



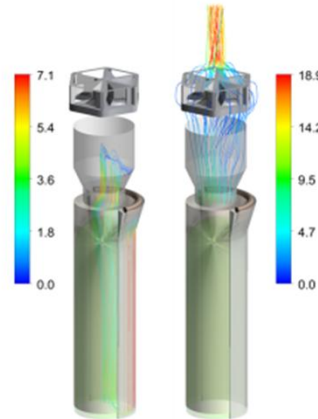
SAFIR2018

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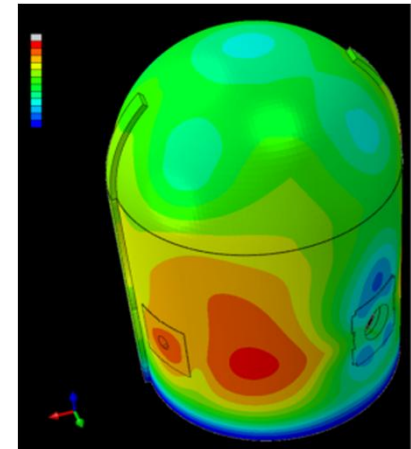
The Finnish Nuclear Power Plant Safety Research Programme 2015-2018



Plant safety and systems engineering



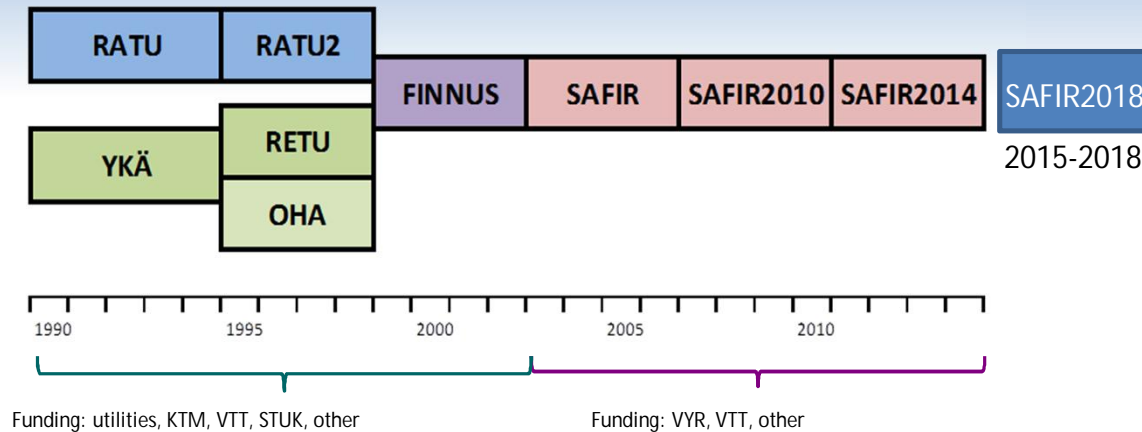
Reactor safety



Structural safety and materials

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Finnish Nuclear Power Plant Safety Research



The nuclear facility operator shall be obliged to participate in financing research aimed at ensuring that, should such new factors concerning safe operation of nuclear facilities emerge that could not be foreseen, the authorities have such sufficient and comprehensive nuclear engineering expertise and other facilities at their disposal that can be used, when necessary, to analyse without delay the significance of such factors. (Nuclear Energy Act Chapter 7a, Section 53a)

- National research programmes have had a significant role in NPP safety research since 1990 and from 2003 the programmes have been known as SAFIR programmes.
- The objective of the programmes follows the Finnish Nuclear Energy Act, i.e., to ensure that should new matters related to the safe use of nuclear power plants arise, the authorities possess sufficient technical expertise and other competence required for rapidly determining the significance of the matters.
- The nuclear facility operators pay an annual fee into the Finnish State Nuclear Waste Management Fund (VYR) that finances research projects in the programmes.
- Finnish Research Programme on Nuclear Waste Management KYT2018 ran in parallel with SAFIR2018.
- The research projects shall be of a high scientific standard and the results shall be published.

SAFIR2018 Objectives

Development and maintenance of expertise

Public research based on actual needs offers an excellent environment for educating new experts.

Development and renewal of research infrastructure

The programme also supported the development of research infrastructure so that the analysis, measurement and testing equipment remain up-to-date.

High level research and international co-operation

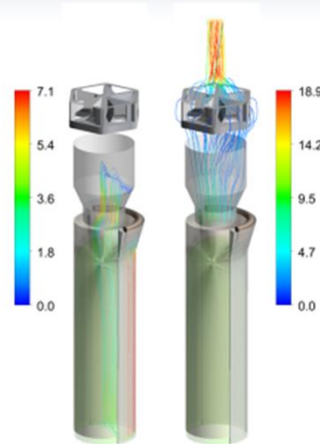
Almost all SAFIR2018 projects had real international co-operation. The results were reported in over 1000 publications and other reports.

SAFIR2018 Research Areas



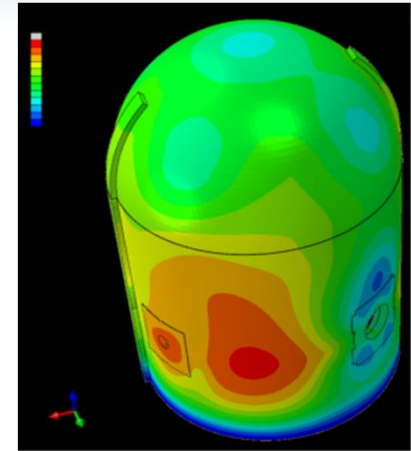
Plant safety and systems engineering

- Overall safety throughout the life cycle of nuclear power plants
- Operational resilience
- Management principles and safety culture
- PRA and Defence-in-Depth (DiD)
- Safety assessment of automation (I&C) and electrical systems
- Extreme weather conditions.



Reactor safety

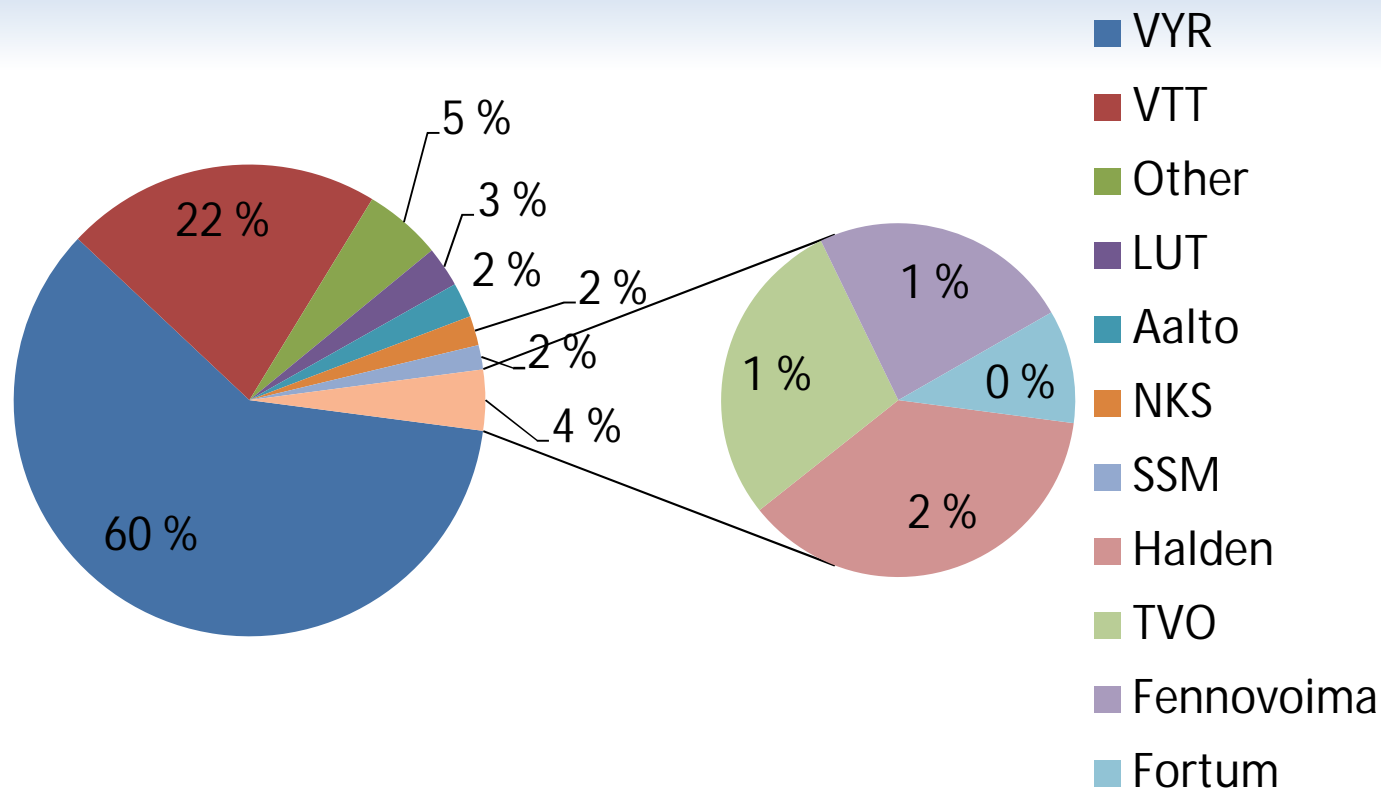
- Experimental and computational methods for ensuring the safety requirements
- Thermal-hydraulic problems, CFD methods
- Reactor core safety analyses
- Fuel behaviour studies, reactor dynamics
- Severe accidents and fission product transport
- Uncertainty and sensitivity analyses.



Structural safety and materials

- Support of the long-term and reliable use of nuclear power plants
- Integrity of barriers and material issues
- Aging phenomena of structures and equipment
- Experimental and numerical methods for external event assessment
- Fire risk evaluation.

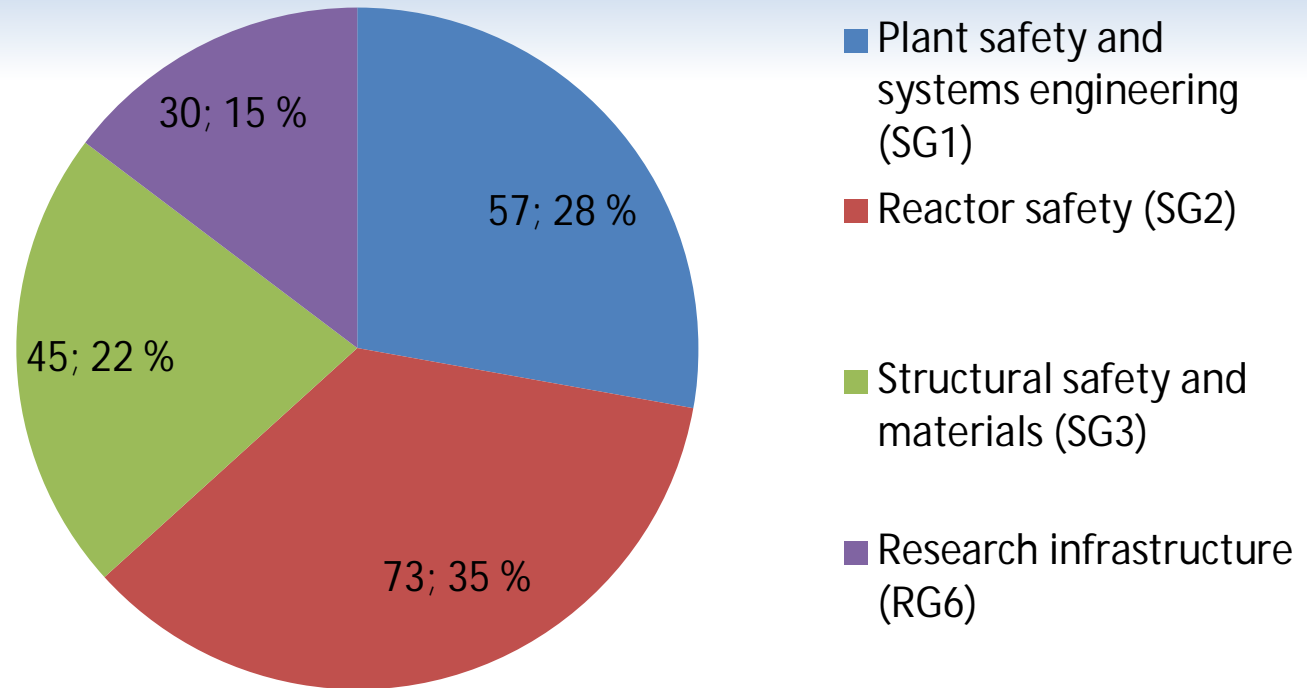
SAFIR2018 Total research funding in 2015-2018 was 29,6 M€



The main funding organisations were the Finnish State Nuclear Waste Management Fund (VYR) with 17,7 M€ and VTT with 6,4 M€.

In addition, VTT Centre for Nuclear Safety equipment and laboratory were funded by SAFIR2018 and KYT2018, which increases the total funding to 46,4 M€.

SAFIR2018 – 209 person years in 2015-2018



The research work in 32 projects was guided by six reference groups (in 2018):

- RG1 Automation, organisation and human factors (SG1; 5 projects)
- RG2 Severe accidents and risk analysis (SG1, SG2, SG3; 7 projects)
- RG3 Reactor and fuel (SG2; 5 projects)
- RG4 Thermal hydraulics (SG2; 4 projects)
- RG5 Structural integrity (SG3; 7 projects)
- RG6 Research infrastructure (4 projects)

SAFIR2018 Results statistics

The projects of the programme have produced 1095 publications and other reports during 2015-2018:

- 166 scientific journal articles (0,81 per person year)
- 236 conference articles
- 453 research reports (SAFIR2018 research organisations)
- 240 other publications (theses, reports of other organisations, other)

44 higher academic degrees were obtained in the research projects:

- 18 Doctors
- 26 Master's degrees.

SAFIR2018 Impact on Nuclear Safety – 1(2)

The impact of SAFIR2018 was followed by several indicators. As part, a questionnaire was made for end users and research partners in 2019.

End users (STUK, Fennovoima, Fortum, TVO):

Has there been a need for expertise from research organisations or universities during 2017-2018?

YES, in several occasions, ... has needed and used this competence, SAFIR2018 has created valuable competence in ...

In which technical areas?

Mechanical and material area, loading and stress calculations, safety culture and leadership, weather, seismic, I&C, reactor transient behaviour, thermal-hydraulic safety analyses, fuel behaviour in normal operation and accidents, safety analysis of concrete structures and containment, fire safety of cables, quality management, competence and resource management, human factors, atmospheric dispersion, ...

SAFIR2018 Impact on Nuclear Safety – 2(2)

Has such expertise been available?

Mostly YES, generally YES, ...

Has there been a lack of experts in some specified area?

Generally NO, in a couple of specific areas YES

Other comments?

Difficulties related to the change of generation of researchers, more topical issues for the power companies, knowhow and experience gained during SAFIR2018 is of great importance, ... and many other comments.

The results and the suggestions for improvement will be taken into account in the new programme SAFIR2022 that started in the beginning of 2019:

<http://safir2022.vtt.fi/>

Seminar practicalities

Posters are in the 1st floor Tetra during the coffee breaks and poster sessions.

Coffee and tea are served in Tetra and also outside it.

The presenters of the posters will be present according to the programme.

Welcome to the seminar dinner today after the panel discussion.