Nuclear decommissioning: Turning waste into Wealth

Disposal of low-level radiation

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Overview

Aims

- Classification of radioactive waste
- Current methods of disposal for each waste type
- The UK low-level radioactive waste facility
- Low-level radioactive waste storage

Radioactive waste 1

Categories of radioactive waste are based on precise classifications:

- low-level
- intermediate-level
- high-level

Radioactive waste 2

How do you think the following wastes should be categorised?

Molten reprocessing waste (actinides etc.)

Contaminated gloves and show covers

Metal cladding from the reactor

Examples of waste 1

Low-level waste

- Contaminated protective shoe covers
- Clothing
- Wiping rags
- Mops
- Filters
- Reactor water treatment residues
- Smoke detectors

From hospitals and industry, as well as reactor sites

Examples of waste 2

Intermediate-level waste

- Metal cladding
- Moderator from a reactor upon decommissioning

Examples of waste 3

High-level waste

- Waste left over after reprocessing spent fuel. Needs cooling as the radioactivity generated heat.

Low-level waste accounts for >90% of the overall waste volume but about 0.1% of the radioactivity.

(Source: nda.gov.uk, 2015)

Categories of waste 1

Low-level waste

- Waste for which the radioactive content does not exceed 4 GBq/Tonne of α or 12 GBq/Tonne of β-γ activity.
- Does not require shielding during handling/transport

Source: Disposal of radioactive waste - http://bit.ly/1U5hDMS

Categories of waste 2

Intermediate-level waste

Waste with higher levels of radioactivity than low-level waste, but not significantly heat-generating

Source: Disposal of radioactive waste - http://bit.ly/1U5hDMS

Categories of waste 3

High-level waste

Waste with higher levels of radioactivity than low-level waste, but for which the decay heat is significant enough to raise its temperature and that of the surroundings. Cooling needs to be taken into account when handling and storing.

Source: Disposal of radioactive waste - http://bit.ly/1U5hDMS

Treatment of waste in the UK 1

Low-level waste

- Compacted and encased in concrete
- Stored near ground level, e.g. at the UK's low-level waste repository

Treatment of waste in the UK 2

Intermediate-level waste

- Encased in cement inside concrete boxes or steel drums.
- Stored at sites awaiting future long term solution, e.g. geological storage (GDF)

Treatment of waste in the UK 3

High-level waste

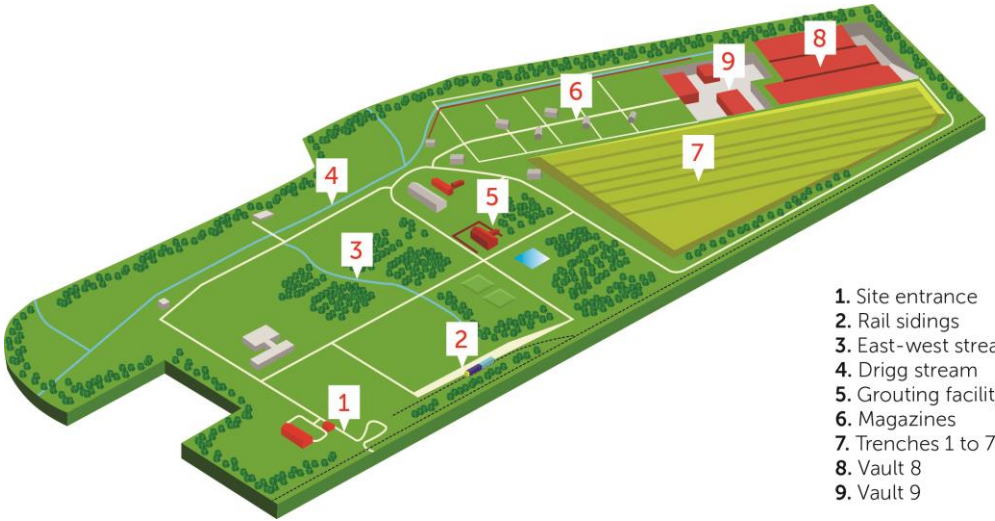
Vitrified – transformed into borosilicate glass (pyrex) inside robust stainless steel containers. These are welded closed and stored at the surface for a minimum of 50 years, then to GDF.

The low-level waste repository 1

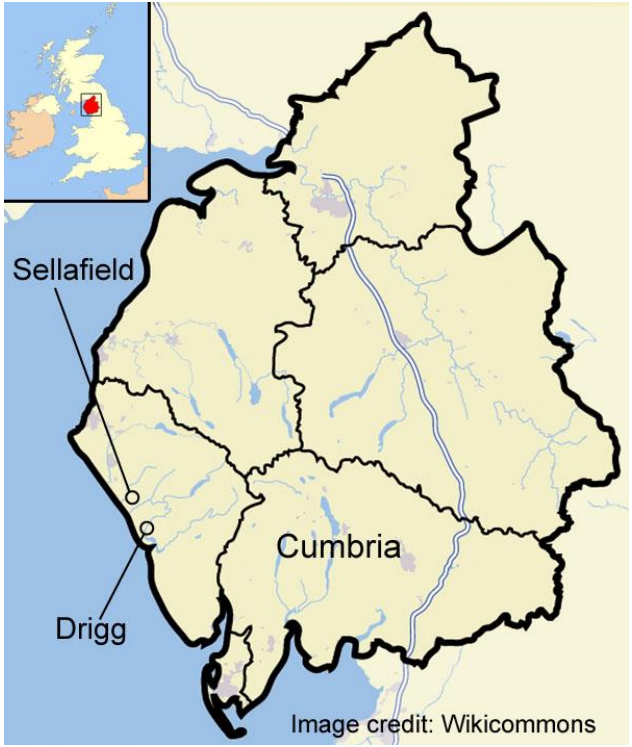
LLWR

- Established in 1959 at Drigg, West Cumbria.
- Owned by UK Nuclear Waste Management Ltd.

The Low-level waste repository 2



1. Site entrance
2. Rail sidings
3. East-west stream
4. Drigg stream
5. Grouting facility
6. Magazines
7. Trenches 1 to 7
8. Vault 8
9. Vault 9



Low-level waste procedures 1

Compaction and grouting

- The large volume of low-level waste mean compaction or super-compaction (if machines using ~1000 Tonnes pressure) are used.
- Grouting (encased in cement).
- Stacked in a near-surface vault.

Low-level waste procedures 2

Surface discharge by nuclear reactor operators

- Gases and liquids to the air or sea
- Governed by UK environmental agency permits

Objectives

After this workshop you should be able to:

- Classify radioactive waste into the appropriate category based on waste properties
- Articulate current UK radioactive waste strategies for each category
- Justify the strategies based on radioactivity and volumes
- Appreciate differences in how fuel is treated internationally, especially spent reactor fuel.

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