

NUCLEAR ENERGY RESEARCH INITIATIVE

Risk-Informed Balancing of Safety, Non-proliferation, and Economics for the Sodium-Cooled Fast Reactor (SFR)

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Project Description

The objective of this project is to develop risk-informed design and evaluation tools for the sodium-cooled fast reactor (SFR) that take into account safety, economics, licensability, and proliferation resistance. These tools will be applied to a number of design alternatives to identify opportunities to reduce SFR cost while maintaining a high level of safety and proliferation resistance.

The proposed design variations, many of which incorporate passive safety features, include loop versus pool-type designs, differing fuel types, as well as sizes ranging from very large monolithic reactors to small modular ones. The resulting risk-informed methodology will help develop technical requirements for the industrial design organization, identify research needs, assess the technology risk of alternatives, and assist with planning. Industrial groups can use this methodology to perform design tradeoffs that would make the SFR economically competitive and licensable, while still maintaining the reactor's safety and proliferation resistance.

The objectives will be achieved through the following activities:

- Establishing two reference designs: 1) a pool design and a 2) loop-type or hybrid design. Variations in plant configurations, fuel employed in-core design, and power output will be made relative to these two reference configurations.
- Defining appropriate metrics for safety, economics, and proliferation resistance that will serve as the basis for evaluating SFR design alternatives
- Performing Probabilistic Risk Assessments and accident evaluations
- Evaluating costs and identifying opportunities to reduce them
- Evaluating proliferation risks
- Developing a risk-informed decision-making methodology that would integrate and balance the results of the preceding analyses