EURAD-2 WP6 STREAM: SUSTAINABLE TREATMENT AND IMMOBILISATION OF CHALLENGING WASTE

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Large amounts of radioactive waste in Europe require the implementation of management routes prior to disposal. Specifically, management routes for challenging low-level and intermediate-level radioactive waste, both solid (metals, spent IERs, incineration ashes) and liquid (oils, decontamination process, evaporator concentrates), still need to be further investigated.
Previous projects like EURAD, THERAMIN, and PREDIS have explored processing routes, including thermal treatments and alternative conditioning methods compared to traditional cement-based immobilization, such as geopolymers and phosphate-based binders. However, these waste management routes are not yet fully mature and require additional studies on the influence of waste composition on the consolidation process of the conditioning matrix, the properties of the hardened waste forms, and the minimization and management of secondary waste.
Additionally, the cement industry's evolution to reduce its environmental footprint will lead to the progressive disappearance of binders with a high clinker content, such as CEM I 52.5, currently used for conditioning certain types of radioactive waste like evaporator concentrates. The availability of supplementary cementitious materials (SCMs), such as fly ash or blast-furnace slag, is also expected to decrease in the near future (especially in Europe). Conversely, novel cements (CEM II/C-M, CEM VI, LC3, belite-calcium sulfoaluminate cements) are under development and standardization, potentially offering new prospects for designing cement-based matrices and backfill materials with reduced environmental impact, following the principles of the circular economy. The performance of these novel cements must be demonstrated to anticipate their implementation at an industrial level.
The work package STREAM (EURAD2-WP6) aims to develop innovative and sustainable waste management routes, including processing optimization and upscaling of treatments and conditioning materials for the predisposal of challenging waste. The identification and the assessment of the properties directly affecting the long-term performances will be conducted in close collaboration with work package L'OPERA (EURAD-2 WP7). Additionally, life cycle assessment (LCA) and life cycle cost (LCC) analyses of the most promising processes and materials developed in STREAM WP will be conducted to guide end-users in selecting the best treatment and conditioning strategy, considering technical, economic, and environmental issues.

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