Novel Thermal Treatments for High Activity Wastes (TWG1) - Summary

Cristiano Padovani

Date: 04/11/2015

Radioactive Waste Management

Objectives of the Session

- Develop a common understanding of:
  - European WMO's appetite in thermal treatments for high activity waste (e.g. ILW)
  - Available technologies, their characteristics and state of development
  - Science underpinning the disposability of treated products
- Build a platform for discussion to identify opportunities for future collaboration, including opportunities to develop a proposal for European funding

Radioactive Waste Management

Scope

Higher activity wastes for which thermal processes are not currently used and for which substantial benefits may exist:

- **Some ILW**
- Some LLW
- Some ‘unconventional’ higher activity wastes/materials (e.g. plutonium stocks)
- *Alternative approaches to HLW management?*

Radioactive Waste Management

Agenda

Title	Organisation
Collaboration on the Thermal Treatment of Waste	NNL/Sellafield Ltd
Novel Treatments to Improve Radioactive Waste Disposal	Andra
Application of Joule Heated Ceramic Melter (JHCM) Technology for Stabilization of Radioactive Wastes in the United States	Energy Solutions
The Innovative Plasma Tilting Furnace for Industrial Treatment of Radioactive Waste	Belgoprocess
Hot Isostatic Pressing of glass and ceramic wasteforms for UK higher activity wastes	University of Sheffield
Nano Flex HLW/ Spent Fuel Rods Recycling and Permanent Disposal	Nano Flex HLW
Geological Disposal of Silicon- rich Vitrified ILW Products in a Cement- based Engineered Barrier System: Addressing Key Uncertainties	AMEC-FW
Plasma Vitrification of Nuclear Waste	Costain
THOR and the Leachability of THOR Residues	Studsvik

European WMO's appetite

There is a strong interest in the UK and in France to evaluate the use of thermal treatments for specific waste types including:

- Organic wastes contaminated with plutonium
- Sludges
- Wastes with high metal content
- Bitumised wastes
- *Graphite?*

There is likely to be interest in other countries given that either:

- They are already using these techniques to treat some wastes
- Plans for disposal do not exist, are more uncertain or are down the line – importance of producing unreactive wasteforms

Radioactive Waste Management

Available techniques

A variety of techniques are available, including:

- Joule Heater Ceramic Melting
- Plasma-based techniques
- Electrode-based techniques
- Hot isostatic pressing
- Thermal oxidation/Pyrolysis
- *Alternative treatments for disposal of HLW*

Overall, one or more techniques can be used to treat a variety of wastes types. Key benefits are:

- Volume reduction (and associated potential cost reduction)
- Reduction in chemical reactivity

Radioactive Waste Management

Science Underpinning Disposal

Work has been carried out in many countries to scope/evaluate the disposability of different type of products. The results tend to show that:

- Low leaching rates can be obtained with suitable processing
- The presence of high silicon in the waste is unlikely to have a detrimental effect on a cement/based EBS, if such wastes *were* to be disposed of in conventional ILW concepts
- In highly α-contaminated materials, radiation damage may affect the characteristics of the wasteform after very long times.

Overall, thermal treatment may bring benefit to disposal as well as upstream

Radioactive Waste Management

Way forward

A good European basis of end users, suppliers and research institutes exists to enable collaboration at European level, including developing a proposal for European funding. Such a proposal would need to consider:

- The need of strategic coordination at European level, including waste types and technologies of greatest interest, strategic benefits (costs, risk-reduction, etc.), and logistic issues associated with transport of wastes, samples and treatment plants
- An element of active demonstration for key waste types
- Consideration of both upstream (treatment) and downstream (disposal) outstanding technical questions