reprocessing or awaiting decision for future long-term management (reprocessing or disposal).

In addition to the above-mentioned waste classes, IAEA GSG-1 classification system defines:

- **Exempt waste** with concentrations of radionuclides small enough not to require provisions for radiation protection. Such material can be cleared from regulatory control and does not require any further consideration from a regulatory control perspective.
- **Very short-lived waste** containing only very short half-life radionuclides, thus such waste can be stored until the activity has fallen beneath the levels of clearance, allowing for the cleared waste to be managed as conventional waste.

The latter two waste classes do not require future long-term management or disposal as radioactive waste due to their short-lifetime and/or levels allowing the exemption or clearance from regulatory control. Accordingly, exempt waste and very short-lived waste are in most cases not reported by Member States. Thus, these waste classes have not been used for data aggregation in the present document.

Several Member States combine VLLW and LLW, or do not have a separate VLLW class. In the latter case, such material could be subject to clearance in accordance with the respective national legislation. Reflecting the disposal routes, several Member States also use a combined waste class “low and intermediate level waste” (LILW). Where other than the IAEA GSG-1 classification system is used for reporting by Member States, a conversion provided by the Member States is applied in this Report in order to achieve the conversion from the national to the IAEA classification systems.

5. Current radioactive waste and spent fuel inventory in the EU

This section is dedicated to the presentation and analysis of the radioactive waste and spent fuel inventory present in the Union's territory and the future prospects as required by Article 14(2)(b) of the Directive. The information used to compile this section was primarily collected from the second national reports and national programmes. The details on the national inventories are given in Annex I of this document. The first Commission report contained information on the radioactive waste disposed of at sea (Table I.8 of the SWD(2017) 161 final[11]). As these disposal practices were prohibited by the London Convention on the Prevention of Marine Pollution by Dumping of Wastes[12] and the total ban on radioactive waste disposal at sea adopted in 1993, and no new information emerged since the publication of the first Commission report, the information on radioactive waste disposed of at sea is excluded from this document.

The section is composed of two parts – the first part relates to the radioactive waste inventory and the second part is dedicated to the spent fuel inventory.

Overall, inventory data reported in the second national reports is generally consistent with the data provided in national programmes and the first national reports. In most of the cases, national reports provided sufficient information to explain non-typical changes in the inventories (e.g. successful volume reduction programmes resulting in reduction of waste amounts without presence of disposal activities). However, the number of sources of uncertainties previously listed in Section 2 still remain an obstacle for most complete and comprehensive reporting of national and EU inventory.

The future prospects of the radioactive waste and spent fuel inventory present in the Community's territory are presented in the Section 6.

EU radioactive waste inventory

The estimated total inventory of radioactive waste on EU territory at the end of 2016 is 3 466 000 m^3. Of this waste, 71.6% is already disposed of (2 483 000 m^3) and 28% (983 000 m^3) is in storage and will have to be managed in the future. Compared to the 2013 radioactive waste inventory, this is a 4.6% increase of total radioactive waste volumes.

Table 1 summarizes the overall amounts of radioactive waste in the EU with comparison to previously reported data (i.e. inventory status as of end 2013).

Table 1. Volumes of radioactive waste in the EU, end 2016

Waste Category	EU RAW Amounts (m^3, rounded to thousands)		
	Stored	Disposed	Total

[11] There is a typo in the Table I.8 Radioactive waste disposed of at sea [the Belgian value should read 2 120 000 (GBq)]

[12] The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972, the "London Convention", entered into force on 30 August 1975.

Year	2013	2016	2013	2016	2013	2016
VLLW	237 000	234 000	279 000	369 000	516 000	603 000
LLW	428 000	417 000	2 025 000	2 102 000	2 453 000	2 519 000
ILW	326 000	326 000	12 000	12 000	338 000	338 000
HLW	6 000	6 000	0	0	6 000	6 000
Total (m^3)	**997 000**	**983 000**	**2 316 000**	**2 483 000**	**3 313 000**	**3 466 000**

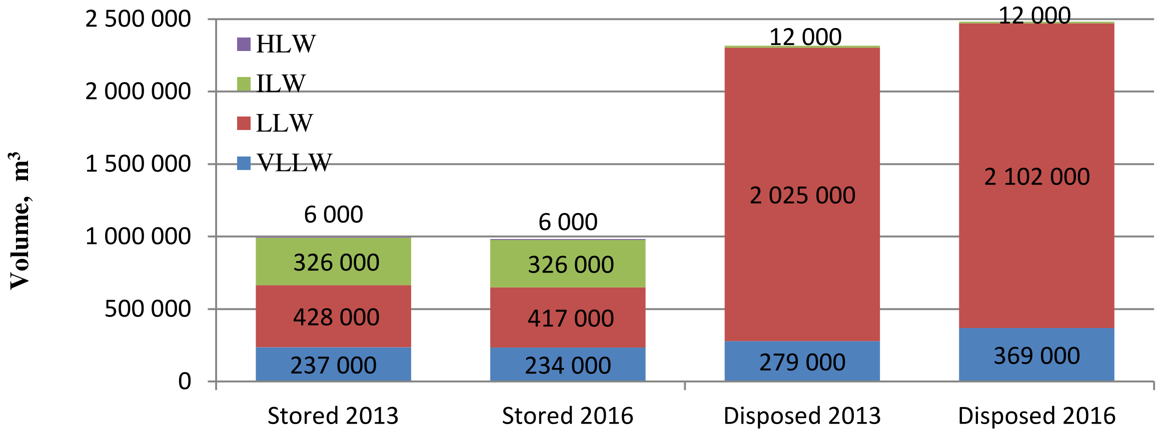


Figure 1. Distribution of the RAW in the EU between stored and disposed of by waste class at the end of 2013 and 2016

Figure 1 and Figure 2 provide information on the distribution of radioactive waste in the EU by waste class and by management status. As can be seen from these figures, distribution of radioactive waste by class has not changed significantly compared to 2013. As in previous reporting, LLW still remains as the dominating waste class making up 73% of the overall waste amount, while VLLW and ILW are estimated to have a 17% and 10% share respectively (see Figure 3). HLW makes up by far the smallest fraction of the overall waste volume, accounting for less than 0.2% (all HLW is kept in storage).

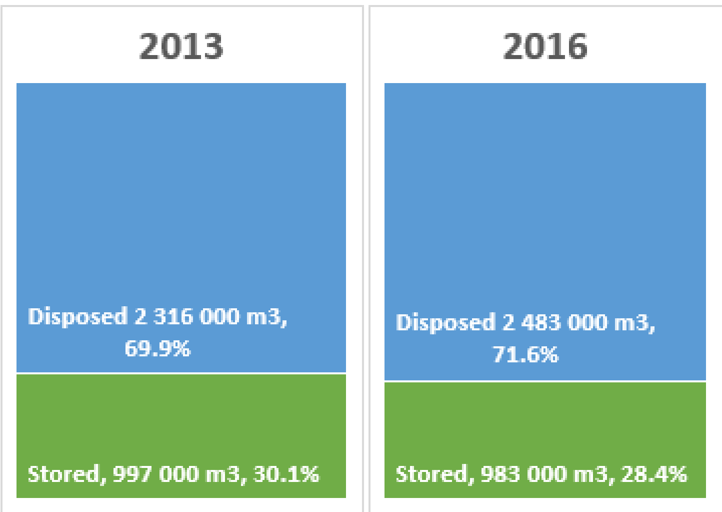


Figure 2. Distribution of the total RAW in the EU between stored and disposed at the end of 2013 and 2016

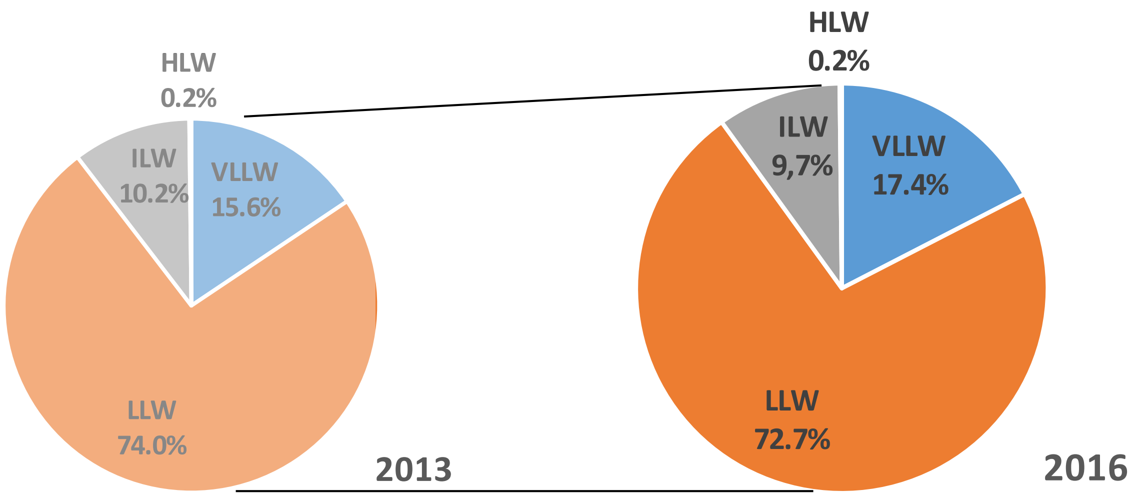


Figure 3. Distribution of the total RAW in the EU by waste category at the end of 2013 and 2016

Even though LLW dominates the radioactive waste inventory, two specific points should be taken into consideration:

- Some Member States do not have a separate VLLW class as defined in IAEA GSG-1 waste classification scheme. In such cases, all the VLLW is reported as part of LLW waste class.

- Some Member States do not register (partially or completely) VLLW amounts in their national inventory.

Both above-mentioned issues lead to the situation in which VLLW amounts are underestimated and LLW overestimated.

As indicated above, the total quantity of the radioactive waste disposed of as of end 2016 equals to 2 483 000 m^3. It consist mainly of LLW (85%). However, due to the non-inclusion of VLLW disposals to the national inventories of some Member States the actual fraction of disposed LLW volumes could be significantly lower. At the end of 2016, 61% of the total VLLW volume is reported as disposed of and the amount of VLLW disposed of has steadily increased. At the same time, 83% of LLW is reported as disposed. A few Member States have reported small amounts of ILW disposed of (0.5% of the total disposed waste). In most of the cases, ILW was disposed of as a result of past practice. Due to safety concerns, some Member States are planning to retrieve ILW and re-dispose it in new disposal facilities.

The total reported volume of **stored radioactive waste** in 2016 is 983 000 m^3. LLW makes almost half of this amount (42%), while VLLW and ILW make 24% and 33% respectively. The HLW fraction in the overall radioactive waste in storage is 0.6% and it remains unchanged since the previous reporting. Distribution of stored RAW by class for 2016 is shown in Figure 4 together with 2013 values for comparison. As in the previous cases, the change between two periods is relatively small.

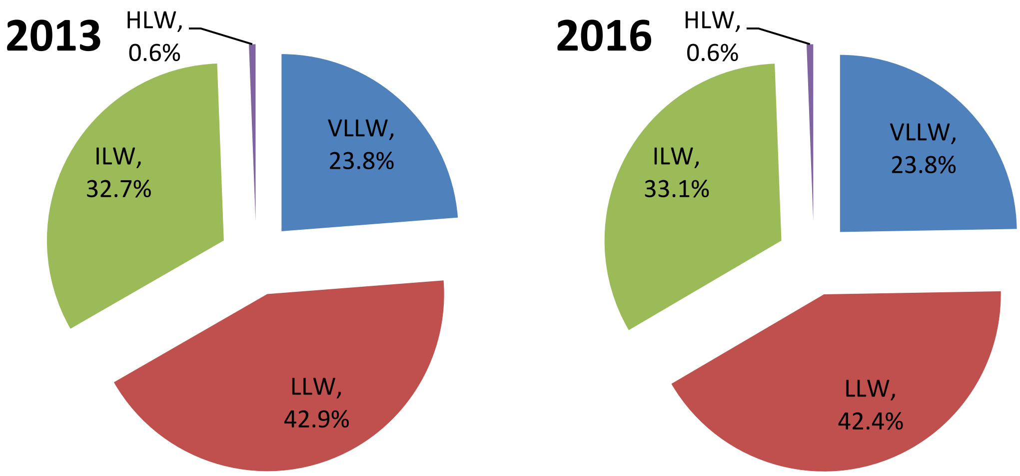


Figure 4. Distribution of stored radioactive waste in the EU by class, end of 2013 (997 000 m^3) **and 2016** (983 000 m^3)

There are significant differences in the amounts of stored radioactive waste between Member States with and without nuclear power programmes. Figure 5 presents this at aggregated level for all RAW classes. In aggregate, the 16 Member States with nuclear power programme have 125 times bigger amounts of RAW than the 12 Member States without nuclear power programmes. This difference varies between RAW classes and e.g. for HLW and ILW it is almost 200 and 240 times, respectively. It can be concluded that Member States with nuclear power programmes are contributing the most to the overall EU radioactive waste in storage (see Figure 5).

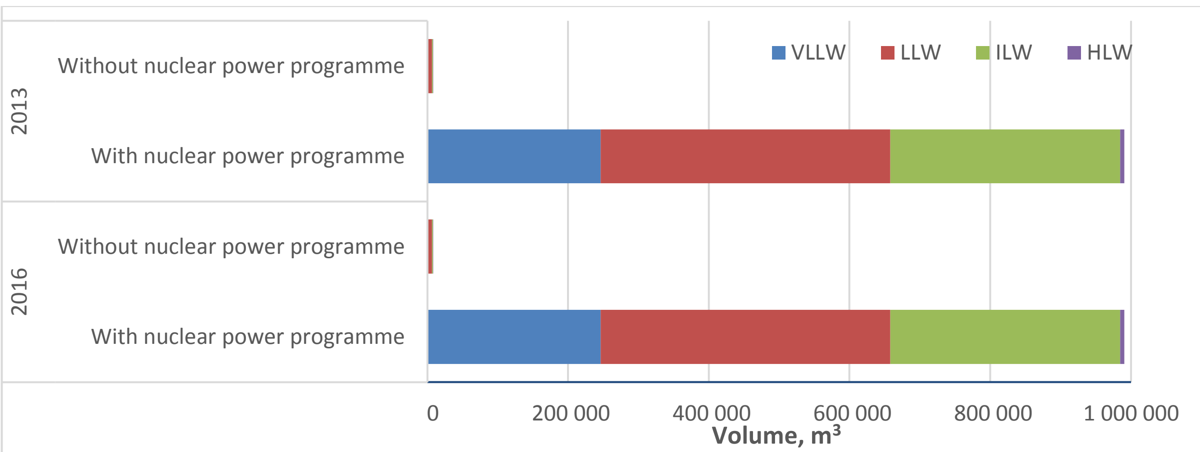


Figure 5. Volumes of stored radioactive waste by class in Member States with and without nuclear power programme, end of 2013 and 2016

Radioactive waste inventory - trends in the EU

The evolution of the total amount of radioactive waste (Table 2), radioactive waste in storage (Table 3) and radioactive waste which has been disposed of (Table 4) is based on the data from the various Commission reports published in 2004, 2007, 2010, 2013 and on the current data from the second national reports (2016).

Table 2. Evolution of total radioactive waste inventory since the end of 2004

Waste Category	Total amount (m^3)				
	2004	**2007**	**2010**	**2013**	**2016**
VLLW	210 000	280 000	414 000	516 000	603 000
LLW	2 228 000	2 435 000	2 356 000	2 453 000	2 519 000
ILW	206 000	288 000	321 000	338 000	338 000
HLW	5 000	4000	5 000	6 000	6 000
Total	**2 649 000**	**3 007 000**	**3 096 000**	**3 313 000**	**3 466 000**

Figure 6 presents radioactive waste inventory evolution for the period 2004-2016. There are no significant changes since the first Commission report. VLLW volume, as well as the percentage of disposed of waste steadily increases year by year. LLW remains the dominant waste class in terms of total volume and disposal rate.

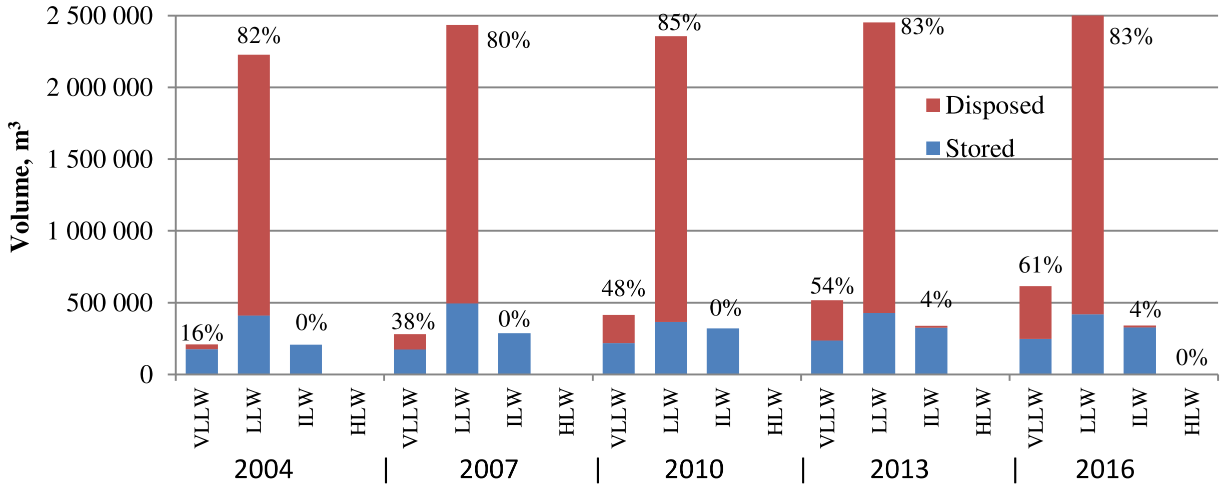


Figure 6. Evolution of total radioactive waste volumes since the end of 2004 (with the percentage of waste disposed of indicated)

Normalized RAW amounts from tables are also presented in figures to allow easier trend observation (see Figure 7, Figure 8 and Figure 9). In all RAW categories a steady increase of volume over time is noticeable. There is one slight decrease of total RAW, coming from the stored part, between reporting in 2004 and 2007. This decrease can be attributed to different RAW conditioning activities resulting in reduction of RAW volumes. Member States applied various techniques such as compaction of the solid waste or solidification treatment of liquid waste. The second decrease is noticeable for HLW between 2007 and 2010 after a previous increase.

The overall evolution of radioactive waste generated in the EU (normalized sum of radioactive waste both stored and disposed) until the end of 2016 is shown in Figure 7. The amount of the VLLW is increasing at the highest rate, ILW rises almost at half speed while the other two classes have the smallest rate of increase.

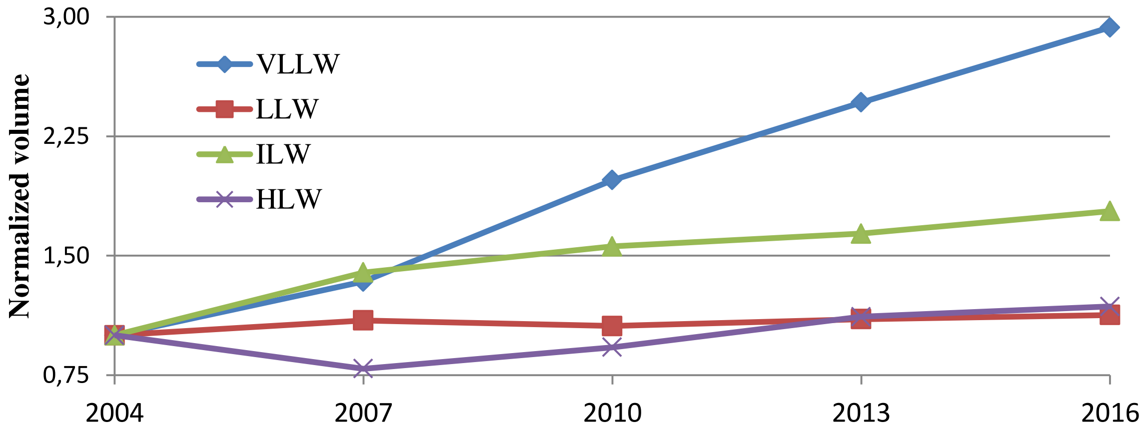


Figure 7. Normalized[13] evolution of RAW volumes in the EU (both stored and disposed)

Evolution of the stored radioactive waste volumes (per waste category) is presented in Table 3.

Table 3. Evolution of stored radioactive waste in the 2004-2016 period

Waste Category	Stored amount (m^3)				
	2004	**2007**	**2010**	**2013**	**2016**
VLLW	176 000	175 000	217 000	237 000	234 000
LLW	411 000	495 000	365 000	428 000	417 000
ILW	206 000	288 000	321 000	326 000	326 000
HLW	6 000	4 000	5 000	6 000	6 000
Total	**799 000**	**962 000**	**908 000**	**997 000**	**983 000**

There are currently no operational deep geological disposal facilities for ILW and HLW. Consequently, the amounts of stored ILW and HLW are steadily increasing over time. The amounts of VLLW and LLW in storage are affected by differences in generation and disposal rates. During different periods, their respective amounts in storage may therefore increase or decrease. The volume of stored VLLW shows a steady increase of about 40 % over the period 2004 – 2016. This shows that the disposal rate of VLLW needs to continue further to keep pace with its generation. Figure 8 presents graphically normalised stored RAW categories for all reporting periods.

[13] The chart shows relative change of radioactive waste volumes over time from 2004.

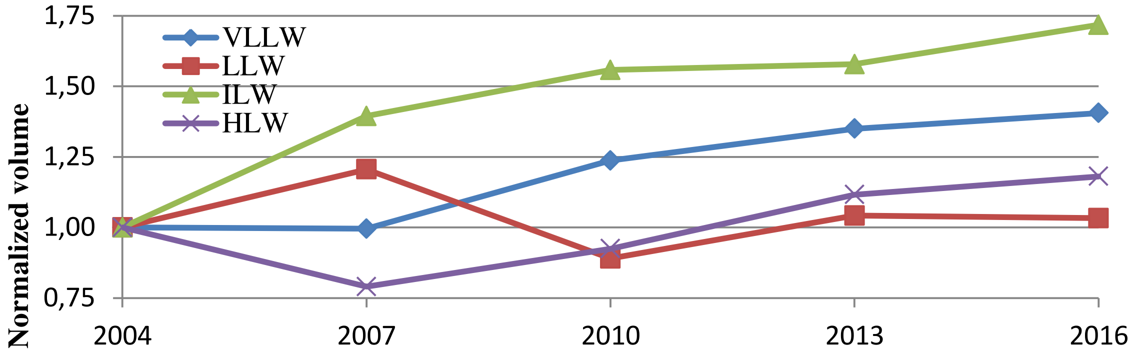


Figure 8. Normalised[14] evolution of stored RAW amounts in EU since the end of 2004

Table 4 shows **the evolution of radioactive waste disposal over time**. The increase in disposed of LLW is levelling over the period since 2004. Contrary to this, the disposal of VLLW shows a steady increase.

14 The chart shows relative change of radioactive waste volumes over time in comparison to the 2004 volumes.

Table 4. Evolution of radioactive waste disposals in the 2004-2016 period

Waste Category	Disposed amount (m^3)				
	2004	**2007**	**2010**	**2013**	**2016**
VLLW	34 000	105 000	197 000	279 000	369 000
LLW	1 817 000	1 940 000	1 991 000	2 025 000	2 102 000
ILW	0	0	0	12 000	12 000
HLW	0	0	0	0	0
Total	**1 851 000**	**2 045 000**	**2 188 000**	**2 316 000**	**2 483 000**

From Table 4, it can be also seen that some Member States are disposing of ILW. However, this is not yet widespread practice. These disposals, in accordance with the IAEA classification, consist mainly of highly active disused radioactive sealed sources containing short-lived radionuclides. Over 96% of ILW is still kept in storage pending proper disposal facilities. Figure 9 presents graphically normalised stored RAW categories for all reporting periods.

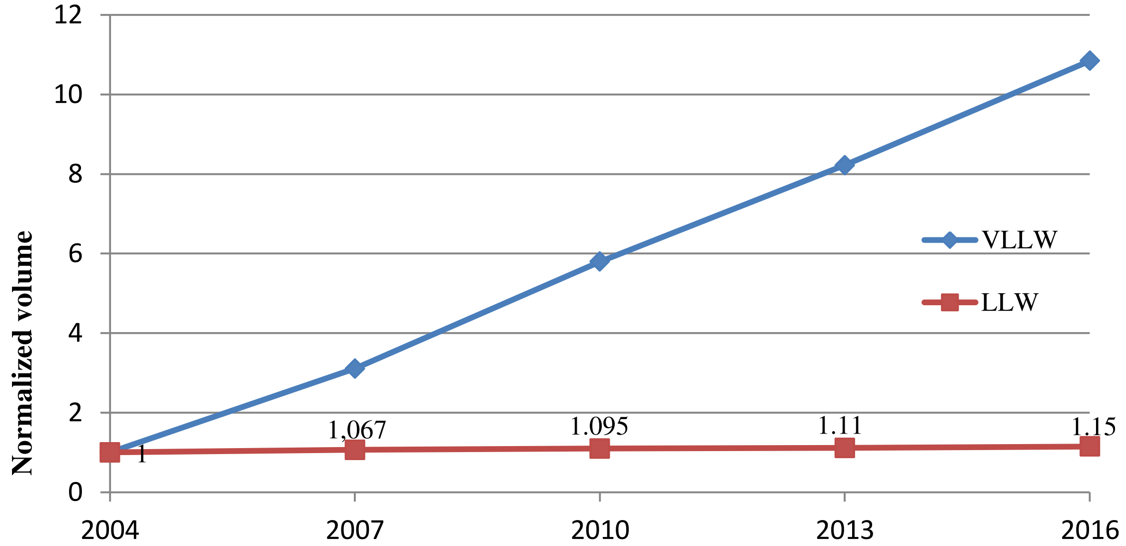


Figure 9. Normalised[15] evolution of VLLW and LLW disposal amounts in EU since the end of 2004

Overall, the situation remains broadly the same compared to the situation described in the first Commission report. 17% of the LLW amount generated is kept in storage. There is no systematic increase in the amounts in storage between 2004 and 2016 and the overall LLW amount of waste generated and disposed of is generally in equilibrium. LLW disposal is dominated by Member States with large LLW inventories, whereas a number of Member States with smaller inventories do not yet dispose of their LLW. For ILW the situation is very different. Less than 4% is reported as disposed of, and in some cases such ILW will be

15 The chart shows relative change factors of radioactive waste volumes over the time in comparison to the 2004 (VLLW and LLW).

retrieved as the current disposal facilities do not meet present safety requirements. There is a steady increase in ILW in storage.

For HLW and spent fuel declared as waste, the first facility for disposal of such material is expected around 2024 in Finland, with other facilities in France (around 2035) and Sweden (around 2032). Therefore, one should expect that the amounts of HLW and spent fuel in storage are increasing steadily in line with their generation.

Currently, thirteen Member States[16] have radioactive waste disposal facilities either in operation or closed (nuclear power programme countries: Czech Republic, Finland, France, Germany, Hungary, Romania, Slovakia, Spain, Sweden, UK; non-nuclear programme countries: Latvia, Poland and Portugal) although based on the information from the national programmes and reports it is expected that more repositories will be built in the coming years.

A number of Member States (both with and without nuclear power plants) have dedicated disposal sites for institutional radioactive waste. In some cases, the disposal of waste undertaken in the past at several sites is now being reconsidered and there are plans for the retrieval of the waste disposed of several decades ago. Consequently, change of radioactive waste inventories can be expected after retrieval for processing and subsequent storage and/or disposal.

Below, the status of RAW inventory for the current and previous reporting period is presented for all Member States. The presentation includes amounts of RAW per management status and for each of the four RAW classes. Because of the above-mentioned difference in scale, the presentation is separate for Member States with and without nuclear power programme.

Sixteen EU Member States operate or have operated nuclear power plants. Member States with nuclear power programmes account together for 99.7% of the radioactive waste inventory in the EU. Percentage share of the total RAW in 2016 between Member States with nuclear power programme is presented in Figure 10.

16 Bulgaria and Lithuania categorised as using these past disposal (radon type) facilities as storage facilities. See Table 8 of the SWD(2017) 159 on Progress of Implementation of Council Directive 2011/70/Euratom.

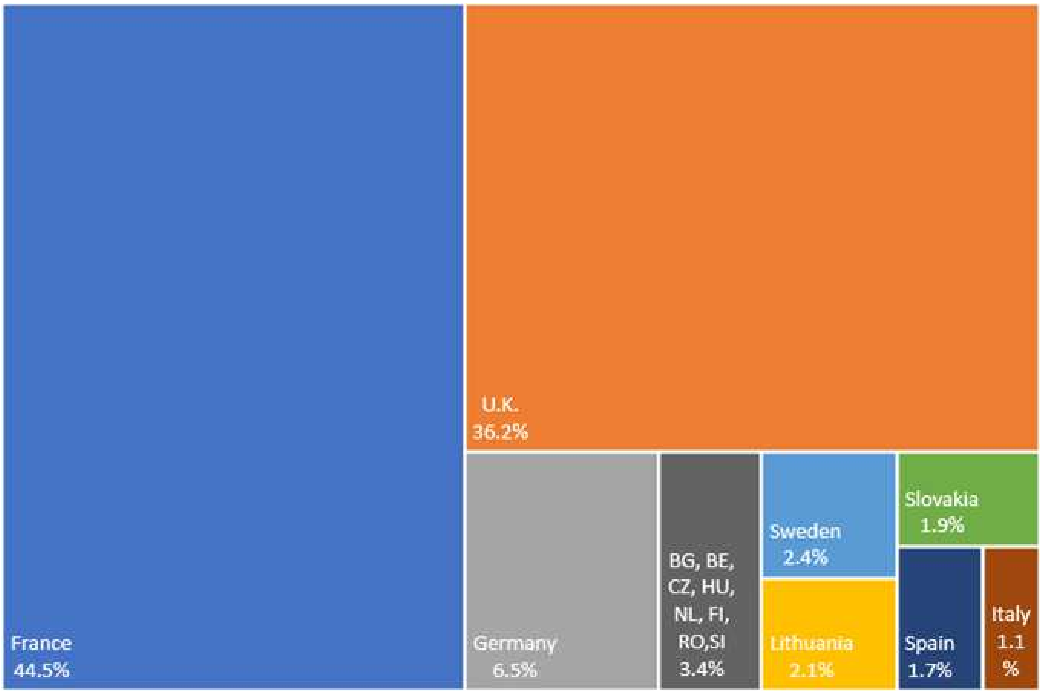


Figure 10. Distribution of total volumes of radioactive waste in Member States with nuclear power programmes, end of 2016[17]

France and UK have by far the highest share with 44.5% and 36% respectively. The next Member State with the highest share is Germany with 6.5%. The total volume of radioactive waste in these Member States is shown individually in Figure 11 (with indicated stored and disposed amounts in 2013 and 2016).

17 Member States' abbreviations in this report are as follows: Austria (AT), Belgium (BE), Bulgaria (BG), Croatia (HR), Cyprus (CY), Czech Republic (CZ), Denmark (DK), Estonia (EE), Finland (FI), France (FR), Germany (DE), Greece (EL), Hungary (HU), Ireland (IE), Italy (IT), Latvia (LV), Lithuania (LT), Luxembourg (LU), Malta (MT), The Netherlands (NL), Poland (PL), Portugal (PT), Romania (RO), Slovakia (SK), Slovenia (SI), Spain (ES), Sweden (SE) and the United Kingdom (UK).

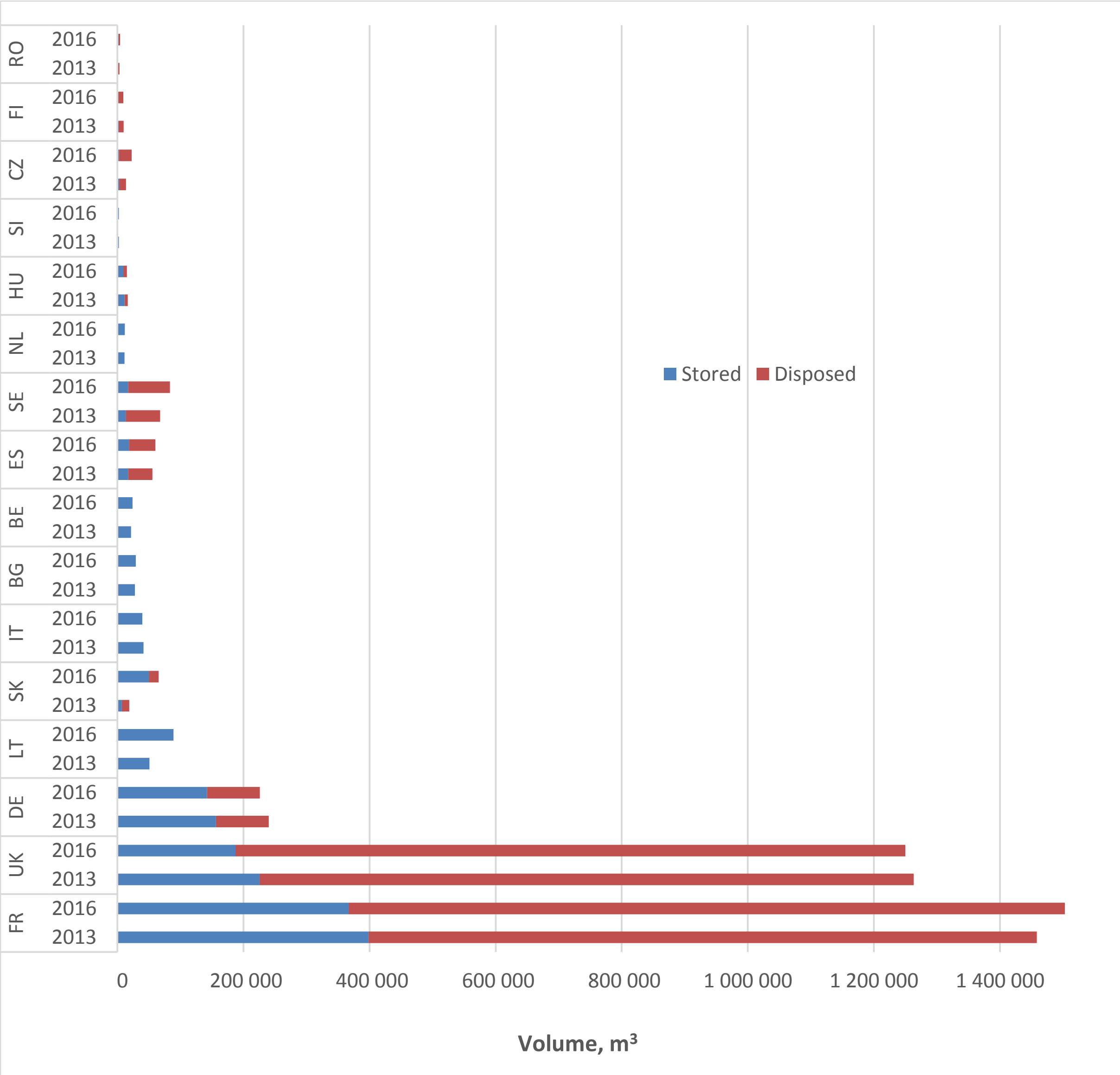


Figure 11. Volumes of RAW in Member States with nuclear power programme, end of 2013 and 2016

Twelve Member States have no nuclear power programmes, although six of them are operating or have operated research, training or demonstration reactors. The distribution among the Member States without nuclear power programmes and the total volume of radioactive waste is shown in Figure 12 and Figure 13 (with indicated stored and disposed of amounts for 2013 and 2016).

Figure 12. Distribution of total volumes of RAW in Member States without nuclear power programme, end of 2016 (HR, LU, CY, IE and MT have together 0.1%)

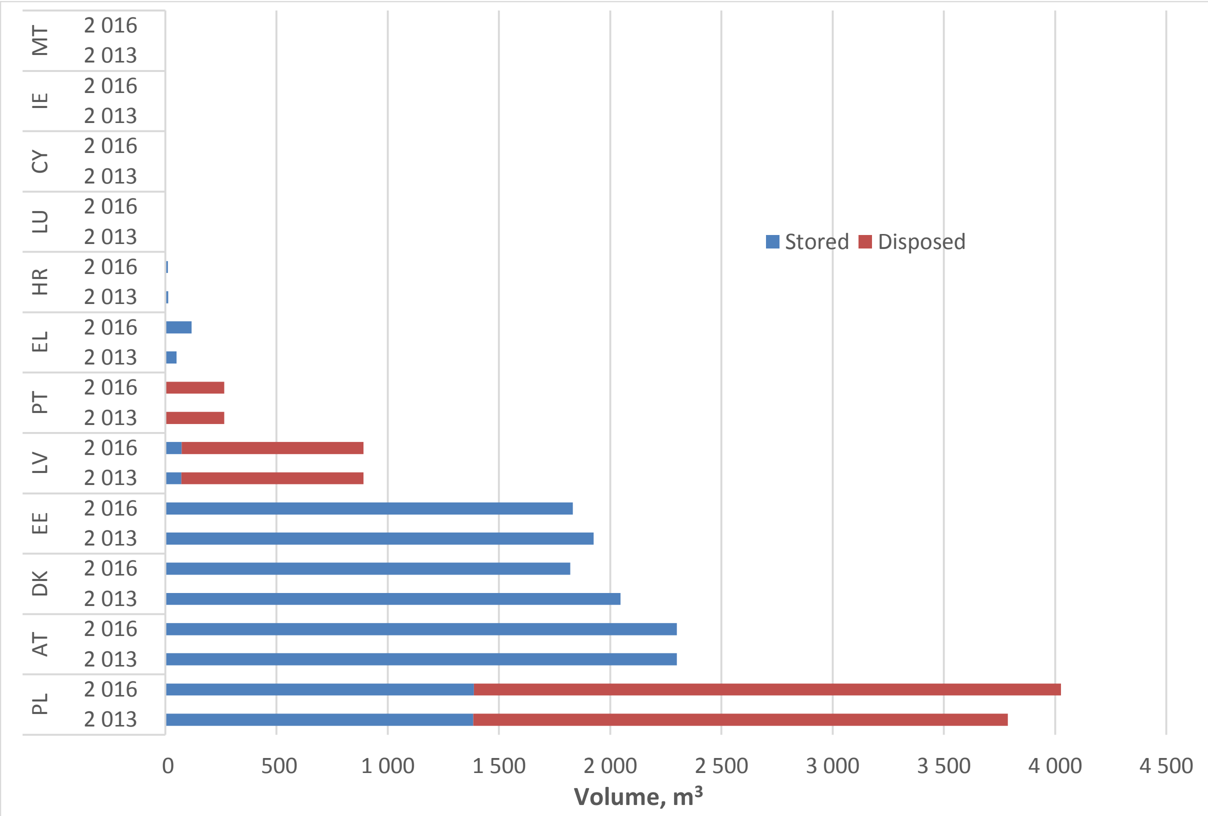


Figure 13. Volume of RAW in Member States without nuclear power programme, end of 2013 and 2016

Member States with nuclear power programmes are primary contributors to the overall radioactive waste inventory of the EU. The radioactive waste amounts are in line with the size of the respective nuclear power programmes. Amounts of stored radioactive waste in Member States with nuclear power programmes are shown in Figure 14 for 2016 and 2013 (with indicated amounts for all RAW classes). The difference between France and UK is primarily from the amount of stored RAW.

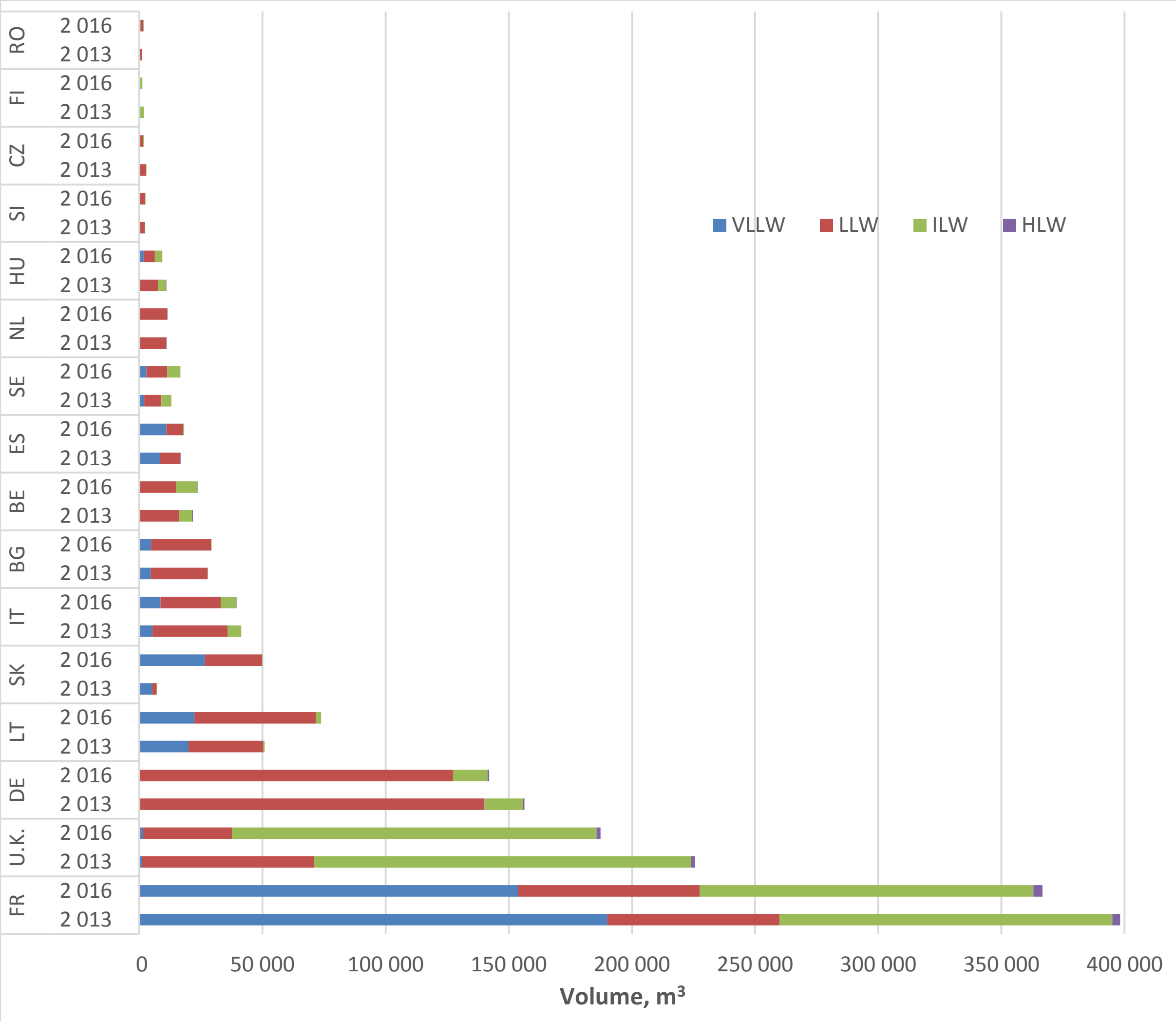


Figure 14. Volumes of stored RAW by class in Member States with nuclear power programmes, end of 2013 and 2016

The amounts of stored radioactive waste for Member States which are without nuclear power programmes are shown in Figure 15 for 2016 and 2013 (with indicated amounts for all RAW classes).

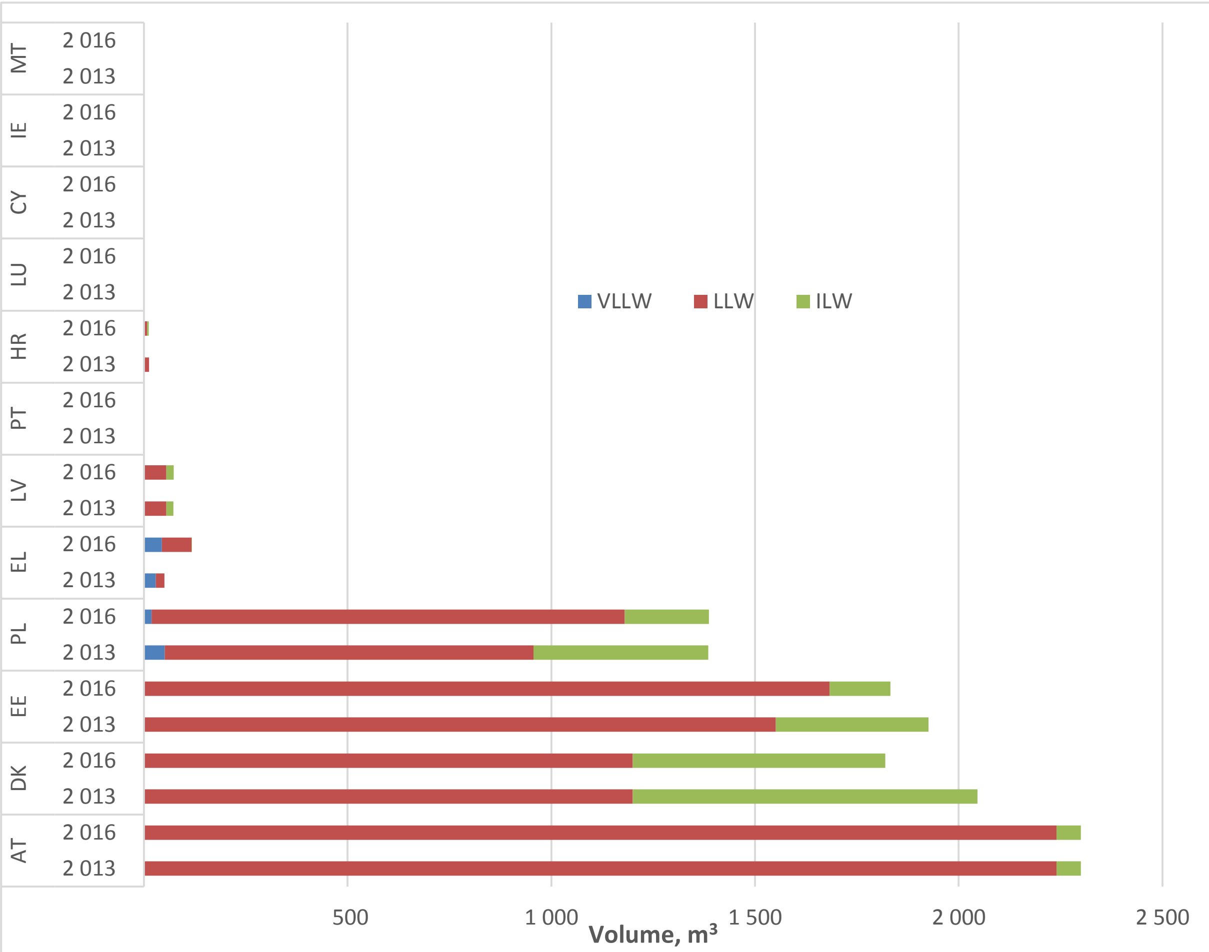


Figure 15. Volumes of stored RAW by class in MSs without nuclear power programme, end of 2013 and 2016

Distribution of the disposed radioactive waste is presented for all Member States in Figure 16 regardless of whether they have a nuclear power programme or not (with indicated amounts of all RAW classes for 2016 and for 2013 for comparison). No HLW waste is disposed of in any Member State as of the current reporting period.

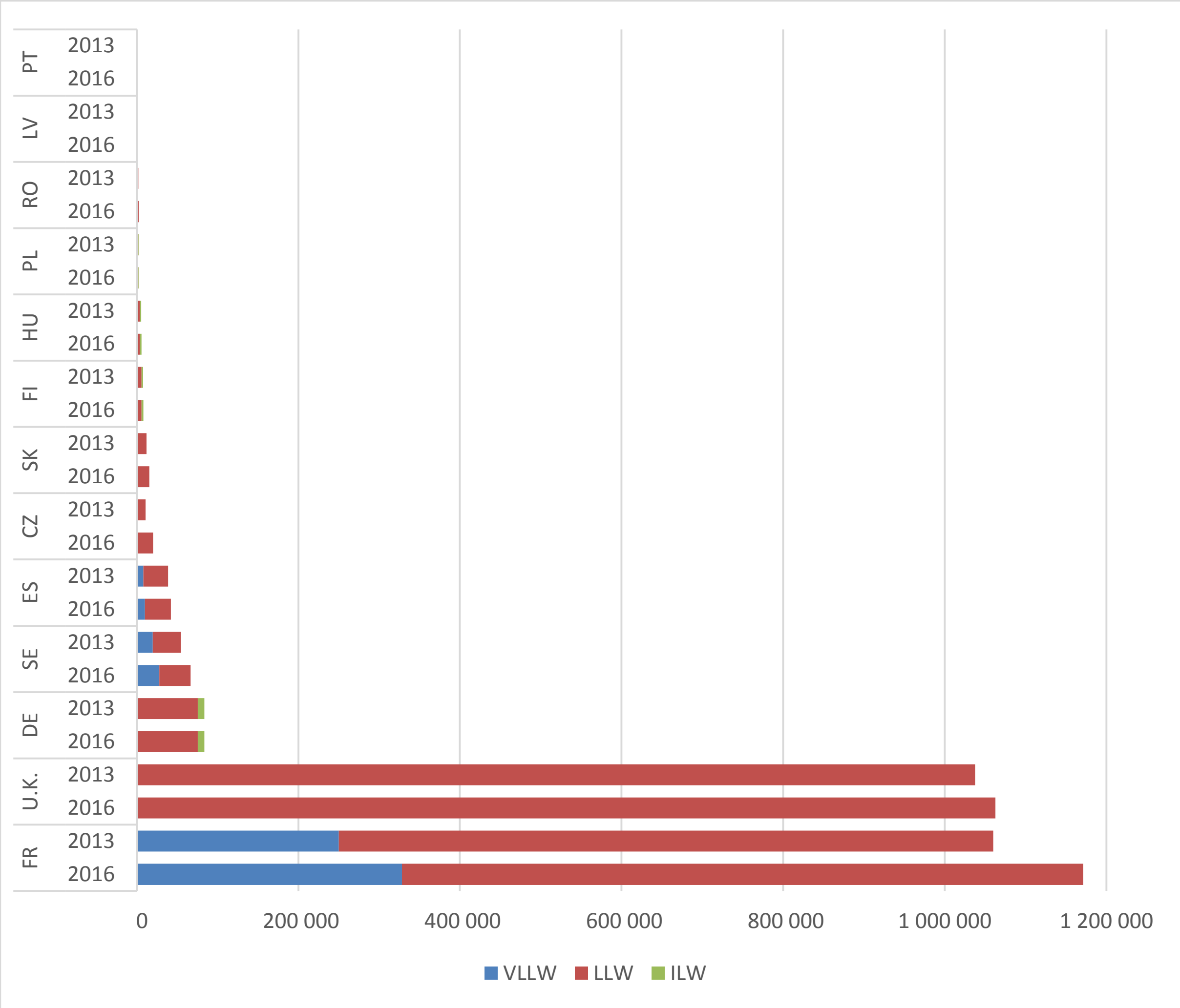


Figure 16. Volumes of radioactive waste disposed of in the EU, end of 2013 and 2016

Spent fuel inventory

Based on the Member State strategy, spent fuel is stored pending either disposal or reprocessing. During reprocessing, uranium and plutonium are recovered and separated from fission products, which are radioactive waste (mainly HLW and ILW). As there are no operational disposal facilities for this type of radioactive waste, spent fuel is currently stored until disposal facilities become available.

At the end of 2016 approximately 58 000 tHM of spent fuel was stored in the EU (7% increase from 2013 and 29% increase since 2007[18]) and around 900 tHM of spent fuel (about 1.5 %) was sent for reprocessing outside the EU with the expected returns of resulting radioactive waste from reprocessing. These amounts include both spent fuel coming from power and non-power (e.g. research, isotope production) reactors.

[18] See footnote 4.

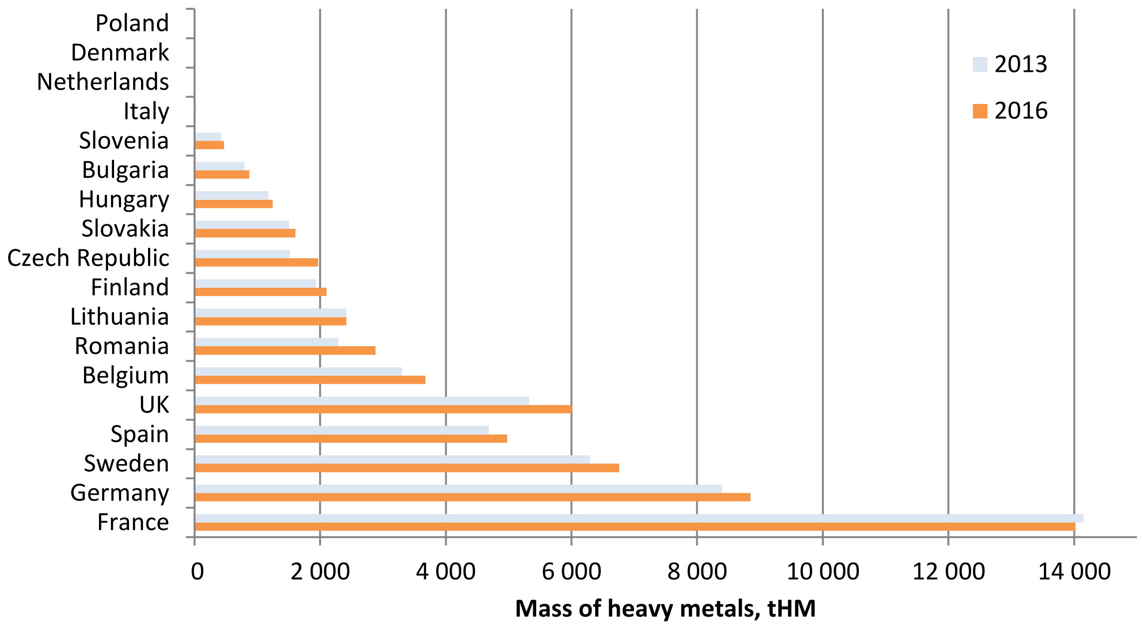


Figure 17. Spent fuel in storage (end of 2013 and 2016)

Most recent reported amounts of spent fuel stored in individual Member States are shown in Figure 17 together with values from 2013 for comparison. Some Member States have smaller inventories of spent fuel (or none) in storage than that generated by the nuclear power plants because part of it or all has been reprocessed. On the other end, countries with neither past, nor current reprocessing, have comparably high spent fuel inventories. A steady increase of the spent fuel mass is visible for all Member States. The percentage share of spent fuel between Member States is presented in the Figure 18.

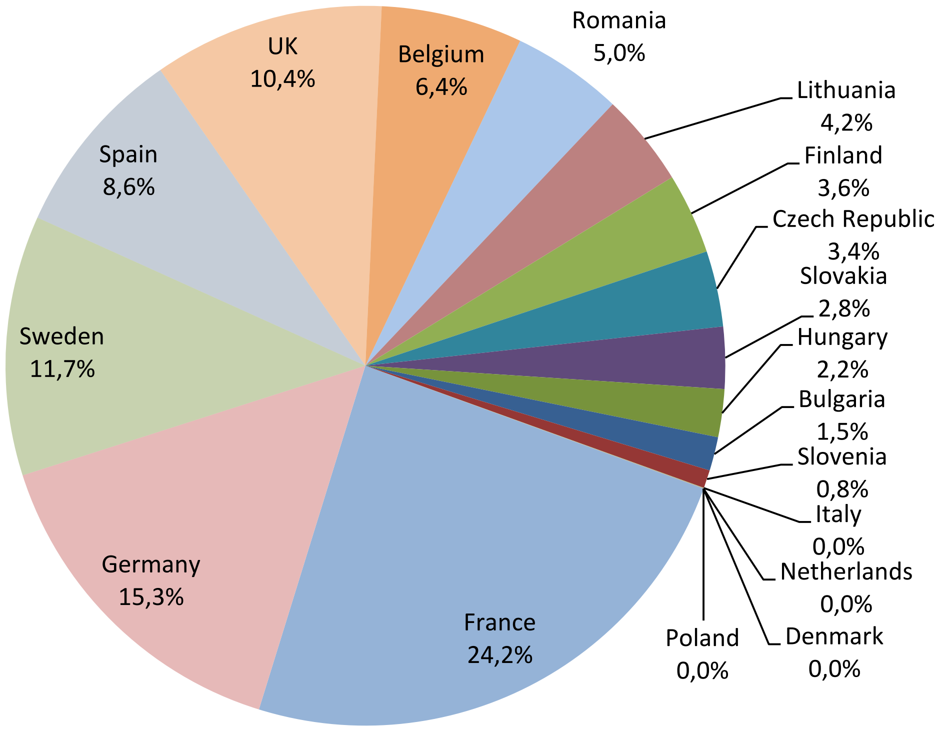


Figure 18. Member States' contribution to the overall spent fuel inventory in the EU, end of 2016

France has almost one quarter of all EU spent fuel, followed by Germany, which has almost 9 percent points less. The third is Sweden with close to 4 percent points less. There is a gradual but smaller difference among the Member States with less spent fuel.

Figure 19 presents the evolution of the total spent fuel mass for all Member States during all reporting periods. The rate of spent fuel mass increase is noticeably slower after 2010.

Given that today there is no disposal route available for spent fuel (first disposal facilities to become operational in 2024-2035) and that not all Member States have their spent fuel reprocessed, there is a continual increase in the amount of spent fuel in storage (see Table 5 and Figure 19).

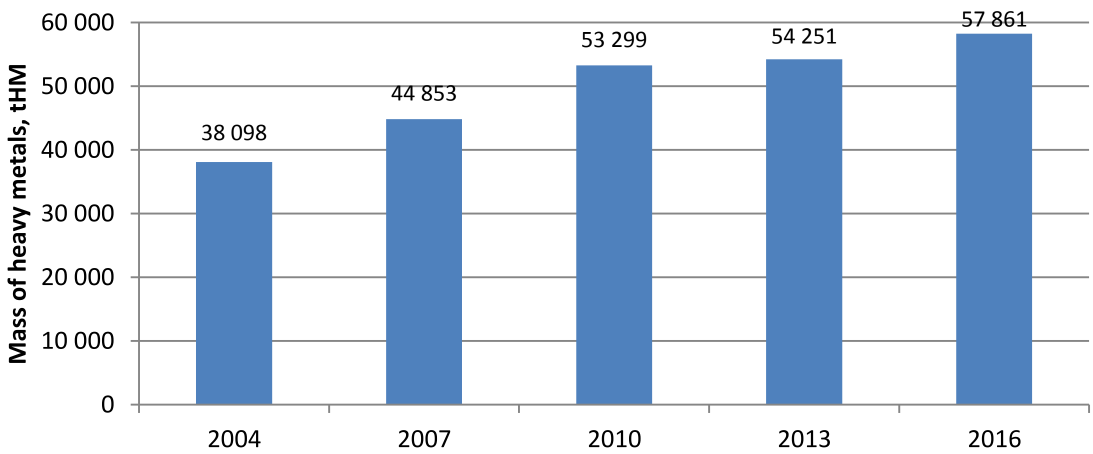


Figure 19. Evolution of spent fuel in storage in Member States since the end of 2004

6. Projections of radioactive waste and spent fuel

In the SWD on the EU Inventory (SWD(2017) 161) the Commission reported that projections of radioactive waste inventories in Member States differed in the level of detail and time frames provided and several Member States have not provided any or sufficiently detailed estimates of their future inventory of spent fuel and/or radioactive waste, particularly regarding new builds and decommissioning. Therefore, at that time it was not possible for the Commission to forecast future total EU inventories.

In the second national reports, Member States improved reporting of the future projections compared to the first national reports. Additional information reported by Member States allowed for the first time to prepare an EU radioactive waste and spent fuel forecast for 2030. Even if this is a clear progress in reporting, it should be noted that all uncertainties mentioned before are significantly larger for future predictions. Due to limitations of the reported inventory data only estimations of radioactive waste and spent fuel projections for 2030 was possible. The majority of the Member States also provided estimates of their future inventories for 2050. However, due to the unavailability of inventory forecast data for 2050 from some large Member States, it was not possible to establish an overall EU inventory long-term forecast.

In the first national reports, Member States were using two different reporting approaches for estimation of radioactive waste projections:

- One approach was to provide the data along with the reference waste classes for the end of the useful life of existing facilities and sites, including decommissioning and site remediation.

- The other approach was to provide the amounts of radioactive waste for the different reference waste classes for specified future dates.

In the second national reports the majority of the Member States have reported their inventory projections for 2030 and 2050. In addition to the inventory projections for specific dates, a few Member States reported long-term estimations of overall radioactive waste and spent fuel generation from the existing nuclear facilities, including decommissioning of those facilities.

Estimated EU radioactive waste and spent fuel inventory for 2030 is presented in Table 5. Data reported by individual Member States are given in Annex I of this document.

Decommissioning of nuclear power plants will become an increasingly important activity for the European nuclear industry in the coming years due to the ageing of the reactor fleet. This will have an important impact on the amounts of radioactive waste generated, especially VLLW and LLW, and should thus be taken into account when planning disposal and storage facilities. As can be seen from Figure 20, it is expected that total VLLW volumes will double by 2030 compared to the current amounts, and that a significant increase of LLW is expected as well. The current VLLW volumes make only 44% of the expected VLLW amounts in 2030 (equivalent to a 225% increase from the current level). Vor LLW current amounts make 76%

of the expected LLW amounts in 2030. The main contributors to this increase are Member States with largest nuclear programmes.

For ILW and HLW, safe and responsible management is challenging in terms of the availability of sufficient long-term storage capacity and the development of sustainable disposal solutions. It is expected that ILW by 2030 will increase by approximately 35%. The biggest part of this increase will come from decommissioning activities. HLW increase by about 50% will result from reprocessing of spent fuel (mostly in France).

Table 5. Estimated future amounts of RAW in the EU MSs for 2030

	Future RAW and SF amount estimates (m^3)				
	VLLW	LLW	ILW	HLW	SF
2016	603 000	2 519 000	338 000	6 000	58 000
2030	1 360 000	3 322 000	455 000	9 000	76 000

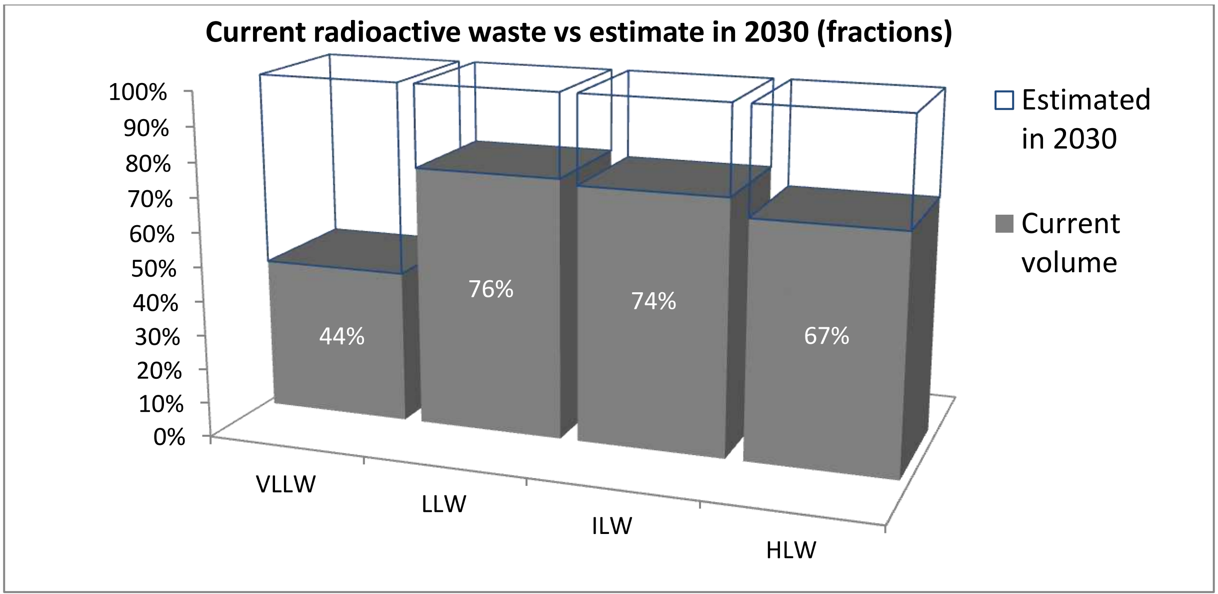


Figure 20. Estimation of radioactive waste generation by 2030 compared to current inventory

With regards to **spent fuel**, an increase from present 58 000 tHM to 76 000 tHM in 2030 is estimated. It has to be noted, that the majority of Member States have not reported inventories from planned new build nuclear power plants. It is expected that by 2030 the spent fuel inventory will increase by approximately 10%. As some Member States proceed with spent fuel reprocessing, the actual increase does not represent the actual amount of spent fuel discharged from the reactors. Part of the spent fuel is sent for reprocessing outside the EU and it is expected that around 1100 m^3 of radioactive waste from spent fuel reprocesing will be returned by 2030.

Annex I: Spent fuel and radioactive waste inventory data

"-" in the tables below means no data was received from the Member State or no such practice exists

"0" in the table means that the data with value "0" was received from the Member State

Table I.1. Overall EU radioactive waste inventory and the future prospects as at the end of 2016

Total RAW		2016		2030		2050		Other date	
MS	**Category**	**Volume, m^3**	**Decom. Share, m^3**	**Volume, m^3**	**Decom. Share, m^3**	**Volume, m^3**	**Decom. Share, m^3**	**Volume, m^3 [Date, year]**	**Decom. Share, m^3**
Austria	VLLW	-	-	-	-	-	-	-	-
	LLW	2 240	900	3 050	1 930	3 620	2 390	3600 [2045]	2390 [2045]
	ILW	60	30	60	30	60	30	60 [2045]	30 [2045]
	HLW	-	-	-	-	-	-	-	-
Belgium	VLLW	-	-	-	-	-	-	-	-
	LLW	14 912	-	29 400	-	52 600	-	54 900 [2130]	-
	ILW	8 755	-	8 700	-	10 780	-	10 900 [2130]	-
	HLW	70	-	70	-	250	-	250 [2130]	-
Bulgaria	VLLW	4 817	0	42 000	35 000	-	-	-	-
	LLW	24 380	150	90 200	42 000	-	-	-	-
	ILW	10	0	10	0	-	-	-	-
	HLW	0	0	1 100	0	-	-	-	-
Croatia	VLLW	-	-	-	-	-	-	-	-
	LLW	7.53	0	1 546	100	4 561	4 540	1440 [2023] 4490 [2043] 4540 [2060]	0 [2023] 2 660 [2043] 2660 [2060]
	ILW	3.81	0	-	-	-	-	-	-
	HLW	0	0	0	0	41	41	0 [2023] 41 [2043] 41 [2060]	0 [2023] 41 [2043] 41 [2060]
Cyprus	VLLW	-	-	-	-	-	-	-	-
	LLW	-	-	<1	-	<1	-	-	-
	ILW	-	-	-	-	-	-	-	-
	HLW	-	-	-	-	-	-	-	-
Czech Republic	VLLW	-		-		-		-	-
	LLW	13 350	0	17 600	11 000	32 800	23 200	-	-
	ILW	9270	0	2 850	1 500	2 500	150	146 000 [2085]	83 000 [2085]
	HLW	0	0	4200 t	4200 t	41	0	4 424	2 829 t

Total RAW		2016		2030		2050		Other date	
MS	Category	Volume, m^3	Decom. Share, m^3	Volume, m^3	Decom. Share, m^3	Volume, m^3	Decom. Share, m^3	Volume, m^3 [Date, year]	Decom. Share, m^3
								[2085]	[2085]
Denmark	VLLW	-	-	-	-	-	-	-	-
	LLW	1 200	-	1 926	-	3 162	-	-	-
	ILW	620	-	9 949	-	9 949	-	-	-
	HLW	-	-	-	-	-	-	-	-
Estonia	VLLW	-	-	-	-	-	-	-	-
	LLW	1 082	-	1 112	28	2 024	337	-	-
	ILW	64	-	65	-	802	650	-	-
	HLW	-	-	-	-	-	-	-	-
Finland	VLLW	-	-	-	-	-	-	-	-
	LLW	6 300	-	9 300	38	11 800	29 038	-	-
	ILW	3 200	-	7 130	-	7 650	-	-	-
	HLW	-	-	-	-	-	-	-	-
France	VLLW	482 000	-	970 000	-	-	-	1 600 000 [2040]	930 000 [2040]
	LLW	917 000	-	1 200 000	-	-	-	1 500 000 [2040]	420 000 [2040]
	ILW	135 500	-	160 000	-	-	-	170 000 [2040]	31 000 [2040]
	HLW	3 650	-	5 700	-	-	-	6 900 [2040]	0 [2040]
Germany	VLLW	-	-	-	-	-	-	-	-
	LLW	202 713*	-	300 378	-	340 878	-	-	-
	ILW	22 523*	-	34 115	-	38 615	-	-	-
	HLW	569.52	-	700	-	700	-	-	-
Greece	VLLW	44.2	-	< 200	< 50	-	-	-	-
	LLW	72.8	-	< 200	< 50	-	-	-	-
	ILW	0.5	-	< 1	< 1	-	-	-	-
	HLW	-	-	-	-	-	-	-	-
Hungary	VLLW	2 950	-	3 536	-	4 829	-	-	-
	LLW	7 376	-	8 841	-	12 072	-	-	-
	ILW	4 725	-	5 706	-	7 740	-	-	-
	HLW	150	-	173	-	228	-	-	-
Ireland	VLLW	-	-	-	-	-	-	-	-
	LLW	-	-	-	-	-	-	-	-
	ILW	-	-	-	-	-	-	-	-
	HLW	-	-	-	-	-	-	-	-
Italy	VLLW	8 591	1 456	24 631	16 041	30 792	22 201	30 792 [2065]	22 201 [2065]
	LLW	24 488	3 607	41 679	16 291	46 015	19 427	46 915 [2065]	19 427 [2065]
	ILW	6 300	171	11 198	4 509	13 497	6 807	13 497 [2065]	6 807 [2065]
	HLW	0	-	38.1	-	38.1	-	38.1 [2065]	-
Latvia	VLLW	0	0	0	0	0	0	-	-
	LLW	873	0	1 889	1 000	1 919	1 000	1 904 [2040]	1000 [2040]

Total RAW		2016		2030		2050		Other date	
MS	**Category**	**Volume, m^3**	**Decom. Share, m^3**	**Volume, m^3**	**Decom. Share, m^3**	**Volume, m^3**	**Decom. Share, m^3**	**Volume, m^3 [Date, year]**	**Decom. Share, m^3**
	ILW	18	0	32	10	37	10	35 [2040]	10 [2040]
	HLW	0	0	0	0	0	0	-	-
Lithuania	VLLW	22 345	-	40 015	24 978	55 725	40 996	-	-
	LLW	49 340	-	40 997	5 696	68 077	9 739	-	-
	ILW	2 077	-	5 483	3 227	10 359	8 103	-	-
	HLW	-	-	-	-	-	-	-	-
Luxem-bourg	VLLW	-	-	-	-	-	-	-	-
	LLW	0.1	-	-	-	0.1	-	-	-
	ILW	-	-	-	-	-	-	-	-
	HLW	-	-	-	-	-	-	-	-
Malta	VLLW	-	-	-	-	-	-	-	-
	LLW	-	-	-	-	-	-	-	-
	ILW	-	-	-	-	-	-	-	-
	HLW	-	-	-	-	-	-	-	-
The Netherlands	VLLW	- **	-	-	-	-	-	-	-
	LLW	11 358	- **	-	-	-	-	70 000 [2130]	-
	ILW	-	-	-	-	-	-	267 [2130]	-
	HLW	105	-	-	-	-	-	133 [2130]	-
Poland	VLLW	1 051	-	1 280	-	1 850	50	-	-
	LLW	2 757	-	4 800	-	23 730	130	-	-
	ILW	218	-	491	-	551	-	-	-
	HLW	-	-	-	-	-	-	-	-
Portugal	VLLW	-	-	-	-	-	-	-	-
	LLW	232	0	269	100	231	90	-	-
	ILW	33	0	47	0	69	3	-	-
	HLW	-	-	-	-	-	-	-	-
Romania	VLLW	437	437	-	-	-	-	-	-
	LLW	3 376	0	7 670	1 000	17 250	2 000	12 730 [2040] 32 370 [2095]	2 000 [2040] 16 100 [2095]
	ILW	100	0	285	60	1 075	175	960 [2040] 2 235 [2095]	60 [2040] 1 320 [2095]
	HLW	0.12	0	0	0	0	0	0 [2040] 0 [2095]	0 [2040] 0 [2095]
Slovakia	VLLW	26 635	-	29 000	29 000	29 000	29 000	29 000 [2040]	29 000 [2040]
	LLW	23 249	-	38 512	24 648	44 644	25 136	41 894 [2040]	25 136 [2040]
	ILW	52	-	1 200	1 187	1 900	1 887	1 900 [2040]	1 887 [2040]
	HLW	-	-	-	-	-	-	-	-
Slovenia	VLLW	-	-	-	-	-	-	-	-
	LLW	2 345	0	2 970	0	4 207	740	3 336 [2040]	0 [2040]
	ILW	38	0	2	0	0	0	6 [2040]	0 [2040]

Total RAW		2016		2030		2050		Other date	
MS	Category	Volume, m3	Decom. Share, m3	Volume, m3	Decom. Share, m3	Volume, m3	Decom. Share, m3	Volume, m3 [Date, year]	Decom. Share, m3
	HLW	0	0	0	0	0	0	-	-
Spain	VLLW	21 107	11 155	45 000	25 000	110 800	79 000	110 800 [2090]	79 000 [2090]
	LLW	39 034	2 985	56 000	13 000	90 400	42 500	90 400 [2090]	42 500 [2090]
	ILW	201	31	400	300	800	600	800 [2090]	600 [2090]
	HLW	12	0	12	0	12	0	12 [2090]	0 [2090]
Sweden	VLLW	30 741	-	53 540	-	53 540	-	-	-
	LLW	47 422	-	90 000	-	145 000	-	-	-
	ILW	5 300	-	11 500	-	15 000	-	-	-
	HLW	0	-	-	-	-	-	-	-
UK	VLLW	1 510	-	151 000	-	550 000	-	2 930 000 [2125]	2 812 800 [2125]
	LLW	1 098 800	-	1 351 700	-	1 588 700	-	2 442 700 [2125]	2 174 003 [2125]
	ILW	148 000	-	191 000	-	258 000	-	453 000 [2125]	258 210 [2125]
	HLW	1 660	-	1 500	-	1 500	-	1 500 [2125]	0 [2125]

* Indicated LLW and ILW amounts include 19 503t of unconditioned non-heat generating waste. For aggregation purposes Commission Services assumed 1t = 1m^3 (numbers not verified by Germany)

** Information on VLLW inventory as well as origin of waste amounts is not registered in the Netherlands.

Table I.2. Spent fuel stored on Member States' territory

	SF in Storage on a Member State territory (tHM)			
Country	**2016**	**2030**	**2050**	**Other date (Mass/date)**
Austria	-	-	-	-
Belgium	3 676	3800	3800	3 800 [2130]
Bulgaria	876	1 496	-	-
Croatia*	-	-	-	-
Cyprus	-	-	-	-
Czech Republic	1 969	2913	5268	9910 [>2185]
Denmark	0.238	-	-	-
Estonia	-	-	-	-
Finland	2 099	3 812	5 005	-
France	14 019	15 457	-	16 956 [2040]
Germany	8 849	10 110	10 110	-
Greece	0**	-	-	-
Hungary	1 246	2 101	3 330	-
Ireland	-	-	-	-
Italy	15.677	2.5	2.5	2.5 [2065]
Latvia	-	-	-	-
Lithuania	2 416	2 416	2 416	-
Luxembourg	-	-	-	-
Malta	-	-	-	-
The Netherlands***	8.2 m^3	-	-	-
Poland	-	-	0.4	-
Portugal	-	-	-	-
Romania	2 882	6 600	14 300	20 400 [2080]
Slovakia	1 606	2 289	3 380	-
Slovenia*	470	673	900	829 [2040]
Spain	4 975	6 672	6 672	6 672 [2090]
Sweden	6 759	9 500	12 000	-
UK	6 003	-	-	-

* Spent fuel reported by Slovenia to be shared equally by Croatia and Slovenia.

** Irradiated fuel of the research reactor GRR-1 has been repatriated in February 2019.

*** In the Netherlands the inventory of spent fuel is recorded in m^3.

Table I.3. Conditioned radioactive waste stored on Member States' territory

Stored conditioned RAW (Estimated volume for disposal, m^3)					
Country	**RAW**	**2016**	**2030**	**2050**	**Volume [Date]**
Austria	VLLW	-	-	-	-
	LLW	2 240	3 050	3 620	3600 [2045]
	ILW	60	60	60	60 [2045]
	HLW	-	-	-	-
Belgium	VLLW	-	-	-	-
	LLW	14 912	-	-	54 900 [2130]
	ILW	8 755	-	-	10 900 [2130]
	HLW	70	-	-	250 [2130]
Bulgaria	VLLW	2 490	0	-	-
	LLW	11 730	74 200	-	-
	ILW	0	10	-	-
	HLW	0	1 100	-	-
Croatia	VLLW	-	-	-	-
	LLW	7.5	-	-	1 150 [2023] 4 490 [2043] 4 540 [2060]
	ILW	3.8	-	-	-
	HLW	0	-	-	0 [2023] 41 [2043] 41 [2060]
Cyprus	VLLW	-	-	-	-
	LLW	-	-	-	-
	ILW	-	-	-	-
	HLW	-	-	-	-
Czech Republic	VLLW	-	-	-	-
	LLW	1 500	3 600	3 600	-
	ILW	420	350	350	-
	HLW	-	-	-	-
Denmark	VLLW	-	-	-	-
	LLW	1 200	-	-	-
	ILW	-	-	-	-
	HLW	-	-	-	-
Estonia	VLLW	-	-	-	-
	LLW	408	408	-	-
	ILW	9	9	-	-
	HLW	-	-	-	-
Finland	VLLW	-	-	-	-
	LLW	300	-	-	-
	ILW	50	-	-	-
	HLW	-	-	-	-
France	VLLW	154 000	-	-	-
	LLW	74 100	-	-	-
	ILW	135 500	-	-	-

Stored conditioned RAW (Estimated volume for disposal, m^3)					
Country	**RAW**	**2016**	**2030**	**2050**	**Volume [Date]**
	HLW	3 650	-	-	-
Germany	VLLW	-	-	-	-
	LLW	109 782	198 000	-	-
	ILW	12 198	22 740	740	-
	HLW	570	700	700	-
Greece	VLLW	-	-	-	-
	LLW	-	-	-	-
	ILW	-	-	-	-
	HLW	-	-	-	-
Hungary	VLLW	-	-	-	-
	LLW	-	-	-	-
	ILW	-	-	-	-
	HLW	-	-	-	-
Ireland	VLLW	-	-	-	-
	LLW	-	-	-	-
	ILW	-	-	-	-
	HLW	-	-	-	-
Italy	VLLW	3 097	15 575	728	0 [2065]
	LLW	2 620	27 881	208	0 [2065]
	ILW	1 073	11 251	13 550	13 550 [2065]
	HLW	-	38	38	38 [2065]
Latvia	VLLW	-	-	-	-
	LLW	53	78	110	93 [2040]
	ILW	5	15	15	15 [2040]
	HLW	-	-	-	-
Lithuania	VLLW	7 813	0	0	-
	LLW	24 787	14 417	0	-
	ILW	0	0	0	-
	HLW	0	0	0	-
Luxembourg	VLLW	-	-	-	-
	LLW	-	-	-	-
	ILW	-	-	-	-
	HLW	-	-	-	-
Malta	VLLW	-	-	-	-
	LLW	-	-	-	-
	ILW	-	-	-	-
	HLW	-	-	-	-
The Netherlands	VLLW	-	-	-	-
	LLW	11 358	-	-	70 000 [2130]
	ILW	-	-	-	267 [2130]
	HLW	105**	-	-	133 [2130]
Poland	VLLW	19	50	50	-
	LLW	1 161	900	900	-

Stored conditioned RAW (Estimated volume for disposal, m^3)					
Country	**RAW**	**2016**	**2030**	**2050**	**Volume [Date]**
	ILW	207	480	540	-
	HLW	-	-	-	-
Portugal*	VLLW	-	-	-	-
	LLW	-	-	-	-
	ILW	-	-	-	-
	HLW	-	-	-	-
Romania	VLLW	437	-	-	-
	LLW	1 187	2 000	1 600	1800 [2040] 950 [2060]
	ILW	101	285	1 075	960 [2040] 1 075 [2060]
	HLW	0.12	0	0	0 [2040] 0 [2060]
Slovakia	VLLW	26 631	0	0	-
	LLW	23 249	1 600	1 000	1 400 [2040]
	ILW	24	1 200	1 900	1 900 [2040]
	HLW	-	-	-	-
Slovenia	VLLW	-	-	-	-
	LLW	2 329	1 519	2 021	1 885 [2040]
	ILW	24	2	0	6 [2040]
	HLW	-	0	0	0
Spain	VLLW	11 020	6 000	0	0 [2090]
	LLW	6 836	10 000	0	0 [2090]
	ILW	201	400	800	0 [2090]
	HLW	12	12	12	0 [2090]
Sweden	VLLW	2 900	2 000	0	-
	LLW	8 500	30 000	5 000	-
	ILW	5 300	11 500	10 000	-
	HLW	0	-	-	-
UK	VLLW	0	151 000	55 000	2 930 000 [2125]
	LLW	14 300	289 000	526 000	2 380 000 [2125]
	ILW	41 400	191 000	258 000	453 000 [2125]
	HLW	1 130	1 500	1 500	1 500 [2125]

* All waste declared as disposed of.

** Includes research reactors' spent fuel (7 m^3)

Table I.4. Unconditioned radioactive waste stored on Member States' territory

Stored unconditioned RAW (volume, m^3 / or mass, t)						
Country	**Volume RAW**	**2016** Storage	Estimated disposal volume	**2030**	**2050**	**Volume [Date]**
Austria	VLLW	-	-	-	-	-
	LLW	-	-	-	-	-
	ILW	-	-	-	-	-
	HLW	-	-	-	-	-
Belgium	VLLW	-	-	-	-	-
	LLW	-	-	-	-	-
	ILW	-	-	-	-	-
	HLW	-	-	-	-	-
Bulgaria	VLLW	2 327	2 327	2 035	-	-
	LLW	8 214	12 650	1 700	-	-
	ILW	3	10	10	-	-
	HLW	0	-	-	-	-
Croatia	VLLW	-	-	-	-	-
	LLW	-	-	-	-	-
	ILW	-	-	-	-	-
	HLW	-	-	-	-	-
Cyprus	VLLW	-	-	-	-	-
	LLW	-	-	-	-	-
	ILW	-	-	-	-	-
	HLW	-	-	-	-	-
Czech Republic	VLLW	-	-	-	-	-
	LLW	351t, 1 843	-	-	-	63 000 [>2085]
	ILW	1.3	-	-	-	4 424 [>2085]
	HLW	-	-	-	-	-
Denmark	VLLW	-	-	-	-	-
	LLW	-	-	-	-	-
	ILW	938	620	-	-	-
	HLW	-	-	-	-	-
Estonia	VLLW	-	-	-	-	-
	LLW	674	1275	676.4	-	-
	ILW	55	140	56.6	-	-
	HLW	-	-	-	-	-
Finland	VLLW	-	-	-	-	-
	LLW	1 481	-	-	-	-
	ILW	535	-	-	-	-
	HLW	-	-	-	-	-
France	VLLW	-	-	-	-	-
	LLW	-	-	-	-	-
	ILW	-	-	-	-	-
	HLW	-	-	-	-	-

Stored unconditioned RAW (volume, m³ / or mass, t)						
Country	**Volume RAW**	**2016** Storage	Estimated disposal volume	**2030**	**2050**	**Volume [Date]**
Germany	VLLW	-	-	-	-	-
	LLW	17 553t	-	-	-	-
	ILW	1 950t	-	-	-	-
	HLW	-	-	-	-	-
Greece	VLLW	44.2	-	53.4	-	-
	LLW	72.8	-	63.6	-	-
	ILW	0.5t	-	< 1	-	-
	HLW	-	-	-	-	-
Hungary	VLLW	2 034	1 795	845	131	-
	LLW	5 086	4 487	2 114	328	-
	ILW	3 252	2 992	1 670	694	-
	HLW	102	150	173	298	-
Ireland	VLLW	-	-	-	-	-
	LLW	-	-	-	-	-
	ILW	-	-	-	-	-
	HLW	-	-	-	-	-
Italy	VLLW	10 128	5 495	-	-	-
	LLW	10 279	21 868	-	-	-
	ILW	1 635	5 227	-	-	-
	HLW	-	-	-	-	-
Latvia	VLLW	-	-	-	-	-
	LLW	2	-	2	0	-
	ILW	13	-	17	22	-
	HLW	-	-	-	-	-
Lithuania	VLLW	20 800	14 532	0	0	-
	LLW	9 150	24 552	0	0	-
	ILW	928	2 077	5 483	10 359	-
	HLW	-	-	-	-	-
Luxembourg	VLLW	-	-	-	-	-
	LLW	-	-	-	-	-
	ILW	-	-	-	-	-
	HLW	-	-	-	-	-
Malta	VLLW	-	-	-	-	-
	LLW	-	-	-	-	-
	ILW	-	-	-	-	-
	HLW	-	-	-	-	-
The Netherlands	VLLW	-	-	-	-	-
	LLW	-	-	-	-	-
	ILW	-	-	-	-	-
	HLW	-	-	-	-	-
Poland	VLLW	-	-	-	-	-
	LLW	-	-	-	-	-

Stored unconditioned RAW (volume, m^3 / or mass, t)						
Country	**Volume RAW**	**2016** Storage	Estimated disposal volume	**2030**	**2050**	**Volume [Date]**
	ILW	-	-	-	-	-
	HLW	-	-	-	-	-
Portugal*	VLLW	-	-	-	-	-
	LLW	-	-	-	-	-
	ILW	-	-	-	-	-
	HLW	-	-	-	-	-
Romania	VLLW	-	-	-	-	-
	LLW	-	-	-	-	-
	ILW	-	-	-	-	-
	HLW	-	-	-	-	-
Slovakia	VLLW	3.8t	3.8	-	-	-
	LLW	27t	27	-	-	-
	ILW	-	-	-	-	-
	HLW	-	-	-	-	-
Slovenia	VLLW	-	-	-	-	-
	LLW	81	-	-	-	-
	ILW	14	-	-	-	-
	HLW	-	-	-	-	-
Spain	VLLW	-	-	-	-	-
	LLW	-	-	-	-	-
	ILW	-	-	-	-	-
	HLW	-	-	-	-	-
Sweden	VLLW	-	-	-	-	-
	LLW	-	-	-	-	-
	ILW	-	-	-	-	-
	HLW	-	-	-	-	-
UK	VLLW	935	1 510	-	-	-
	LLW	19 500	21 800	-	-	-
	ILW	67 800	106 600	-	-	-
	HLW	1 100	530	-	-	-

* All waste declared as disposed of.

Table I.5. Disposed of radioactive waste on Member States' territory

Disposed RAW (Volume as disposed, m^3)					
Country	**RAW**	**2016**	**2030**	**2050**	**Other date**
Austria	VLLW	-	-	-	-
	LLW	-	-	-	-
	ILW	-	-	-	-
	HLW	-	-	-	-
Belgium	VLLW	-	-	-	-
	LLW	-	-	-	-
	ILW	-	-	-	-
	HLW	-	-	-	-
Bulgaria	VLLW	-	42 000	-	-
	LLW	-	16 000	-	-
	ILW	-	0	-	-
	HLW	-	0	-	-
Croatia	VLLW	-	-	-	-
	LLW	-	-	-	-
	ILW	-	-	-	-
	HLW	-	-	-	-
Cyprus	VLLW	-	-	-	-
	LLW	-	-	-	-
	ILW	-	-	-	-
	HLW	-	-	-	-
Czech Republic	VLLW	-	-	-	-
	LLW	11 850	14 000	29 200	-
	ILW	8 850	2 500	2 000	-
	HLW	-	4200 t	-	-
Denmark	VLLW	-	-	-	-
	LLW	-	-	-	-
	ILW	-	-	-	-
	HLW	-	-	-	-
Estonia	VLLW	-	-	-	-
	LLW	-	-	2 024	-
	ILW	-	-	802	-
	HLW	-	-	-	-
Finland	VLLW	-	-	-	-
	LLW	6 020	8 020	9 820	-
	ILW	2 160	7 100	7 800	-
	HLW	0	-	-	-
France	VLLW	328 249	-	-	-
	LLW	843 171	-	-	-
	ILW	0	-	-	-

Disposed RAW (Volume as disposed, m³)					
Country	**RAW**	**2016**	**2030**	**2050**	**Other date**
	HLW	0	-	-	-
Germany	VLLW	-	-	-	-
	LLW	75 378	102 378	340 878	-
	ILW	8 375	11 375	37 875	-
	HLW	0	0	0	-
Greece	VLLW	-	-	-	-
	LLW	-	-	-	-
	ILW	-	-	-	-
	HLW	-	-	-	-
Hungary	VLLW	1 155	2 691	4 698	-
	LLW	2 889	6 727	11 745	
	ILW	1 733	4 036	7 047	
	HLW	0	0	0	
Ireland	VLLW	-	-	-	-
	LLW	-	-	-	-
	ILW	-	-	-	-
	HLW	-	-	-	-
Italy	VLLW	-	9 056	30 064	30 792 [2065]
	LLW	-	13 798	45 807	46 915 [2065]
	ILW	-	-	-	-
	HLW	-	-	-	-
Latvia	VLLW	0	0	-	-
	LLW	818	1 809	1 809	-
	ILW				-
	HLW	0	0	-	-
Lithuania	VLLW	0	40 015	55 725	-
	LLW	0	26 580	68 077	-
	ILW	0	1 020	0	
	HLW	-	-	-	-
Luxembourg	VLLW	-	-	-	-
	LLW	-	-	-	-
	ILW	-	-	-	-
	HLW	-	-	-	-
Malta	VLLW	-	-	-	-
	LLW	-	-	-	-
	ILW	-	-	-	-
	HLW	-	-	-	-
The Netherlands	VLLW	- *	-	-	-
	LLW	-	-	-	-
	ILW	-	-	-	-

Disposed RAW (Volume as disposed, m^3)					
Country	**RAW**	**2016**	**2030**	**2050**	**Other date**
	HLW	-	-	-	-
Poland	VLLW	1 033	1230	1 800	-
	LLW	1 596	3 900	22 830	-
	ILW	11	11	11	-
	HLW	0	-	-	-
Portugal	VLLW	-	-	-	-
	LLW	232	269	231	-
	ILW	33	47	69	-
	HLW	-	-	-	-
Romania	VLLW	-	-	-	-
	LLW	2 189	5 670	15 430	10 930[2040] 19 930 [2060]
	ILW	-	-	-	-
	HLW	-	-	-	-
Slovakia	VLLW	-**	29 000	29 000	29 000 [2040]
	LLW	-**	36 912	43 644	40 494 [2040]
	ILW	-	-	-	-
	HLW	-	-	-	-
Slovenia	VLLW	-	-	-	-
	LLW	-	1452	2187	1452 [2040]
	ILW	-			
	HLW	-	-	-	-
Spain	VLLW	10 087	39 000	110 800	110 800 [2090]
	LLW	32 198	46 000	90 400	90 400 [2090]
	ILW	-	-	-	800 [2090]
	HLW	-	-	-	12 [2090]
Sweden	VLLW	27 841	51 540	53 540	-
	LLW	38 922	60 000	140 000	
	ILW	0	0	5 000	
	HLW	0			
UK	VLLW	-	-	-	-
	LLW	1 062 700***	-	-	-
	ILW	0	0	-	-
	HLW	0	0	-	-

* Information on VLLW inventory is not registered in the Netherlands.

** Information on currently disposed VLLW/LLW not reported by Slovakia.

*** Includes 33 600 m^3 of LLW in Dounreay historical disposal pits.

Table I.6. Other radioactive waste on Member States' territory

Country	Waste type	**Amount** (number, volume, mass or activity)		
		2016	**2030**	**2050**
Austria	DSRS (number)	-	-	-
	NORM (m^3)	-	-	-
Belgium	DSRS (number)	-	-	-
	NORM (m^3)	-	-	-
	Radium extracting waste (m^3)	275 000	-	-
Bulgaria	DSRS (number)	428	-	-
	NORM (m^3)	-	-	-
Croatia	DSRS (number)	-	-	-
	NORM (m^3)	-	-	-
Cyprus	DSRS (number)	718	-	-
	NORM (m^3)	-	-	-
Czech Republic	DSRS (number)	60 885	-	-
	NORM (m^3)	-	-	-
Denmark	DSRS (number)	-	-	-
	NORM (t)	450	1 250	2 250
	Tailings and ore (t)	4 800	-	-
Estonia	DSRS (number)	-	-	-
	NORM (t)	-	-	-
Finland	DSRS (number)	-	-	-
	NORM (m^3)	-	-	-
France	DSRS (number)	-	-	-
	NORM (t)	-	-	-
	Uranium conversion treatment residues (m^3)	-	-	-
	Products remaining after extraction of the uranium contained by the ore (t)	-	-	-
Germany	DSRS (number)	-	-	-
	NORM (m^3)	-	-	-
Greece	DSRS (number)	819	-	-
	NORM (m^3)	100	-	-
Hungary	DSRS (number)	-	-	-
	NORM (m^3)	-	-	-
Ireland	DSRS (number)	16	-	-
	NORM (m^3)	-	-	-
Italy	DSRS (GBq)	906 907	-	-
	NORM (m^3)	-	-	-
Latvia	DSRS (number)	-	-	-

Country	Waste type	Amount (number, volume, mass or activity)		
		2016	2030	2050
	NORM (m^3)	-	-	-
Lithuania	DSRS (number)	85 000	85 000	85 000
	NORM (m^3)	67	-	-
Luxembourg	DSRS (m^3)	-	-	0.1
	Contaminated material (m^3)	-	-	-
Malta	DSRS (number)	103	-	-
	NORM (m^3)	-	-	-
	Uranium salts (kg)	2.23	-	-
	Thorium salts (kg)	0.125	-	-
	Contaminated material (m^3)	0.125	-	-
The Netherlands	DSRS (number)	-	-	-
	NORM (m^3)	21 509	-	158 000*
Poland	DSRS (number)	-	-	-
	NORM (m^3)	-	-	-
Portugal	DSRS (number)	-	-	-
	NORM (m^3)	200	350	550
Romania	DSRS (number)	-	-	-
	NORM (m^3)	2 692 800	-	-
	Other (m^3)	25 605	-	-
	Sterile and radioactive rock (m^3)	7 082 552	-	-
Slovakia	DSRS (number)	-	-	-
	NORM (m^3)	-	-	-
Slovenia	DSRS (number)	-	-	-
	NORM (m^3)	1 614 443	1 614 443	1 614 443
Spain	DSRS (number)	-	-	-
	NORM (m^3)	-	-	-
Sweden	DSRS (number)	-	-	-
	NORM (m^3)	-	-	-
U.K.	DSRS (number)	-	-	-
	NORM (m^3)	-	-	-

* NORM estimate for The Netherlands in 2130.

Table I.7. Comparison of global EU radioactive wastes in disposal (m^3, rounded to thousands)

Disposed	6th report[3] 2004*	7th report[4] 2007*	EC internal data 2010*	2013	2016	2030**
Total waste	**1 851 000***	**2 045 000***	**2 188 000***	**2 316 000**	**2 483 000**	**3 201 000**
VLLW	34 000	105 000	197 000	279 000	369 000	743 000
LLW	1 817 000*	1 940 000*	1 991 000*	2 025 000	2 102 000	2 429 000
ILW	0	0	0	12 000	12 000	29 000
HLW	0	0	0	0	0	0

* Reviewed and updated data. For more information see Commission SWD(2017) 161 final, 15.5.2017

** Commission estimate primarily based on the information reported by Member States and on the other sources when information was not available in second national reports.

Table I.8. Comparison of global EU spent fuel and radioactive wastes in storage (m^3, rounded to thousands)

Stored	6th report[3] 2004*	7th report[4] 2007*	EC internal data 2010*	2013	2016	2030**
Total SF	38 000	45 000	53 000	54 000	58 000	76 000
Total waste	**798 000***	**962 000***	**909 000***	**997 000**	**983 000**	**1 945 000**
VLLW	176 000	175 000*	217 000*	237 000	234 000	617 000
LLW	411 000*	495 000*	365 000*	428 000	417 000	893 000
ILW	206 000*	288 000*	321 000*	326 000	326 000	426 000
HLW	5 000*	4 000	5 000	6 000	6 000	9 000

* Reviewed and updated data. For more information see Commission SWD(2017) 161 final, 15.5.2017.

** Commission estimate primarily based on the information reported by Member States and on the other sources when information was not available in second national reports.

Table I.9. Comparison of global EU spent fuel and radioactive wastes – Total (m^3, rounded to thousands)

Total	6th report[3] 2004*	7th report[4] 2007*	EC internal data 2010*	2013	2016	2030**
Total SF	38 000	45 000	53 000	54 000	58 000	76 000
Total waste	**2 649 000***	**3 007 000***	**3 097 000***	**3 313 000**	**3 466 000**	**5 146 000**
VLLW	210 000	280 000*	414 000*	516 000	603 000	1 360 000
LLW	2 228 000*	2 435 000*	2 356 000*	2 453 000	2 519 000	3 322 000
ILW	206 000*	288 000*	321 000*	338 000	338 000	455 000
HLW	5 000*	4 000	5 000	6 000	6 000	9 000

* Reviewed and updated data. For more information see Commission SWD(2017) 161 final, 15.5.2017.

** Commission estimate primarily based on the information reported by Member States and on the other sources when information was not available in second national reports.

Annex II: Summary of radioactive waste classifications in Member States

Table II.1. Summary of radioactive waste classification schemes used by the EU Member States

<table>
<tr><th>MS</th><th>Summary</th></tr>
<tr><td>AT</td><td>The structure and classification of the radioactive waste at NES is based on the recommendation of the European Commission (Commission Recommendation of 15 September 1999 on a classification system for solid radioactive waste 1999/669/EC, Euratom):

LILW-SL: Low and Intermediate Level Waste – Short Lived; waste containing radionuclides with a maximum half-life of around 30 years (such as Cs-137 and Sr-90) with a limited concentration of long-lived radionuclides.

In accordance with the recommendation of the European Commission, for the category LILW-SL long-lived radio-nuclides are limited to 4 000 Bq/g in individual waste packages and to an overall average of 400 Bq/g in the total waste volume.

LILW-LL: Low and Intermediate Level Waste – Long Lived; waste containing long-lived radionuclides, whose concentration exceeds the limits for LILW-SL.

Waste stored for decay: Waste containing radionuclides with a half-life below 100 days; such waste is stored until the radioactivity decays and the waste may be disposed of as conventional inactive waste following clearance measures by the authority.

As no nuclear power plants or other large nuclear facilities are in operation in Austria, there is no high-level radioactive waste, only low- and intermediate-level waste, such as waste from medical uses, industry, research and the decommissioning of facilities.</td></tr>
</table>

BE	For the long-term management of radioactive waste, ONDRAF/NIRAS has adopted a classification in three categories (these categories do not cover the radioactive radium-bearing substances contained in Umicore's licensed storage facilities in Olen), defined in accordance with the classification proposed in 1994 by the IAEA and that recommended in 1999 by the European Commission: waste is classified according to its activity and half-life. **Category A** waste is short-lived, low-level and intermediate-level conditioned waste containing limited quantities of long-lived radionuclides. It poses a risk to people and the environment for several hundreds of years. It can be considered for surface or near-surface disposal. It corresponds to low-level waste (LLW) in the IAEA 2009 classification. The radiological criteria and limits for category A waste will be defined in the safety report and licensing conditions for the planned surface disposal facility in Dessel (licensing process ongoing). ONDRAF/NIRAS considers short-lived, very low-level waste that cannot be cleared to be category A waste. **Category B** waste is low-level and intermediate-level conditioned waste contaminated with such quantities of long-lived radionuclides that it poses a risk to people and the environment for several tens to several hundreds of thousands of years in some cases5. Its thermal power is potentially significant at the time of its conditioning, but it will emit too little heat after the storage period to be classified as category C waste. It corresponds to intermediate-level waste (ILW) in the IAEA 2009 classification. **Category C** waste is high-level conditioned waste containing large quantities of long-lived radionuclides and which, like category B waste, poses a risk for several tens to several hundreds of thousands of years in some cases. After the period currently considered for its storage (around 60 years of cooling required in the event of subsequent disposal in poorly-indurated clay), its thermal power still causes a significant increase in the temperature of the disposal facility's host formation. It corresponds to high-level waste (HLW) in the IAEA 2009 classification. Category C waste includes vitrified waste from the reprocessing of spent fuel from commercial nuclear reactors and from the BR2 research reactor and non-reprocessed spent fuel declared as waste. For the processing of non-conditioned waste and the storage of conditioned waste, ONDRAF/NIRAS uses a more detailed classification system, based on the physic-chemical and radiological characteristics of the waste, that determine the processing route (evaporation, incineration, (super)compaction, solidification process, etc.) and the appropriate storage facility.

BG

With the amendments and supplements to the Regulation on the Safe Management of Radioactive Waste, Directive 2011/70/Euratom was transposed in 2013 and the RAW classification was fully brought in compliance with the Safety Guide 'Classification of Radioactive Waste' GSG-1, IAEA, 2009:

Category 1: waste containing radionuclides of low activity, which does not require radiation protection measures or a high level of isolation or containment; the RW in this category is further subdivided as:

a) Category 1a: waste compliant with the levels for regulatory clearance under the ASUNE (Act for Safe Use of Nuclear Energy);

b) Category 1b: very short-lived waste containing mainly radionuclides with short half-lives (not more than 100 days), the activity of which diminishes below the levels for regulatory clearance under the ASUNE as a result of appropriate on-site storage for a limited period of time (typically no longer than a few years);

c) Category 1c: very low level waste with levels of specific activity exceeding the minimum levels for regulatory clearance under the ASUNE and with very low content of long-lived radionuclides, representing a limited radiological risk; this waste category does not require the implementation of specific measures for radiation protection or containment and storage.

Category 2: low and intermediate level waste, containing radionuclides in concentrations that do not require any special measures for heat dissipation during storage and disposal; the radioactive waste from this category is further subdivided into:

a) Category 2a: short-lived low and intermediate level waste, containing mostly short-lived radionuclides (with a half-life shorter than or equal to the half-life of Cs-137), and long-lived alpha-activity radionuclides with specific activity lower than or equal to 4.106 Bq/kg for a single package or lower than or equal to 4.105 Bq/kg for the entire volume of the RAW;

b) Category 2b: long-lived low and intermediate level waste, containing long-lived alpha-activity radionuclides (with a half-life longer than the half-life of Cs-137) with specific activity exceeding the limits for category 2a.

Category 3: high level waste in which the concentration of radionuclides is such that heat dissipation must be taken into account for storage and disposal purposes.

The RAW classification is aimed at long-term safety — the endpoints of RAW management.

The disposal method is based on the RW classification:

- RAW of category 1c may be disposed of in surface landfills;
- RAW of category 2a must be disposed of in surface engineered facilities for RAW disposal;
- RAW of categories 2b and 3 must be disposed of only in geological facilities for RAW disposal.

CY	Cyprus follows the guidelines of IAEA regarding the definition and classification of radioactive waste, as described in the General Safety Guide No. GSG-1 “Classification of radioactive waste”, IAEA, Vienna, 2009.

CZ	In agreement with the Decree No. 377/2016 Coll., on requirements for safe management of radioactive waste and decommissioning of nuclear installations or workplaces of category III or IV, RAW is further classified as gaseous, liquid and solid. Solid RAW is classified, particularly based on the method of storage as follows: a) temporary radioactive waste, which after storage for at most 5 years exceeds radioactivity lower than clearance levels; b) **very low-level waste** with radioactivity higher than that of temporary radioactive waste, but which does not require any special measures during disposal; c) **low-level waste** with radioactivity higher than that of temporary radioactive waste, but which at the same time contains limited amounts of long-lived radionuclides; d) **intermediate-level waste** that contains a significant amount of long-lived radionuclides, and therefore it requires a higher degree of isolation from the surrounding environment than the low-level waste; and e) **high-level waste** for which, during storage and disposal, it is necessary to take into account heat generated by decay of the contained radionuclides; the waste is processed and treated to meet the acceptance criteria and it must be disposed in deep geological repositories several hundred meters under the ground. Spent fuel shall not be considered radioactive waste under the Atomic Act unless it has been declared as radioactive waste by its owner or by SÚJB. Spent fuel storage shall be subject to the same requirements as radioactive waste management before disposal and spent fuel shall be stored so that its further treatment is not impeded. Natural materials produced in the course of mining and treatment of uranium ores are managed subject to the Act No. 157/2009 Coll., on mining waste management, Act No. 263/2016 Coll., Atomic Act, as sources of ionizing radiation and therefore they are not covered by the Policy.

DE	In the Register of radioactive waste, a basic distinction is made between: • irradiated fuel elements and radioactive waste from their reprocessing, and • other radioactive waste On account of its high decay power, the former is considered to be heat-generating waste, most of which can be categorised as high-level radioactive waste in accordance with the IAEA classification. Other radioactive waste is, with a few exceptions, waste with negligible heat generation and is considered to be low or intermediate-level waste in accordance with the IAEA classification. Other radioactive waste (radioactive waste with negligible heat generation) is categorised in the Register of radioactive waste according to its state of processing1): • RAW: Unprocessed, partly pre-sorted, radioactive waste in its original form. • Pre-treated waste: RAW which has been pre-treated and is to be subjected to further treatment. • Conditioned waste products: Waste products packaged in inner containers that are to be placed in standardised, basic types of container (disposal containers) provided for disposal purposes. The products are generally produced in accordance with qualified procedures. They have been fully processed and are unlikely to be subjected to any further treatment inducing physical or chemical changes, except for any necessary subsequent drying. The waste does still have to be packaged in a disposal container in order to be disposed of, however. • Disposal packages: Waste products packaged in standardised disposal containers (with or without an inner container). The products are generally produced in accordance with qualified procedures.
DK	Classification of radioactive waste in Denmark is based on the IAEA GSG-1 classification. The use of the category VLLW may only take place after specific approval by the Regulatory Authorities.

EE*	Radioactive waste is categorized by activity or specific activity, by half-life, by type of radiation and by heat generation as a result of radioactive decay. Categories are established by Regulation No 34 of 4 October 2016 of Minister of the Environment "The Classification of Radioactive Waste, the Requirements for Registration, Management and Transfer of Radioactive Waste and the Acceptance Criteria for Radioactive Waste". In conditioning and storing of radioactive waste, their producer has to take into account, beside their type, also physical, chemical and biological properties of radioactive waste. **NORM** (Naturally Occurring Radioactive Material – substances containing natural radionuclides) waste. Radioactive waste produced as a result of handling raw materials containing substances that contain natural radionuclides (Th-232 and U-238 and radionuclides belonging in their decay series), the specific activity of which is greater than clearance levels established under Article 62(3) of the Radiation Act. **Short-lived waste**. Radioactive waste that contain radionuclides with less than a 100-day half-life and that decay below the clearance levels established under Article 62 (3) of the Radiation Act within up to 5 years. **Low and intermediate activity short-lived waste.** Radioactive waste that contains β- and γ sources with half-life less than 30 years half-life and a limited amount of long-lived αsources (no more than 4,000 Bq/g for one waste package and no more than 400 Bq/g averaged for total waste package amount). **Low and intermediate activity long-lived waste**. Radioactive waste, which contains radionuclides with half-life higher than 30 years with the activity concentration higher than that for low and intermediate activity short-lived waste and which will generate less than 2 kW/m3 heat energy during radioactive decay. **High level waste**. Radioactive waste, which generates more than 2 kW/m3 heat energy during radioactive decay.

EL	In general, the IAEA radioactive waste classification is applied. Specific criteria are as follows: The 100 days and 30 years half-lives apply for distinguishing between very short lived and long lived RW, respectively. **Very low-level waste** (VLLW) contains isotopes with half-lives less than 30 y and activities about two orders higher than the exempted values. Waste with radionuclides with higher half times are considered as VLLW too (e.g. 226Ra), if the activity is very low. Examples are objects using 226Ra for luminance, smoke detectors with 241Am, soil with NORM 226Ra at low concentrations, etc. **Low level waste** (LLW) do not contain long-lived (i.e. with t1/2 > 30 y) radionuclides. Long lived radionuclides (i.e. with t1/2 > 30 y) could be present in LLW, if the concentration is lower than 400 Bq/g on average for long lived alpha emitting radionuclides, or 10 kBq/gr for long lived beta and/or gamma emitting radionuclides. Although classification is related to the disposal options – which have not been determined yet - and the availability and suitability of the storage procedures and infrastructure, almost all (except very few cases) radioactive waste in Greece are classified as VSLW, VLLW or LLW, due to their activities and form. A very few RW which concern regeneration bed resins and activated or contaminated objects in connection with GRR-1 operation, as well as a few RM found in scrap metal, have not been classified yet. For very short-lived waste (VSLW) (t1/2 <100 d) decay and clearance are employed. Generic and conditional clearance levels apply.
ES	In Spain, radioactive waste is classified as very low-level waste (VLLW), low and intermediate-level waste (LILW) (both are disposed of at the El Cabril storage centre), special waste (SW) and high-level waste (HLW), which mainly include spent fuel (SF).
FI*	The operational waste is divided into four categories based on its radioactivity concentration. These categories are: 1) Intermediate-level waste, 2) Low-level waste, 3) Very low-level waste, and 4) exempt waste. The activity limits for the categories are defined in the STUK guide (Regulatory Guide YVL D.4) and STUK Regulation (STUK Y/4/2018). Different categories for disposal with threshold of 100 MBq/kg (10 times lower for emplacement room) and 500 years: SL (Short lived) and LL (Long Lived).

FR

The long-term management of radioactive waste is based largely on the level of radioactivity and the half-life of the radionuclides contained in the waste.

High-level waste (HLW). HLW, which consists of the non-recoverable residues from the reprocessing of spent fuel, is currently stored at the Marcoule and La Hague sites pending a final solution. Andra is responsible for carrying out studies and research in order to select a location and design an industrial facility for reversible deep geological disposal, known as Cigéo. This will start with a pilot industrial phase with a few radioactive waste packages, with operation being planned to start by 2035.

Long-lived low and intermediate level waste (LILW-LL). This waste has a significant content of long-lived radionuclides. Intermediate level waste mainly comes from the structures surrounding spent fuel (hulls and end fittings) or residues from the operation of nuclear facilities (waste following the processing of effluent, equipment, etc.). There are two main types of low-level waste: radium-bearing waste from operations to explore and chemically process minerals or from former industrial sites polluted with radioactivity at the beginning of the 20th century, and graphite waste from the operation and decommissioning of France's original nuclear power plants. Some bitumen-bound sludge packages are also included in this category.

Short-lived low and intermediate level waste (LILW-SL). This is mainly waste resulting from the maintenance (clothing, tools, filters, etc.) and operation of nuclear facilities (processing of liquid effluents or filtration of gaseous effluents). It may also come from operations to clean up and decommission such facilities. This waste is managed by surface disposal and is monitored for the time needed for its radioactivity to fall to levels having a negligible impact.

Very low-level waste (VLLW). This waste, which mainly comes from the decommissioning of nuclear facilities or traditional industries using naturally radioactive materials, is disposed of at the very low-level waste disposal facility commissioned in August 2003 (Cires).

<table>
<tr><th></th><th></th><th>Very short-lived waste containing radioelements with a half-life < 100 days</th><th>Short-lived waste in which the radioactivity comes mainly from radioelements with a half-life < 31 years</th><th>Long-lived waste chiefly containing radioelements with a half-life > 31 years</th></tr>
<tr><td>Hundreds Bq/g</td><td>Very low level waste (VLLW)</td><td rowspan="3">Managed by radioactive decay at generation site
and then disposal through dedicated conventional waste disposal routes</td><td colspan="2">Recycling or dedicated surface disposal
(disposal facility at the Aube industrial consolidation, storage and disposal facility)</td></tr>
<tr><td>Millions Bq/g</td><td>Low level waste (LLW)</td><td rowspan="2">Surface disposal
(Aube waste disposal facility)</td><td>Near-surface disposal
(being studied under the Law of 28 June 2006)</td></tr>
<tr><td rowspan="2">Billions Bq/g</td><td>Intermediate level waste (ILW)</td><td></td></tr>
<tr><td>High level waste (HLW)</td><td>Not applicable [1]</td><td colspan="2">Deep geological disposal
(planned under the Law of 28 June 2006)</td></tr>
</table>

HR	Radioactive waste classification in Croatia is in accordance with Classification of Radioactive Waste, IAEA General Safety Guide No. GSG-1, 2009.

HU

Radioactive waste is classified on the basis of the activity and half-life of isotopes contained therein, as follows.

Radioactive waste is of a **high level** if its heat generation must be taken into account in the planning and operation of storage and placement. Radioactive waste with heat generation greater than 2 kW/m^3 or classified in category 1 of radioactive waste under Government Decree No 190/2011, based on the total activity of the radioactive waste package, is clearly qualified as such.

Radioactive waste is of a **very low level** if the activity concentration of isotopes with a half-life of not longer than 30 years (rounded off for whole years) is not greater than fifty times the specific exemption activity concentration (SMEAK), and not greater than the general exemption activity concentration (ÁMEAK) in relation to isotopes with a half-life of more than 30 years (rounded off for whole years). If radioactive waste contains several types of radioisotopes, classification of isotopes with a half-life of not longer than 30 years (rounded off for whole years) is based on the following:

$$\sum_i \frac{AK_i}{SMEAK_i} \leq 50$$

and in relation to isotopes with a half-life of more than 30 years (rounded off for whole years):

$$\sum_i \frac{AK_i}{ÁMEAK_i} \leq 1$$

where AKi is the activity concentration of the i-th radioisotope in the radioactive waste, while SMEAKi is the specific exemption activity concentration of the i-th radioisotope and ÁMEAKi is the general exemption activity concentration of the i-th radioisotope.

Radioactive waste is deemed to be of a low or medium-level if it is not deemed to be high or very low level radioactive waste.

Radioactive waste should be classified as being of a low or medium-level on the basis of the activity concentration and specific exemption activity concentration (SMEAK) of isotopes contained therein, as follows (Table 1).

Table 1 – Classification of radioactive waste

Radioactive waste class	**Activity concentration reference**
Low level	$\leq 10^3$ SMEAK
Medium level	$>10^3$ SMEAK

If the radioactive waste also contains several types of radioisotope, classification is based on Table 2:

Table 2 – Classification of radioactive waste containing several types of radioisotope

Radioactive waste class	Activity concentration reference
Low-level	$\sum_i \frac{AK_i}{SMEAK_i} \leq 1000$
Medium-level	$\sum_i \frac{AK_i}{SMEAK_i} > 1000$

Classification based on the half-life of radionuclides contained in waste should be performed as follows.

Low or medium-level radioactive waste is deemed to be short-lived if it contains radionuclides with a half-life of more than 30 years only to a limited extent. Based on the average total quantity of waste, in relation to isotopes with a half-life of more than 30 years it holds true that:

$$\sum_i \frac{AK_i}{SMEAK_i} \leq 1$$

Low or medium-level radioactive waste is deemed to be long-lived if its radionuclide concentration with a half-life of more than 30 years exceeds the limit values of short-lived radioactive waste.

IE	As Ireland has no nuclear facilities, by definition, all of the radioactive waste arising nationally falls into the IAEA's low level waste category, and no formal waste categorisation process beyond that is deemed of value in that context.
IT	On August 7, 2015 the joint decree by the Ministry of Environment, Land and Sea Protection and the Ministry of Economic Development, concerning a revised radioactive waste classification more in line with IAEA classification scheme, has been issued, replacing the old classification provided by the Technical Guide No. 26 ENEA-DISP dating back to 1987. **Very short-lived waste.** Radioactive waste containing radionuclides with very short half-life, of less than 100 days, requiring up to 5 years to reach activity concentrations lower than values specified in Article 1, paragraph 2 of Legislative Decree n. 230 of 17 March 1995. This type of waste mainly arises from medical uses and research activities. This waste shall be stored in facilities suitable for temporary storage or waste management for disposal, such as those authorized by Article 33 of Legislative Decree n. 230 of 17 March 1995, for a period of time necessary to reach the abovementioned required activity concentration level. **Very low-level waste.** Radioactive waste with activity concentration that does not meet the criteria set out for exempt waste, but though lower than 100 Bq/g with a maximum alpha contribute of 10 Bq/g for alpha-emitting long-lived radionuclides. This category includes also radioactive waste containing mainly short-lived radionuclides, which over a period of up to 10 years reach an activity concentration beneath the clearance levels set out in Article 30 and Article 154, paragraph 3-bis of the Legislative Decree n. 230 of 17 March 1995. **Low Level Waste.** Radioactive waste that does not meet the criteria established for exempt waste and that requires containment and isolation periods of up to a few hundred years in order to be disposed of. This category includes radioactive waste characterized by levels of activity concentration of up to 5 MBq/g for short-lived radionuclides, of up to 40 kBq/g for the long-lived isotopes of Nickel and of up to 400 Bq/g for long-lived radionuclides. **Intermediate level waste.** Radioactive waste with activity concentrations exceeding the values set out for low-level waste, though not requiring provisions for heat dissipation during its storage and disposal. This category includes waste containing long-lived radionuclides that mostly requires a degree of isolation higher than that provided by near surface disposal facilities with engineered barriers, therefore requiring disposal in geological formations. This category includes also waste characterized by levels of activity concentrations of up to 400 Bq/g for alpha-emitting radionuclides and mainly containing radionuclides beta/gamma emitters even long lived, with such an activity concentrations that they can be disposed of in near surface facilities with engineered barriers, provided that the level of activity concentration complies with the objectives of radiation protection established for the abovementioned surface disposal facility, such as, for instance, the waste containing activation products arising from the decommissioning of some parts of the nuclear facilities. **High-level waste.** Radioactive waste with high activity concentrations, such as to

generate a significant amount of heat or with high concentrations of long-lived radionuclides, or both of these characteristics, which require a degree of isolation and containment for a time period of thousands of years and over. This waste requires disposal in geological formations.

LT

Correspondence between national waste classes and IAEA GSG-1 waste classes (%)

National waste classes	IAEA GSG-1			
	VLLW	**LLW**	**ILW**	**HLW**
Class A	100%			
Class B		100%		
Class C		100%		
Class D			100%	
Class E			100%	
Class F (DSRS)	30%	30%	40%	

LU*

Radioactive waste is categorized by the half-life of the corresponding nuclides and whether the disused sources are sealed or unsealed.

The classification of the radioactive waste rests within the Belgian authorities, according to the Belgian classification systems, when treating and conditioning the waste.

LV

Information about the classification of radioactive waste is defined in Cabinet Regulation No 129. Depending on the half-life period, radioactive waste is classified as follows:

1) Radioactive waste with a half-life not exceeding 30 days and which does not generate long-lived daughter products after radionuclide decay (short-lived radioactive waste);

2) Radioactive waste with a half-life exceeding 30 days or which generates long-lived daughter products after radionuclide decay (long-lived radioactive waste).

Depending on the heat generation rate, radioactive waste is classified as follows:

1. Radioactive waste with a heat generation rate of less than 2 kW per one cubic metre of radioactive waste, as a result of radioactive decay (low and intermediate radioactivity waste);

2. Radioactive waste with a heat generation rate greater than or equal to 2 kW per one cubic metre of radioactive waste, as a result of radioactive decay (high radioactivity waste).

<table>
<tr><td>MT</td><td>Classification of radioactive waste in Malta is based on the IAEA GSG-1 classification.</td></tr>
<tr><td>NL</td><td>Classification scheme is given in the figure below (source: National report of the Kingdom of the Netherlands for the Council Directive 2011/70/EURATOM, 2018)

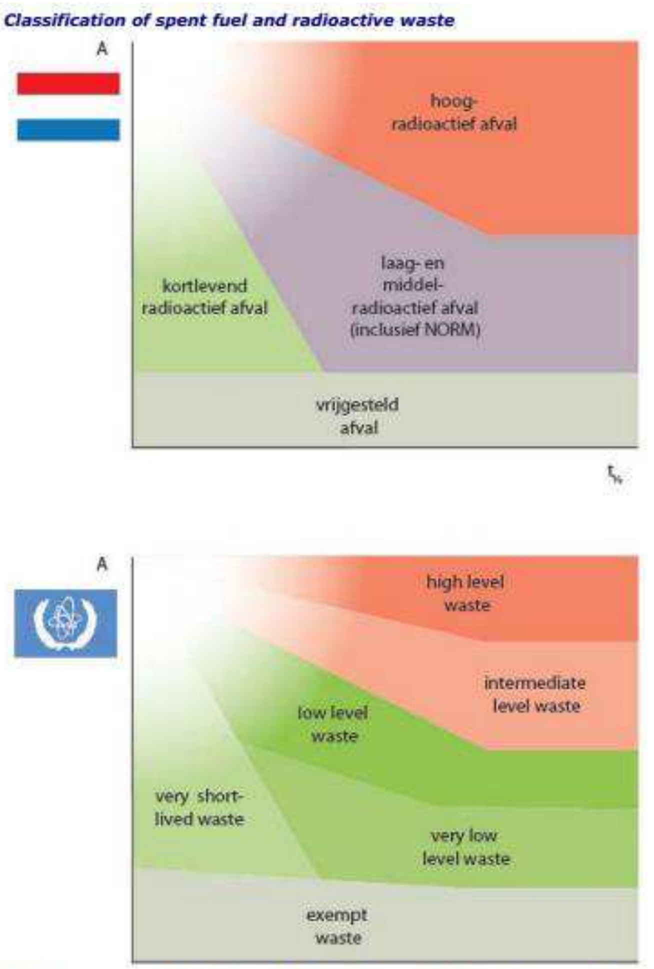


Figure 2: Classification of spent fuel and radioactive waste in Dutch; (above: hoogradioactief afval is high-level waste, laag- en middelradioactief afval (inclusief NORM) is low- and intermediate-level waste (including NORM), kortlevend radioactief afval is very shortlived waste and vrijgesteld afval is exempt waste), according to IAEA standards (below).</td></tr>
<tr><td>PL*</td><td>In accordance with Article 47 of Atomic Law:

Radioactive waste is classified into three categories with respect to the concentration of radioactive isotopes contained in the waste: low-, medium- and high-level radioactive waste. These categories are further sub-divided into sub-categories according to the half-live of radioactive isotopes and the concentration of radioactive isotopes contained in the waste.

Liquid waste is additionally classified according to its activity concentration.

Spent nuclear fuel intended for disposal is classified as a high-level radioactive waste.</td></tr>
</table>

	Disused (spent) sealed radioactive sources form an additional category of radioactive waste. Those sources are classified into the following subcategories of spent sealed radioactive sources according to the level of their activity: low-, medium- and high-level, which are further subdivided according to the half-life of contained radionuclides into short-lived and long-lived sub-categories. The low, intermediate and high level waste is subsequently classified into sub-categories: - Transitional waste which will decay within the period of three years below the value given in third column of Annex III , - Short-lived waste – waste containing radionuclides of half-life < 30 years with the restricted average long-lived radionuclides concentration to 400 kBq/kg and the restricted maximum long-lived radionuclides concentration resulting from material inhomogeneity in a representative 1 kg sample to 4000 kBq or waste containing only long-lived radionuclides with the restricted average radionuclides concentration to 400 kBq/kg, - Long-lived waste: waste whose average long-lived radionuclides concentration exceeds 400 kBq/kg. The spent sealed sources are grouped into three subcategories: - Low level - if the activity of the source exceed the value given in Annex 3 – second column, but is below 10^8 Bq, - Intermediate level: if the activity is in the range 10^8<A<10^{12} Bq, - High level: if the activity of the source A>10^{12} Bq.
PT	Categorization of radioactive waste and management options are included in the National Programme, as specified in the International Atomic Energy Agency's standards.
RO*	According to the provisions of the CNCAN Order No. 156/2005 for approval the Regulation on the classification of radioactive waste, the general classification of radioactive waste is the following: - excluded radioactive waste (EW) - transitional radioactive waste (TW) - very low-level radioactive waste (VLLW) - low and interim level short lived radioactive waste (LILW-SL) - low and interim level long lived radioactive waste (LILW-LL) - high-level radioactive waste (HLW). The general classification refers to the requirements for assuring the isolation from

biosphere of the radioactive waste during its disposal.

The **excluded radioactive waste** is waste containing radionuclides with an activity concentration so small that the waste can be released from regulatory control.

The **transitional radioactive waste** is waste having activity concentration above clearance levels, but which decays below clearance levels within a reasonable storage period (not more than 5 years).

The **very low-level radioactive waste** is short-lived waste in which the activity concentration is above the clearance levels, but with a radioactive content below levels established by CNCAN for defining the low-level waste. The disposal of very low-level waste requires less complex arrangements than the disposal of short-lived low-level waste.

The **low and intermediate level radioactive waste** is radioactive waste in which the activity concentration is above the levels established by CNCAN for the definition of very low-level waste, but with a radioactive content and thermal power below those of high-level waste. Low-level waste does not require shielding during handling or transportation. Intermediate level waste generally requires shielding during handling, but needs little or no provision for heat dissipation during handling or transportation. The long-lived radioactive waste is a waste containing radionuclides with half-life above 30 years in quantities and/or concentrations of activity above the values established by CNCAN, for which isolation from biosphere is necessary for more time than the institutional control duration.

The short-lived radioactive waste is a radioactive waste that is not long lived.

The **high level radioactive waste** is:

a) liquid radioactive waste containing the most part of fission products and actinides existing initially in the spent fuel and forming the residues of the first extraction cycle of reprocessing;

b) the solidified radioactive waste of letter a) and the spent fuel;

c) any other radioactive waste with activity concentration range similar to the waste mentioned at letter a) and b).

SE	**Cleared Material**. Material with so small amounts of radioactive nuclides that it can be released from regulatory control **Very low-level waste, short-lived (VLLW-SL)**. Contains small amounts of short lived nuclides with a half-life less than 31 years, dose rate on waste package is less than 0,5 mSv/h. Long lived nuclides with a half-life greater than 31 years can be present in restricted quantities **Low-level waste, short-lived (LLWSL)**. Contains small amounts of short lived nuclides with a half-life less than 31 years, dose rate on waste package (and unshielded waste) is less than 2 mSv/h. Long lived nuclides with a half-life greater than 31 years can be present in restricted quantities. **Intermediate level waste, short-lived (ILW-SL)**. Contains significant amounts of short lived nuclides with a half-life less than 31 years, dose rate on waste package is less than 500 mSv/h. Long lived nuclides with a half-life greater than 31 years can be present in restricted quantities**.** **Low and intermediate longlived, waste (LILW-LL)**. Contains significant amounts of long lived nuclides with a half-life greater than 31 years, exceeding the restricted quantities for short lived waste **Spent fuel/High level waste (HLW)**. Typical decay heat >2kW/m3 and contains significant amounts of long-lived nuclides with a half-life than 31 years, exceeding the restricted quantities for short-lived waste.

SI	Under JV7, in accordance with the level and type of radioactivity, radioactive waste in solid form is classified into the categories of transitional radioactive waste, very low-level radioactive waste, low- and intermediate-level radioactive waste, high-level radioactive waste, and radioactive waste containing naturally occurring radionuclides. The ZVISJV-1 defines spent fuel as 'nuclear fuel that has been irradiated in and permanently removed from a reactor core. Spent fuel may either be considered as a valuable resource that may be reprocessed or as radioactive waste that is destined for direct disposal'. SF is a secondary raw material from which uranium and plutonium can be obtained, through processing, to be used as raw material for new nuclear fuel. Radioactive waste produced from the processing of SF is classed as high-level radioactive waste containing radionuclides, the decay of which generates an amount of heat that has to be considered when it is being managed. **Very low-level waste (VLLW)** for which the regulatory authority competent for nuclear and radiation safety may decide on clearance. **Low- and intermediate-level radioactive waste (LILW)** in the management of which heat generation does not need to be considered. It is further classified into two groups: 1 **Short-lived LILW**, where the specific activity of the contained alpha emitters, having a half-life exceeding 30 years, is equal to or lower than 4,000 Bq/g in any individual package but in no case greater than 400 Bq/g on average in the overall amount of LILW. 2 **Long-lived LILW**, where the specific activity of alpha emitters exceeds the limitations applying to short-lived LILW. **High-level waste (HLW)**, which contains radionuclides, the decay of which generates such an amount of heat that has to be considered in its management **Radioactive waste containing naturally occurring radionuclides** that are produced in the exploitation and processing of nuclear mineral raw materials or in other industrial processes and are not considered sealed sources of radiation under the regulation governing the use of radioactive sources and radiation practices.
SK	Classification of radioactive waste (according to the IAEA GSG-1) is based on their activity and is defined by Section 5 of the ÚJD SR Decree No. 30/2012 Coll., laying down the details of the requirements for the management of nuclear materials, radioactive waste and spent nuclear fuel: a) **transient radioactive wastes** whose activity falls below the limit value for their introduction to the environment during storage; b) **very low-activity radioactive waste**, whose activity is slightly higher than the limit value for their introduction to the environment, contain mainly radionuclides with a short half-life, or also a low concentration of radionuclides with a long half-life, and which during storage require a lower degree of isolation from the environment through a system of engineered barriers, as in the case of surface-type radioactive waste

	repositories; c) **low-activity radioactive waste**, whose average specific activity of radionuclides with a long half-life, especially radionuclides emitting alpha radiation, is less than 400 Bq/g, maximum specific activity of radionuclides with a long half-life, especially radionuclides emitting alpha radiation, is locally less than 4000 Bq/g, does not produce residual heat, and following treatment meet safe operating limits and conditions for surface-type radioactive waste repositories; d) **medium-activity radioactive waste**, whose average specific activity of radionuclides with a long half-life, especially radionuclides emitting alpha radiation, is equal to or over 400 Bq/g, may produce residual heat and measures for its removal are less than in the case of highly active radioactive waste, and which following treatment do not meet safe operating limits and conditions for surface-type radioactive waste repositories; e) **highly-active radioactive waste**, whose average specific activity of radionuclides with a long half-life, especially radionuclides emitting alpha radiation, exceeds values specified for low activity radioactive waste requiring measures for the removal of residual heat and can be deposited only in an underground-type radioactive waste repository.
UK*	In the UK, historically, radioactive waste has been classified under the following broad categories, according to its heat-generating capacity and activity content: **High-Level Waste (HLW)** is waste in which temperature may rise significantly as a result of its radioactivity, so that this factor has to be taken into account in designing storage or disposal facilities. **Intermediate-Level Waste (ILW)** is waste with radioactivity levels exceeding the upper boundaries for Low-Level Waste (LLW), but which does not require heating to be taken into account in the design of storage or disposal facilities. **Low-Level Waste (LLW)** is defined as radioactive waste having a radioactive content not exceeding four gigabecquerels per tonne (GBq/te) of alpha and/or 12 GBq/te of beta/gamma activity. This general definition does not directly equate to the waste acceptance criteria in place at specific disposal sites for LLW. **Very Low-level Waste (VLLW)**, a sub-category of LLW is defined as: - in the case of low volumes ('dustbin loads') – low-volume VLLW: "Radioactive waste which can be safely disposed of to an unspecified destination with municipal, commercial or industrial waste ('dustbin' disposal), each 0.1m3 of waste containing less than 400 kilobecquerels (kBq) of total activity or single items containing less than 40kBq of total activity." - for wastes containing carbon-14 or hydrogen-3 (tritium): • in each 0.1m3, the activity limit is 4,000kBq for carbon-14 and hydrogen-3 (tritium) taken together; and • for any single item, the activity limit is 400kBq for carbon-14 and hydrogen-3 (tritium) taken together.

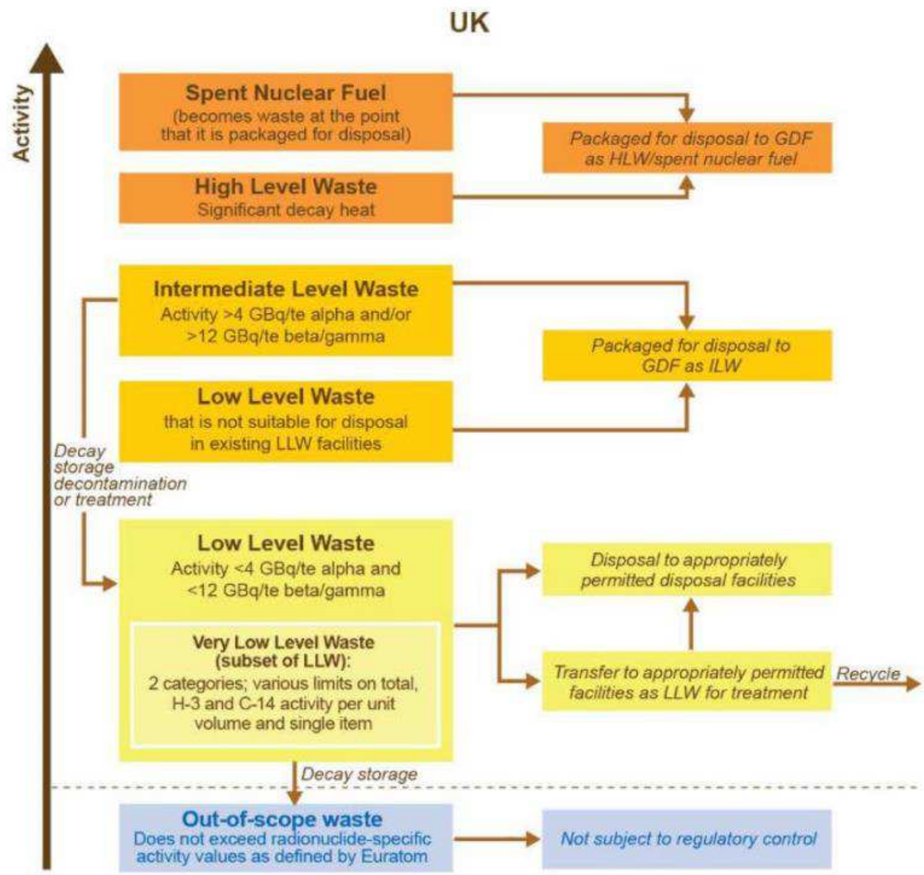
Controls on disposal of this material, after removal from the premises where the wastes arose, are not necessary.

In the case of bulk disposals – high-volume VLLW:

"Radioactive waste with maximum concentrations of 4 megabecquerels per tonne (MBq/te) of total activity which can be disposed of to specified landfill sites. For waste containing hydrogen-3 (tritium), the concentration limit for tritium is 40MBq/te. Controls on disposal of this material, after removal from the premises where the wastes arose, will be necessary in a manner specified by the environmental regulators."

The principal difference between the two definitions of VLLW is the need for controls on the total volumes of VLLW in the second (high-volume) category being deposited at any one particular landfill site.

Higher-Activity Waste (HAW) is defined by the UK Government as the collection of: HLW, ILW, and the relatively small proportion of LLW that is not currently suitable for disposal in existing LLW disposal facilities (due to some chemical, physical or radiological property that is incompatible with the extant waste acceptance criteria).



* Information from the Joint Convention report presented to the 6th review meeting (May 2018)