Next generation Digital Twins to support Optimisation, Construction and Operation of surface and subsurface radioactive waste management facilities - DITOCO2030

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The nuclear sector is now at the doorstep of adopting new technologies to enhance its safety-critical and socially significant operations. Among these innovations Digital Twins (DT), the virtual replica of physical assets, offer a powerful tool for informed decision-making, operational efficiency and transparency. The DITOCO2030 work package (WP) aims to develop a roadmap for bridging the R&D gap between the currently fragmented DT of individual disciplines (i.e. engineering, safety, geology, infrastructure development, etc.), data management systems and decision-making platforms. This will involve identifying and integrating knowledge from various sectors to better understand the opportunities and limitations of this technology to support optimization, construction and operation of surface and subsurface radioactive waste management facilities. We will focus on identifying, collecting and transferring existing knowledge from other communities and industry to the nuclear waste management community. This will involve merging human and technical competencies, aligned with the specific needs of DT projects and the broader industry and regulatory context. We will document and analyze current practices and conduct gap analysis to guide strategic recommendations for future DT development, specifically addressing the requirements of end-users. Qualitative and quantitative performance indicators will also be developed to differentiate between effective and ineffective DT in the long term. A significant challenge consists in aligning the various objectives and applications of DT, such as long-term safety, operational efficiency, design, optimization and communication and integrating them in an interoperable manner across all relevant disciplines. This alignment aims to build practical knowledge that supports and enhances safety. The project will explore opportunities for cross-industry collaboration to advance innovation, performance, and efficiency in next-generation DT for the nuclear sector. It will also focus on stakeholder engagement by organizing workshops and dissemination activities, ensuring feedback is incorporated and knowledge is efficiently shared. This will pave the way for more integrated and effective deployment of DT in the lifecycle of nuclear waste management. The work will support future directions for DT development and research opportunities examining how DT can support regulatory compliance and improve safety by providing real-time monitoring, analysis, and reporting of asset performance and condition.

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