

## Summary

This document is a Guide for how to plan for and perform demonstration of safety in modernization- and new build projects including digital instrumentation and control (I&C) systems within the nuclear power industry. The document has been developed in close collaboration with an expert group having comprehensive experience from digital I&C implementation and Safety Demonstration in relevant projects. The Guide establishes three important purposes with Safety Demonstration. The first purpose is to convince oneself (in the project and as Licensee) that the plant during and after the project implementation is safe, and document the bases for that conclusion. The second purpose is to demonstrate the safety, with the argumentation and evidence, to reviewers and the regulating authority. The last and not least of the three, is to minimize both licensing and commercial risks linked to the project and the overall investment.

Licensing and other overall project risks are deemed to decrease radically by applying this Guide's methodology for Safety Demonstration. The cornerstones of the methodology are sequential communication and gradual acceptance and approval of results according to agreed acceptance criteria between the stakeholders (suppliers, NPP project, reviewers, Licensee and the regulator) and all this to be started early in the project. For the Licensee or investor this means, in addition to the assured and demonstrated safety with increased confidence from the regulator and the public, also significantly reduced risk for failed investments thanks to more predictable project performance with regards to both quality of results, time and money.

The Guide suggests a structure for how to plan a Safety Demonstration and a life cycle model with phases or reporting steps related to normal project development phases. It is important to keep in mind that the planning phase of Safety Demonstration is most important. By performing this phase early and carefully, the stakeholders can agree and commit up front to how, when and based on what, acceptance will be achieved and agreed. Experience from several NPP modernization and new build projects, but also smaller less complex projects involving digital I&C and Smart Devices, have shown that lack of such agreements is one of the largest causes of delays and unexpected cost increase.

The structure presented in the Guide aims at being useful for all sizes of projects by adapting the scope and level of detail depending on the specific project scope. The Guide contains a typical example of a Safety Demonstration life cycle overview diagram and template documents for what to include in a Safety Demonstration Plan and in Safety Demonstration Reports. The focus of the Guide is to give a general model for Safety Demonstration and it also provides useful detail references for specific problem areas when it comes to digital I&C systems in safety critical applications.

The development of the Guide was initiated by Elforsk and the project steering and expert group constituted by representatives from Vattenfall, Fortum, Forsmarks Kraftgrupp (FKA), Oskarshamnsverkets Kraftgrupp (OKG), the Swedish radiation safety authority (SSM), one Swedish trade organization (Svensk Energi) and one representative from Elforsk.