



lasar³

TRACTEBEL
ENGIE

System-Theoretic Accident Model and Processes (STAMP) for Probabilistic Safety Assessment (PSA) in Gen IV Reactor Technologies

In collaboration with TRACTABEL (ENGIE) - Engie Tower-
Bruxelles - Belgium

Context of the research

System-Theoretic Accident Model and Processes (STAMP) is a framework for analyzing the safety of complex systems in DPSA that expands the conventional event-centered perspective with the integration of control structures, feedback loops and safety constraints into the evaluation of potential accident scenarios. By recognizing that accidents stem from inadequate control actions, STAMP allows the analyst to identify vulnerabilities that arise not just from hardware failures, but also from flawed governance, organizational dynamics and operational constraints. When applied to Gen IV reactors, STAMP is expected to provide a clearer understanding of both the technical and human elements that influence reactor safety. This holistic perspective is especially relevant given the advanced designs and integrated features of Gen IV concepts.

Objective of the research

- Conduct a comprehensive review of existing safety assessment techniques to enable the identification of strengths and limitations of current approaches in the context of Gen IV reactors.
- Develop a systematic framework that incorporates STAMP principles into DPSA.
- Apply the proposed framework on a representative Gen IV reactor case study.
- Provide strengths, limitations, actionable guidelines and recommendations for use of the developed framework by industry stakeholders, regulatory bodies, and design teams.

Collaborations

Tractebel, part of the Engie Group, is a leading engineering firm specializing in energy and nuclear safety. The work will be performed in the Laboratory of Analysis of Systems for the Assessment of Reliability, Risk and Resilience (LASAR³) of Politecnico di Milano in tight collaboration with TRACTABEL in Bruxelles (Belgium), where an internship is foreseen.

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