Contribution ID: **100** Type: **Poster**

Integration of Small Modular Reactors in the Swedish Nuclear Energy System: A Proliferation Resistance Study

The International Project on Innovative Nuclear Reactors and Fuel Cycles (INPRO) has developed a comprehensive methodology to assess the sustainability of nuclear energy systems in terms of environmental impact, safety, proliferation resistance, waste management, infrastructure, and economics. Within the framework of the newly-established competence centre in Sweden entitled Academic-industrial Nuclear technology Initiative to Achieve a sustainable energy future (ANItA), we apply this methodology to explore the potential extension of the Swedish nuclear power programme through the introduction of Small Modular Reactors (SMRs). The analysis takes into account several key factors, including reactor design, deployment units, location, and mode of operation.

Our primary focus is to evaluate the proliferation resistance of the envisioned nuclear energy system from multiple perspectives. This includes the non-proliferation legal framework applicable in Sweden, available nuclear technology and materials, and implemented safeguards considerations in operating procedures and SMR designs. Furthermore, we deliberate whether SMRs can still be subject to safeguards approaches applied for large-scale reactors, and address challenges associated with their future safeguards verification. Lastly, we explore technical solutions and construct a set of recommended proliferation resistance measures aimed at supporting designers, vendors, operators, and regulators in their efforts to foster a sustainable and safe energy future.

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Confirm that the work is original and has not been published anywhere else

YES

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Track Classification: Topical Group C: Safety, Security and Safeguards: Track 12: Safeguards for SMRs