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Context of Single Failure Criterion (SFC) Application for Small Modular Reactor (SMR)

The Single Failure Criterion (SFC) ensures reliable performance of safety systems in nuclear power plants in response to design basis initiating events. The SFC, basically, requires that the system must be capable of performing its task in the presence of any single failure.

The capability of a system to perform its design function in the presence of a single failure could be threatened by a common cause failure such as a fire, flood, or human intervention or by any other cause with potential to induce multiple failures. When applied to plant's response to a postulated design-basis initiating event, the SFC usually represents a requirement that particular safety system performs its safety functions as designed under the conditions which can include:
 All failures caused by a single failure;
 All identifiable but non-detectable failures, including those in the non-tested components;
 All failures and spurious system actions that cause (or are caused by) the postulated event.

The paper provides an updated overview of the regulatory design requirements for new reactors and small modular reactors addressing Single Failure Criterion (SFC) in accordance to international best-practices, particularly considering the SCF relation to in-service testing, maintenance, repair, inspection and monitoring of systems, structures and components important to safety.

The paper discusses the comparison of the current SFC requirements and guidelines published by the IAEA, WENRA, EUR and nuclear regulators in the United States, United Kingdom, Russia, Korea, Japan, China and Finland. Also, paper addresses the application of SFC requirements in design; considerations for testing, maintenance, repair, inspection and monitoring; allowable equipment outage times; exemptions to SFC requirements; and analysis for SFC application to two-, three- and four-train systems and applications for small and modular reactors.

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