Applying Finnish safety and RAMI procedures to IFMIF-DONES in the EUROfusion Work Package Early Neutron Source

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- Work Package Early Neutron Source (WPENS)
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- Benefits for Finland and EUROfusion
IFMIF-DONES

- International Fusion Material Irradiation Facility – DEMO Oriented Neutron Source
- Irradiation environment in the future Fusion Power Plants is characterized by the presence of 14 MeV fusion neutrons in the first wall area
- The neutrons cause damage within the structure of the material which leads to swelling through the creation of voids
- IFMIF-DONES is to produce fusion characteristic neutron spectrum with enough intensity to allow accelerated testing, up to a level above the expected operational lifetime of DEMO and the future Fusion Power Plant
IFMIF-DONES

- Accelerator-based irradiation environment utilizing deuteron-lithium nuclear reaction with a broad energy spectrum peaked at around 14 MeV fusion neutrons
- The Main Building: Accelerator System, Lithium System, Test Systems and Plant Services
Work Package Early Neutron Source (WPENS)

Plant Level Analysis:
- 4 WPs
- ~45 lab ppy
- ~2.5 industrial ppy
- 2015-2018
Safety – Objectives

- Analysis of the whole facility to feedback design teams with implemented safety aspects
- Prepare documentation for Preliminary Safety Analysis Report (PSAR)
- Demonstration of design robustness and safety margins for radiation protection of workers, public and environment
- Collect feedback from similar operating facilities
RAMI – Objectives

- Formulation of the top level ENS RAMI requirements
- Adapting the RAMI requirements for the different parts of the facilities and systems
- Identification and reduction of the main sources of uncertainties
Safety – Tasks in 2016

- Failure Mode, Effects and Criticality Analysis (FMECA) for the systems important to safety
- Initiating event and accident sequence analysis are studied to create the basic internal even trees for probabilistic safety analysis
- Other internal events are studied with the special emphasis on the fire hazards
RAMI – Tasks in 2016

- Expectations of different stakeholders are captured and formulated in the form of RAMI requirements for the ENS system.
- Data of previous validation activities are compiled and analysed in order to capture lessons learned and point out existing uncertain aspects in the design of the facility.
Benefits for Finland and EUROfusion

- Export Finnish nuclear safety analysis and RAMI practices to international particle accelerator and material irradiation facilities
- Methods and tools developed on the fission energy production are applied to the fusion energy production
- Import know-how and lessons learned to domestic nuclear projects (e.g. decommissioning of nuclear facilities)
- Connect with new customers for VTT Nuclear House hot cell