SAFEGUARDS FOR CENTRALIZED FUEL & WASTE MANAGEMENT AND NUCLEAR FUEL TRANSPORT IN LFR REACTOR DEPLOYMENT

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The development of Small Modular Reactors (SMRs), such as Lead-cooled Fast Reactors (LFRs), is crucial for the transition to low-carbon energy. To fully harness their potential, it is imperative to adapt and strengthen existing nuclear safeguards, addressing the unique characteristics of these reactors to ensure the highest standards of safety, security & safeguards, and regulatory compliance. After systematically assessing locations, this study focuses on deploying LFRs in Europe, with an emphasis on nuclear safeguards for a Centralized Spent Fuel & Waste Management Facility and secure nuclear fuel transport to and from this facility. With this setting, the project targets reactor deployment by 2035, including modular units of 300–400 MWe and larger designs of up to 1,200 MWe. This work describes how to handle and secure LFR spent fuel, integrating monitoring, dose estimations, material accounting, and verification mechanisms to ensure compliance and minimize proliferation risks. Similarly, in this study, contributions to the development of the safeguard framework for nuclear fuel transport, incorporating real-time tracking, reinforced containment systems, and international oversight are included. This study outlines the deployment strategy integrating robust safeguards for a centralized facility for spent fuel and waste management and nuclear fuel transport, ensuring safety, security, and safeguards compliance with legal and regulatory frameworks. This project intends to contribute to the analysis of the critical safeguard aspects of this centralized facility in the case of the LFR, identifying challenges and advantages that could benefit other Generation IV reactor technologies.

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