NDA PhD bursary: waste packaging and storage

Waste packaging and storage

- Working group reporting to the NWDRF
- Objectives:
  - Establish and maintain a cross-industry technical community with an interest and expertise in the conditioning, packaging and storage of nuclear waste
  - Deliver a targeted programme of research that enables improved delivery of the NDA mission by
    - identifying common issues, opportunities and (technical) risks
    - developing research proposals to address them
  - Share information and experience, leading to
    - more effective programmes within individual organisations
    - Improved technical co-ordination across the industry

WP&SWG: Activities

- Meetings at least twice a year, all members plus:
  - Institutions invited to host some meetings
  - Invited speakers
- Review NDA PhD bursary and other PhD initiatives
- Produce and review DRP proposals
- Cross-industry learning and sharing of “best-practice”
- Members:
  - Site licensed companies (SLCs): DSRL, LLWR, Magnox, RWM, SL
  - Regulators: EA / NWAT, ONR, SEPA
  - NDA
  - Others: MOD, AWE, EDF

PhD call: WP&S topics

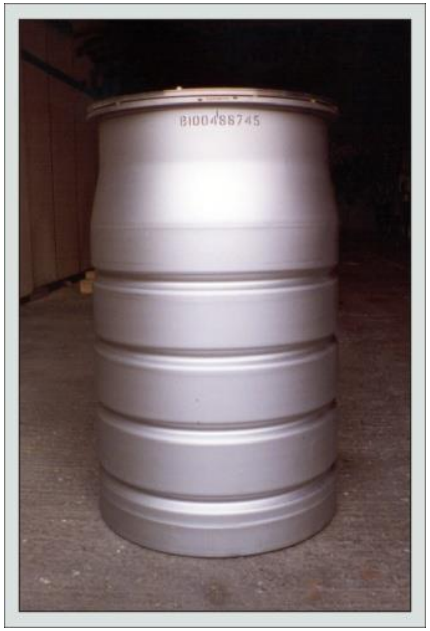
1. Technologies for waste package monitoring during surface storage
2. Tools and techniques for prediction and modelling of waste evolution and storage performance
3. Performance of metal containers not made from stainless steel
4. Methods for more efficient application of the waste hierarchy principles of reuse and recycle
5. Development of alternative treatment technologies to improve packaging processes
6. Determining the rate of release of tritium from solid waste under ambient conditions, and the factors that affect it

Package monitoring during storage

- Existing Higher Activity Waste (HAW) waste packages are metal (stainless steel, ductile cast iron) or concrete containers
- Where waste is encapsulated this is mostly based on cement encapsulation, supercompaction or vitrification
- HAW packages produced prior to availability of a geological disposal facility (GDF), or for surface storage in Scotland, are likely to require long-term storage
- Monitoring of package integrity and ageing processes is necessary to confirm continued suitability for storage and ideally also track any observable ageing trends
- PhD studies concerned with application of in-cell or in-store monitoring technologies would be relevant to this topic
- Also relevant would be development of tools and techniques for modelling and prediction of waste evolution and storage performance

Non-stainless steel metal package performance

- Most HAW waste packages are manufactured using stainless steel, but other metals could be used if specific performance requirements can be met
- Ductile cast iron, in thick sections, is an existing example of an alternative; another example could be carbon steel



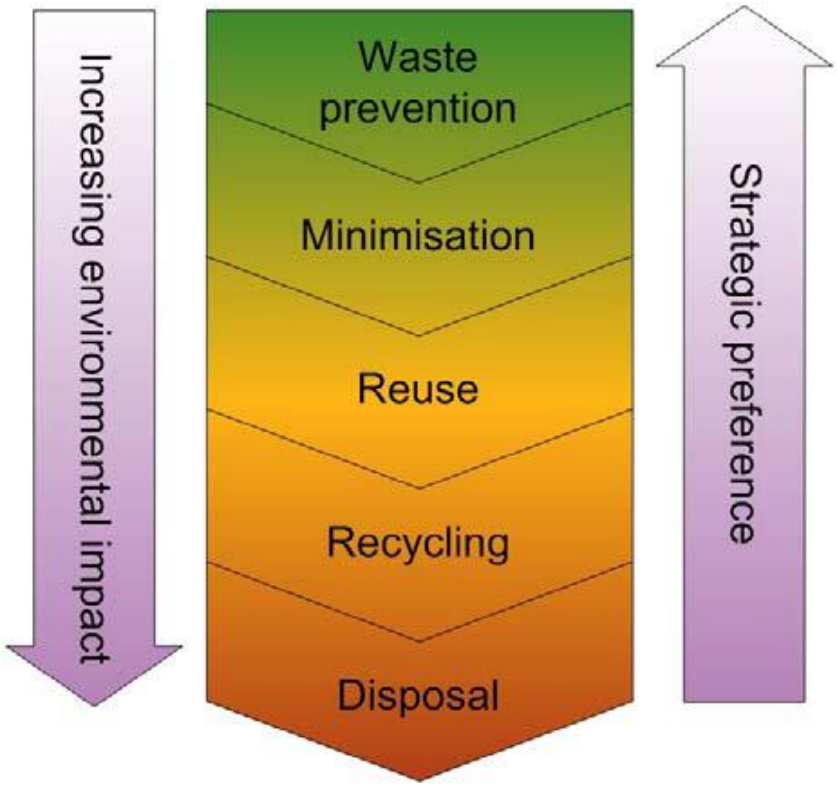
Non-stainless steel metal package performance (2)

- In historical option studies, other metals have not been favoured (e.g. on grounds of cost, longevity, mechanical properties, etc)
- Can other metal containers be enhanced or confidence in them improved to meet performance requirements?
- PhD studies that would assist development of alternative metal containers are sought

Applying the waste hierarchy

- Development of methods to more efficiently apply the waste hierarchy principles of reuse and recycle are sought

- May include
  - efficient methods of sorting and segregating of wastes
  - Decontamination
  - Reuse or recycling processes
  - Typically consider contaminated waste materials such as metals, concrete and soil



Applying the waste hierarchy (2)

- The nuclear industry used considerable amount of steel in the construction of chemical facilities and reactors. Could this be decontaminated and reused?
  - e.g. plutonium contaminated steels may be decontaminated by remelting, where the Pu will readily partition to the metallurgical slag
- Recycle of wastes
  - Large volumes of stainless steel, copper, Nimonic alloys
  - Large volumes of concrete
- Sorting and segregation
  - In the past, wastes were often mixed without thought of recovery. Being able to sort and segregate by material and / or radioactivity may provide more efficient packing and reduce cost
- Decontamination to reduce bulk activity of the bulk material enabling reclassification and diversion of waste

Alternative waste treatment tech.

- Very diverse wastes – chemically, physically, radiologically and mixtures thereof
- Volumes vary from site to site

- Cement encapsulation is the baseline but some wastes not so amenable to cements:
  - Amphoteric metals such as Al, U
  - Oils and organic materials
- New processes could:
  - reduce volumes / numbers of waste packages and improve wasteform performance
  - treat problematic wastes
  - be used to rework already produced waste packages

Alternative waste treatment tech. (2)

- Recycle of wastes:
  - Large volumes of stainless steel, copper, Nimonic alloys
  - Large volumes of concrete
- Some sites have small volumes of waste, typically “hard to treat” via conventional routes know as problematic wastes:
  - Mercury, oils (organic and synthetic), resins, sludges, etc.
  - Mobile or high throughput technologies
- Any new product needs to be verified for performance and disposal
- Mixed waste is often poorly characterised
  - Processes insensitive to input?
  - Methods of easily sorting and segregating wastes?

Tritium migration /influencing factors

- Lack of understanding in this area leads to conservative assumptions being made when assessing doses
- Impacts on transport assessments (c.f. IAEA transport regs)
- Desire better understanding of tritium release rates from common waste materials, e.g.
  - Stainless steel
  - Concrete
  - Magnox
- Would result in better packaging advice and potentially cost savings

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