
THERAMIN

Generic Criteria for Evaluating the Disposability of Thermally Treated Wastes

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THERAMIN Project

- **THERAMIN - Thermal treatment for radioactive waste minimisation and hazard reduction**
- Objective: Promotion of thermal treatment of low and intermediate radioactive waste (LILW) prior to disposal
 - Strategic impact of thermal treatment (WP2)
 - Demonstration of thermal treatment technologies (WP3)
 - Disposability of thermal products (WP4)
- Schedule: 01 June 2017 – 31 May 2020



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Disposability Criteria under THERAMIN Project

- To evaluate the **disposability of thermal treatment products** in the framework of THERAMIN
- **Objective** of the generic disposability criteria :
 - Develop a **common set of disposability criteria that can be used to evaluate** any form of waste products, from any thermal treatment, at any type of disposal facility
- **Generic disposability criteria** defined here as: “Factors affecting the disposability of conditioned waste produced from application of some form of thermal treatment”



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Methodology of derivation

- Disposability criteria are strongly linked to status and context of **national disposal programmes and policy**
- Contribution from each partner through a review of their national context
 - Waste classification → **LLW&ILW / SL&LL**
 - Disposal facilities → **Existing & under study**
Surface Disposal & Deep Geological Disposal
 - National WAC → **formal WAC / preliminary WAC / requirements**
- Derived generic disposability criteria
 - **Highlight factors** for waste product disposability and the ways in which thermal treatment can impact on these factors (both positively and negatively).
 - **Qualitative criteria** only (quantitative criteria are site specific)
 - Need to be applied in conjunction with existing criteria applicable to other wastes that are planned for disposal in a particular facility.

Ability to meet existing disposal requirements

- **In many cases, no additional requirements needed even if thermal treatment products may help to meet existing requirements / WAC**
 - No free liquid (water) or gas present in waste – volatiles driven off
 - No hazardous material present / inert product – reactive waste components often consumed
 - Minimal gas generation
 - Robust wasteform – product of thermal treatment is often (although not always) monolithic
 - Homogeneity / no localised accumulations of radioactivity
 - Mechanical resistance to stresses imposed during transport, handling and disposal operations...



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Specific considerations for thermally treated waste

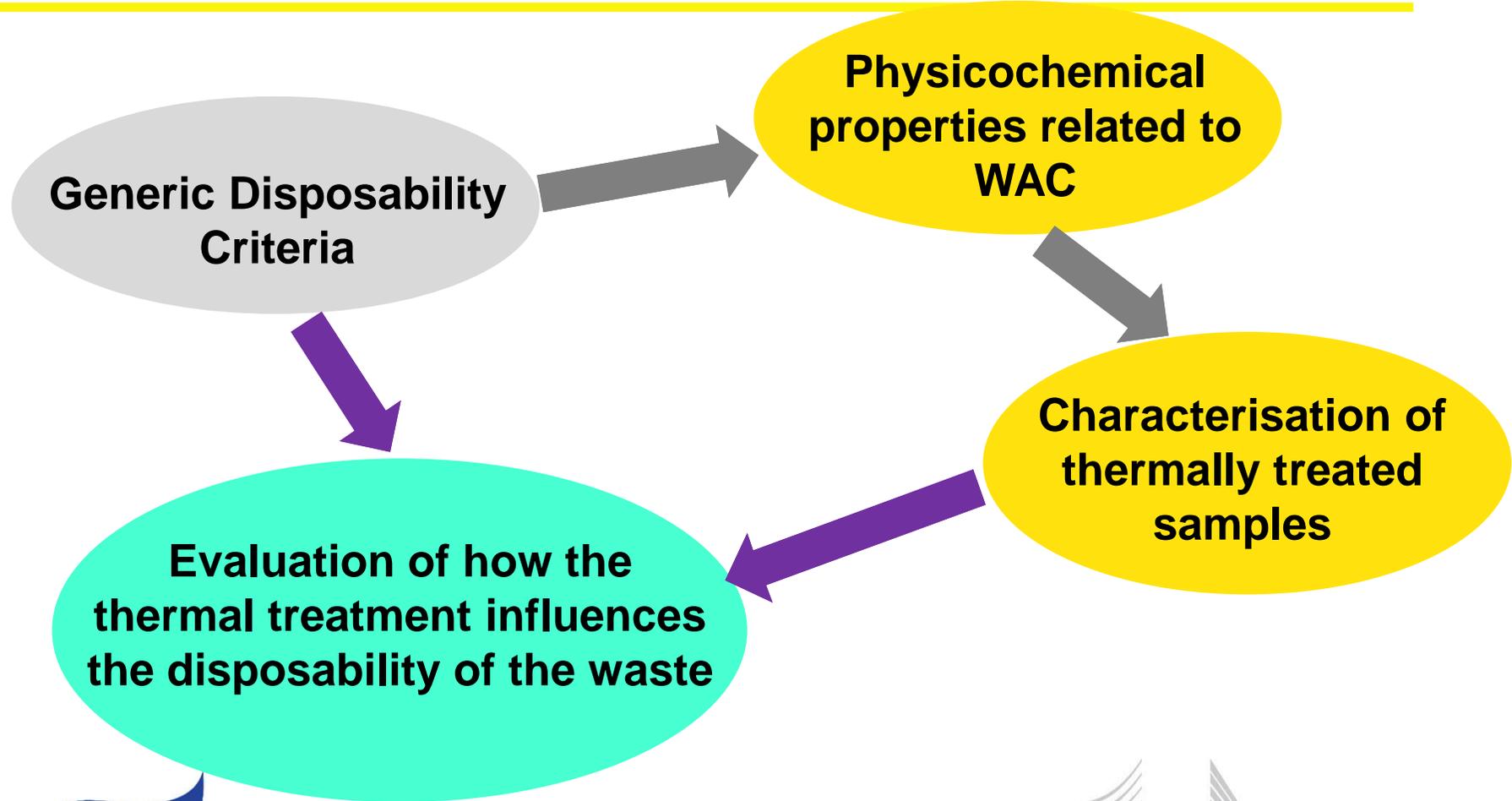
- **Additional considerations relating to thermal treatment implications should be considered**
 - The potential for thermal treatment to concentrate radioactivity and fissile material in the waste product
 - The impacts of generating a relatively high density, low voidage wastefrom in many cases, which could affect waste package handling.
 - The potential for thermal treatment to introduce new mechanisms for contamination of equipment and/or waste packages (e.g. splashing, particulate generation and/or carry-over to the off-gas system).
 - The chemistry and mechanical properties of thermally treated wastes, which may behave differently during handling, storage and disposal, thereby introducing uncertainties, e.g. relating to chemical compatibility in a disposal environment.
 - Safety functions applicable to thermally treated wastes may or may not be the same as those applicable to other wastes to be disposed of in the same facility, depending on the drivers for implementing thermal treatment. Evaluation of thermally treated waste in the post-closure safety case for a disposal facility may therefore differ from that for other wastefroms

Generic disposability criteria

- 20 Topic/category applicable to the disposability evaluation of thermally treated waste → 9 specific to thermally treated waste

- **Dimensions / mass of packages**
- *Provisions for transport, handling and emplacement*
- **Package integrity and required lifetime**
- **Activity content**
- *Radionuclide inventory*
- *Dose rate limits*
- *Surface contamination*
- *Nuclear criticality*
- **Thermal output**
- *Gas generation*
- **Chemical content**
- **Chemical durability**
- **VOIDS**
- *Waste package stacking*
- *Impact performance*
- *Fire performance*
- *ID / labelling*
- *QA / QC requirements*
- **Data management**
- **Secondary waste**

From WAC to disposability



Conclusion

- **Development of generic criteria in THERAMIN Project**
 - Based on the contribution from each partner
 - Proposed generic disposability criteria for thermally treated waste products developed in contrast with the existing criteria for other type of waste
 - Can be used to evaluate any form of waste products, from any thermal treatment, at any type of disposal facility
- **Perspectives**
 - **Development of more specific disposability criteria for LLW/ILW**
 - **National context and policy**
 - Distinction between **surface and geological disposal**
 - Distinction between waste containing **SL and LL radionuclides**

More information?

- **THERAMIN Public Deliverables available at:**
<http://www.theramin-h2020.eu/>
 - **Deliverable D4.1** - Waste Acceptance Criteria and requirements in terms of characterisation
 - **Deliverable D5.4** - Project Synthesis Report
- L. Harvey *et al.* 2020 IOP Conf. Ser.: Mater. Sci. Eng. 818 012013
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Appendix



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Generic disposability criteria specific to Thermally treated waste - 1

Topic / Category	Generic disposability criterion
Dimensions / mass of packages	The design of containers used to package thermally treated waste should be compatible with: (i) the thermal processing route being employed (ii) relevant safety functions for storage and disposal, (iii) with all applicable constraints on waste classification, handling, transport and disposal, taking account of the processed waste characteristics.
Package integrity and required lifetime	Apply existing criteria for the disposal context in question. Any additional criteria on package integrity defined for thermally treated waste should be linked to safety functions applied to such waste.
Activity content	The disposal concept for thermally treated waste should take account of the potential for activity to be concentrated during thermal treatment (as a result of waste volume reduction), which could have implications for the waste classification, waste package dose rates and the likelihood of nuclear criticality
Thermal output	The thermal output of thermally treated waste should not have a detrimental impact on performance of the engineered and natural barriers that make up the disposal system, taking account of the potential for activity to be concentrated during thermal treatment.



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Generic disposability criteria specific to Thermally treated waste - 2

Topic / Category	Generic disposability criterion
Chemical content	Apply existing criteria for the disposal context in question. The choice of thermal treatment route and the design of the associated disposal facility should ensure the chemical compatibility of thermally treated waste with other disposal system components.
Chemical durability	Existing requirements on chemical durability for the applicable disposal route should be applied to thermally treated waste. No additional generic disposability criteria for thermally treated waste are considered necessary, although requirements relating to the containment provided by a wasteform may be justified, depending on the post-closure safety case.
Voids	Void space within packages of thermally treated waste should be minimised wherever practicable; this may influence aspects of how thermal treatment is implemented.
Data management	Data management requirements for the relevant disposal route should be applied to thermally treated waste. In addition, records of the thermal treatment regime applied to the waste should be kept.
Secondary waste	Secondary waste associated with thermal treatment should be minimised to the extent that is practicable.



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