

## **Problematic Waste IPT**

### **2016 Problematic Waste Inventory Summary**

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NWP/REP/132

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## Acronyms

AWE	Atomic Weapons Authority
CNS	Capenhurst Nuclear Services
DSRL	Dounreay Site Restoration Ltd
FED	Fuel Element Debris
HAW	Higher Activity Waste
ILW	Intermediate Level Waste
IPT	Integrated Project Team
IX Material	Ion Exchange Material
LAW	Lower Activity Waste
LLWR	Low Level Waste Repository
MAC	Miscellaneous Activated Components
MOD	Ministry of Defence
NDA	Nuclear Decommissioning Authority
NWP	National Waste Programme
PCM	Plutonium Contaminated Material
RWM	Radioactive Waste Management Ltd.
STFC	Science and Technology Facilities Council
UKAEA	United Kingdom Atomic Energy Authority
WEEE	Waste Electrical and Electronic Equipment

## 1. Introduction

Problematic radioactive waste, in the nuclear industry, describes any waste which has no defined waste treatment and disposal route available or for which existing routes are significantly suboptimal. Wastes are problematic by virtue of their physical, chemical and / or radiological properties. Problematic radioactive wastes are present across the nuclear industry and pose challenges to a significant range of waste producers in the UK. These are wastes which span the radiological spectrum, including Lower Activity Waste (LAW) and Higher Activity Waste (HAW).

This paper provides a high level summary of the findings from the 2016 update of the LAW and HAW problematic waste inventory and, in particular, focuses on:

- Radiological waste classification
- Problematic waste types
- Problematic waste type volumes

The aim of the analysis is to assist the Problematic Waste Integrated Project Team (IPT), the National Waste Programme (NWP), led by LLW Repository Ltd, Radioactive Waste Management Ltd. (RWM), waste producers and other stakeholders to better understand where additional support and research is needed across the industry regarding management of problematic wastes including possible treatment and disposal routes.

## 2. Radiological Waste Classification

The problematic waste inventory includes both LAW and HAW. Figure 1 below shows that 38% of entries in the inventory were classed as HAW and 62% as LAW.

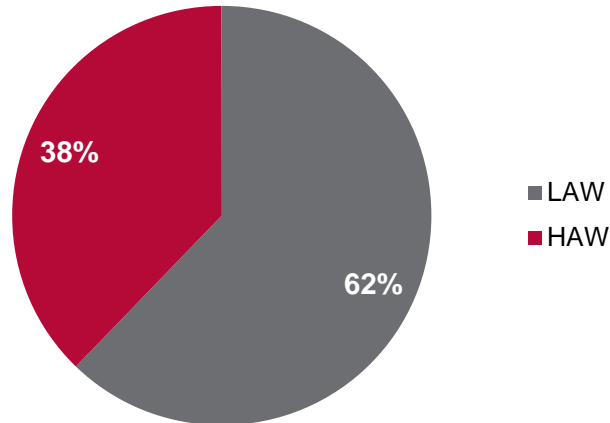


Fig 1. Inventory by radiological waste classification (no. of entries)

The proportion of HAW and LAW inventory entries held by each waste producer can be seen in Figure 2. The graph indicates that the waste producer with the largest number of entries in the inventory is Magnox Ltd, with 189 entries of LAW and 104 entries of HAW. CNS, LLW Repository Ltd and GE Healthcare all had no entries of HAW in the inventory. STFC and Springfields had no LAW entries in the inventory.

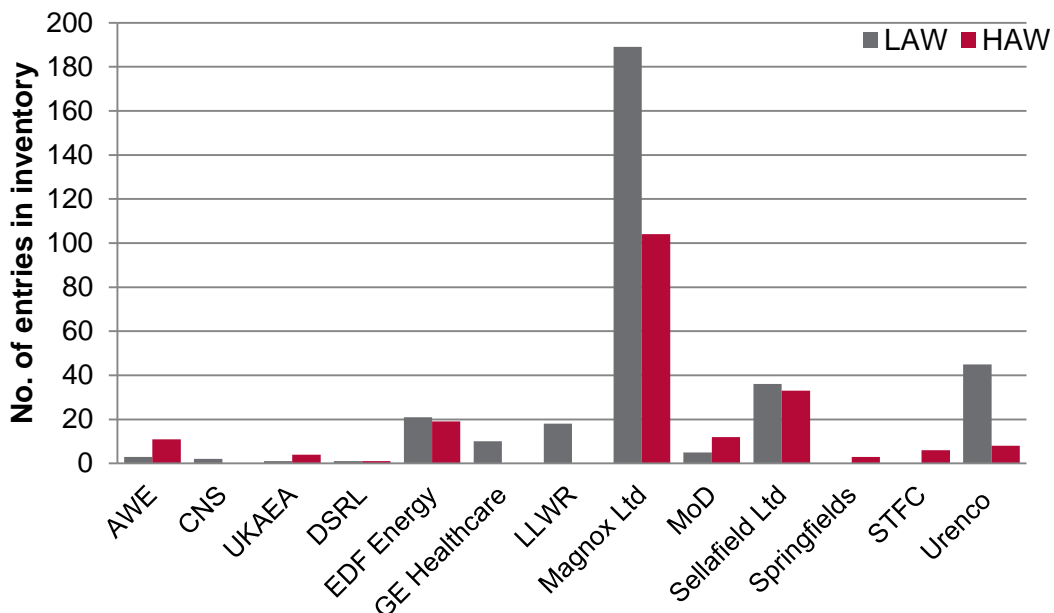


Fig 2. LAW/HAW by waste producer

### 3. Problematic Waste Types

The 2016 inventory contains 36 LAW problematic waste types and 29 HAW types. The waste groups are listed in Table 1.

**Table 1: Problematic waste groups used in the 2016 problematic waste inventory**

LAW Waste Groups		HAW Waste Groups
Material Contaminated with Oil	Redundant Laboratory Chemicals	Absorbent Material
Aqueous Liquids including bottles	Pyrochemical Waste	Aqueous Liquids
Asbestos	Redundant Transport Containers	Asbestos
Batteries	Sludge	Bulk Fines or Particulates
Bulk Fines or Particulates	Solvents	Containerised Waste
Bulk Waste	Sources	Contaminated Bulk Oil
Containerised Waste	Tritiated Oil	Electrical and WEEE
Contaminated Oil and Oil Contaminated Waste Unsuitable for Incineration	Tritium Contaminated Waste	FED
Electrical and WEEE	Uranics	Graphite
Failing Discrete Item Limit	Ventilation Filters	Halide-based Fire Suppressant Powders
FED	Waste Containing Liquids	High Fissile/Moderator/Heat Waste
Graphite		ILW Fuel
High Fissile/Moderator Waste		Ion Exchange Material
Ion Exchange Materials		MAC
Lead		Material Contaminated With Oil
Liquid Filters and Fines		Mercury Waste
MAC		Metal
Mercury Wastes		Oil Contaminated Waste
Metal		Physically Awkward Waste
Mixed Waste		Plutonium Contaminated Materials
Plutonium Contaminated Materials		Putrescible & Cellulose Waste
Pressurised Waste		Pyrochemical Waste
Putrescible and Cellulose Waste		Radium/Thorium/Americium and Radium/Thorium/Americium Contaminated Waste
Radium/Thorium/Americium and Radium/Thorium/Americium Contaminated Waste		Sludge
Reactive Metals		Solvents

The waste types with the highest number of entries within the inventory for LAW can be seen in Figure 3 below. LLW oil and oil contaminated waste, with 33 inventory entries, was the highest overall. This was closely followed by redundant laboratory chemicals and sludges.

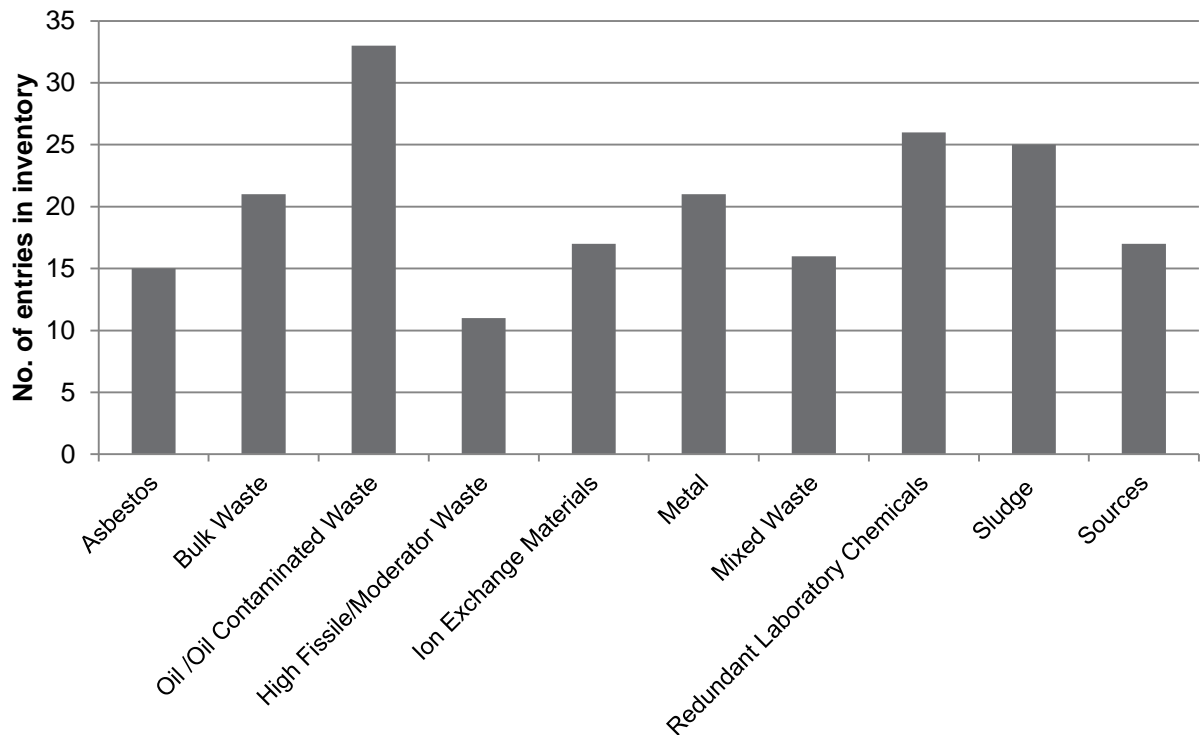


Fig 3. LAW inventory by waste type (top 10 groups)

Figure 4 illustrates the waste types with the highest number of entries in the inventory for HAW. The waste types with the greatest number of inventories were miscellaneous activated components (MAC), with 21 entries, and uranics, with 18 entries.

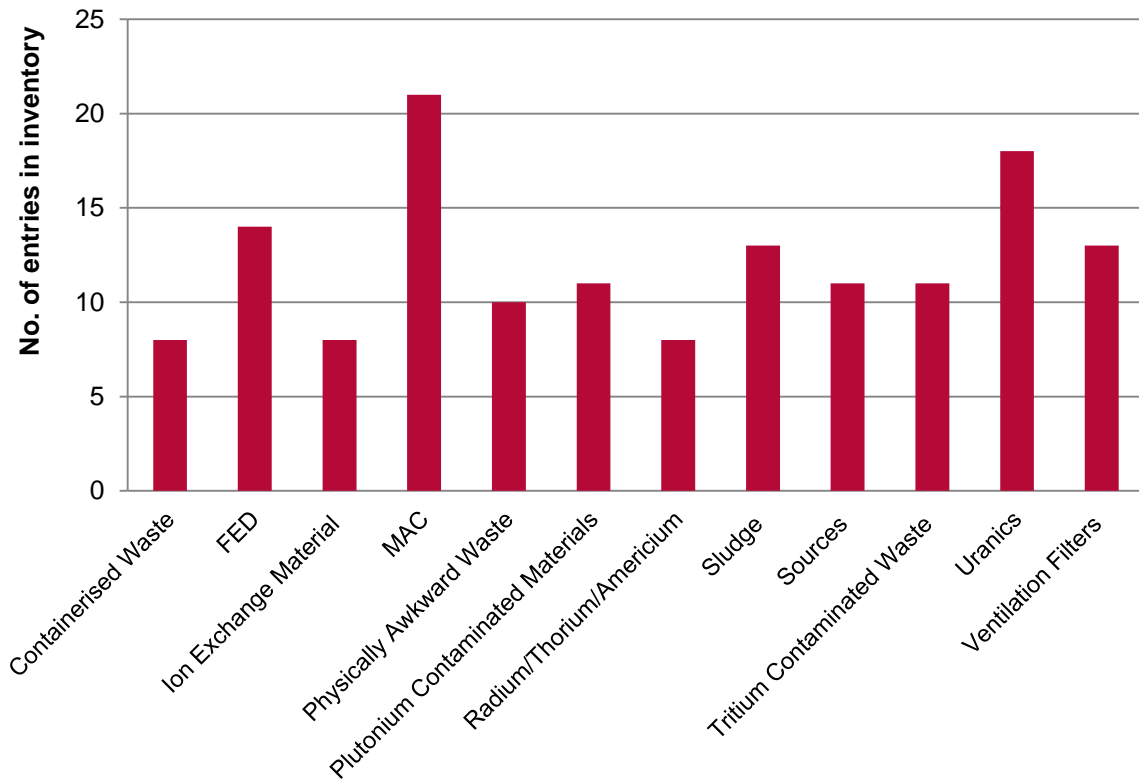


Fig 4. HAW inventory by waste type (top 12 groups)



#### 4. Problematic Waste Type Volumes

This section of the summary provides information on the volume of different waste types in the problematic waste inventory. It should be noted that there is significant uncertainty in the data for problematic waste type volumes as, for many entries in the inventory, no volumes were provided by waste producers.

The volumes for waste types with greater than 100m<sup>3</sup> and 1-100m<sup>3</sup> have been provided separately for both LAW and HAW problematic waste types in this section.

LAW waste types with volumes greater than 100m<sup>3</sup> are illustrated in Figure 5 below. Metal waste had the largest volume with 2,966m<sup>3</sup> recorded in the inventory. Mixed wastes had the next largest volume of 2,626m<sup>3</sup>, followed by 496m<sup>3</sup> of Plutonium Contaminated Materials (PCM) and 492m<sup>3</sup> of lower activity Fuel Element Debris (FED).

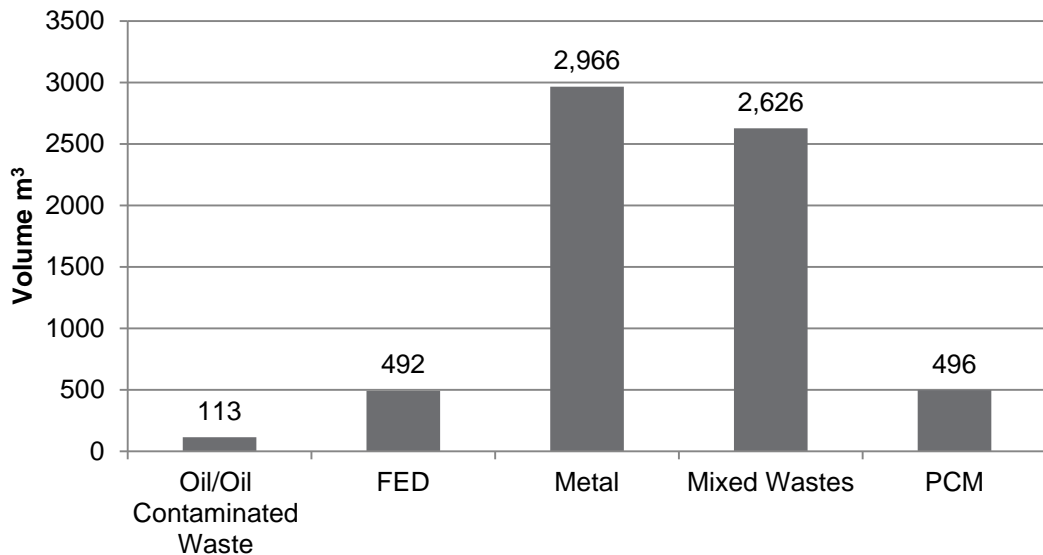
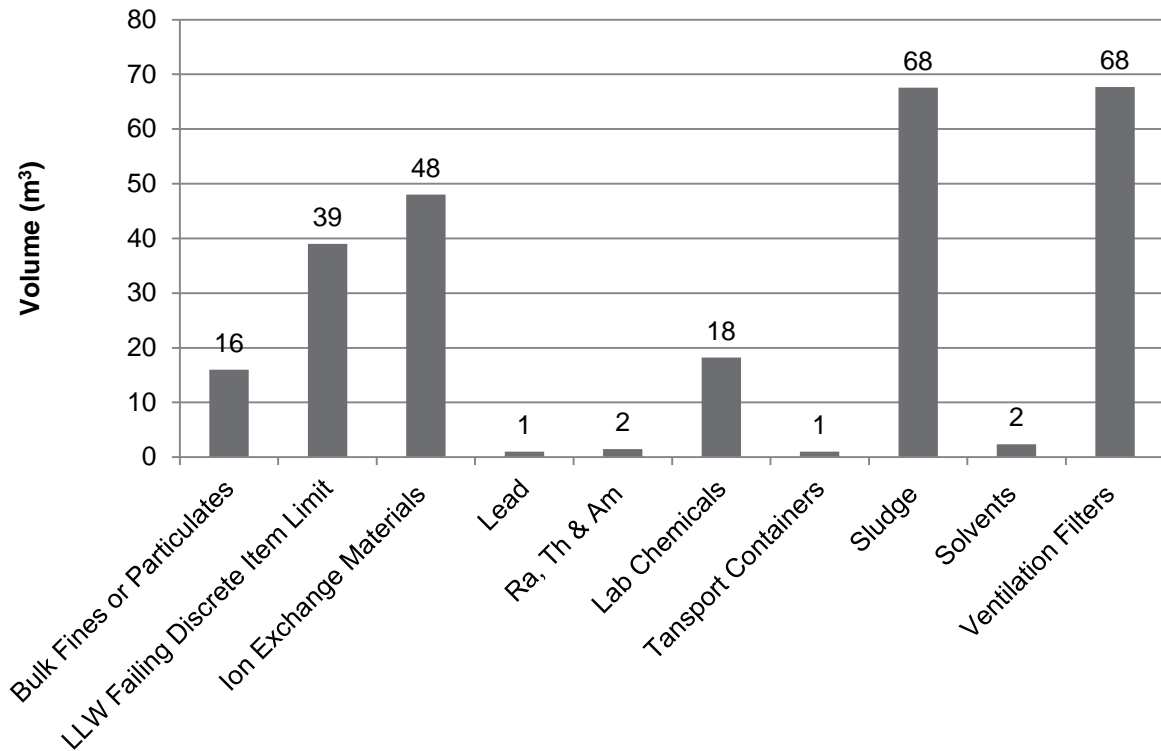


Fig 5. LAW problematic waste types with volumes >100m<sup>3</sup> in inventory

LAW waste types with volumes greater than 1m<sup>3</sup> but less than 100m<sup>3</sup> are shown in Figure 6. Within this category the greatest volumes recorded were for filters and sludge at 68m<sup>3</sup>, followed by ion exchange materials at 48m<sup>3</sup>.

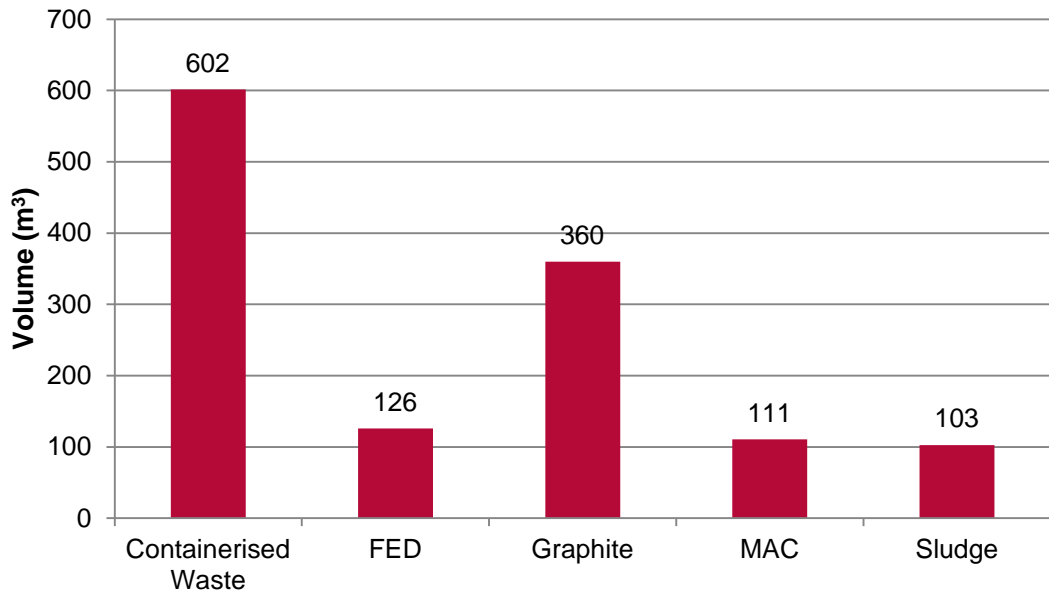


**Fig 6. LAW problematic waste types with volumes 1m<sup>3</sup> -100m<sup>3</sup> in inventory**

Within the LAW problematic waste inventory, batteries, material contaminated with oil, WEEE, mercury pressurised waste and waste containing liquids all had recorded volumes under 1m<sup>3</sup>. There were 15 LAW waste types with no volume data recorded in the inventory:

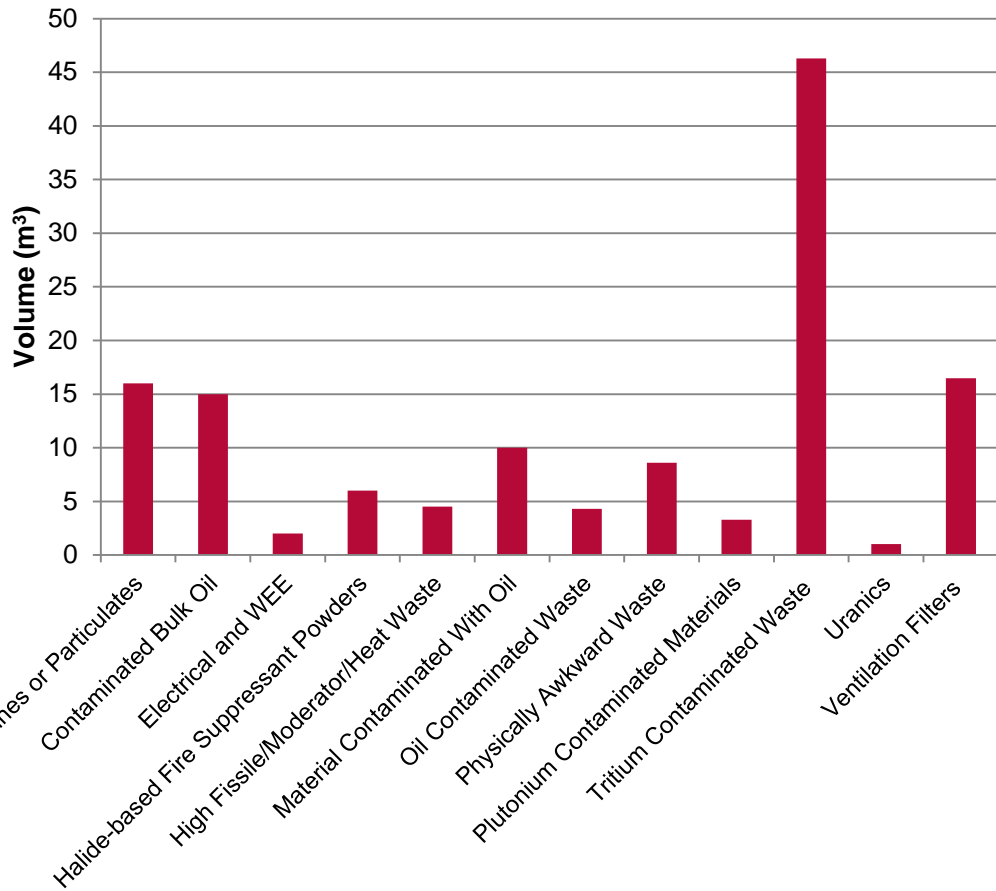
- |                                |                            |
|--------------------------------|----------------------------|
| Aqueous liquid                 | Putrescible and cellulosic |
| Asbestos                       | Pyrochemical               |
| Bulk waste                     | Reactive metals            |
| Containerised waste            | Sources                    |
| Graphite                       | Tritiated oil              |
| High fissile / moderator waste | Tritium contaminated waste |
| Liquid filters and fines       | Uranics                    |
| MAC                            |                            |

Figure 7 illustrates volumes of HAW problematic waste types greater than 100m<sup>3</sup>. It highlights a large volume of containerised waste (602m<sup>3</sup>) and graphite (360m<sup>3</sup>), followed by FED, MAC and sludge.



**Fig 7. HAW problematic waste types with volumes >100m<sup>3</sup> in inventory**

HAW problematic waste type volumes, for those wastes with between 1m<sup>3</sup> and 100m<sup>3</sup> in the inventory, are shown in Figure 8. This includes a relatively large volume of tritium contaminated waste, at 46m<sup>3</sup>. Other waste in this volume category included ventilation filters, bulk fines or particulates and contaminated bulk oils.



**Fig 8. HAW problematic waste types with volumes 1m<sup>3</sup> -100m<sup>3</sup> in inventory**

There were 3 HAW waste types with volumes at or under 1m<sup>3</sup>: mercury, sources and ILW fuel. There were nine HAW waste groups for which no volume data was recorded:

- Absorbent Material
- Aqueous liquids
- Asbestos
- Ion exchange material
- Metal
- Putrescible and cellulose wastes
- Pyrochemical
- Radium / Thorium and Americium and Radium / Thorium / Americium contaminated waste
- Solvents

## 5. Conclusion

The data analysis has shown that there are a greater number of LAW problematic wastes entries in the inventory than HAW. For those wastes which have volume data in the inventory, there is also a greater volume of LAW waste in the inventory than HAW waste; there are 6,957m<sup>3</sup> of LAW wastes and 1436m<sup>3</sup> of HAW wastes in the inventory. However, it must be noted that 15 of the 36 LAW waste groups and nine of the 29 HAW waste groups have no volume data recorded in the inventory.

In regards to number of entries by waste producers, Magnox Ltd dominated the inventory with 55% of total entries, representing a volume of 1,249m<sup>3</sup> for those entries with volume data recorded in the inventory. This was followed by Sellafield with 13% of total entries.

It is evident that the usefulness of the problematic waste inventory could be improved by the inclusion of volume data for all entries.