

# SAFIR2014

## The Finnish National Nuclear Power Plant Safety Research Programme 2011-2014



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<http://safir2014.vtt.fi>

### High-quality applied research and education of experts for nuclear power plant safety

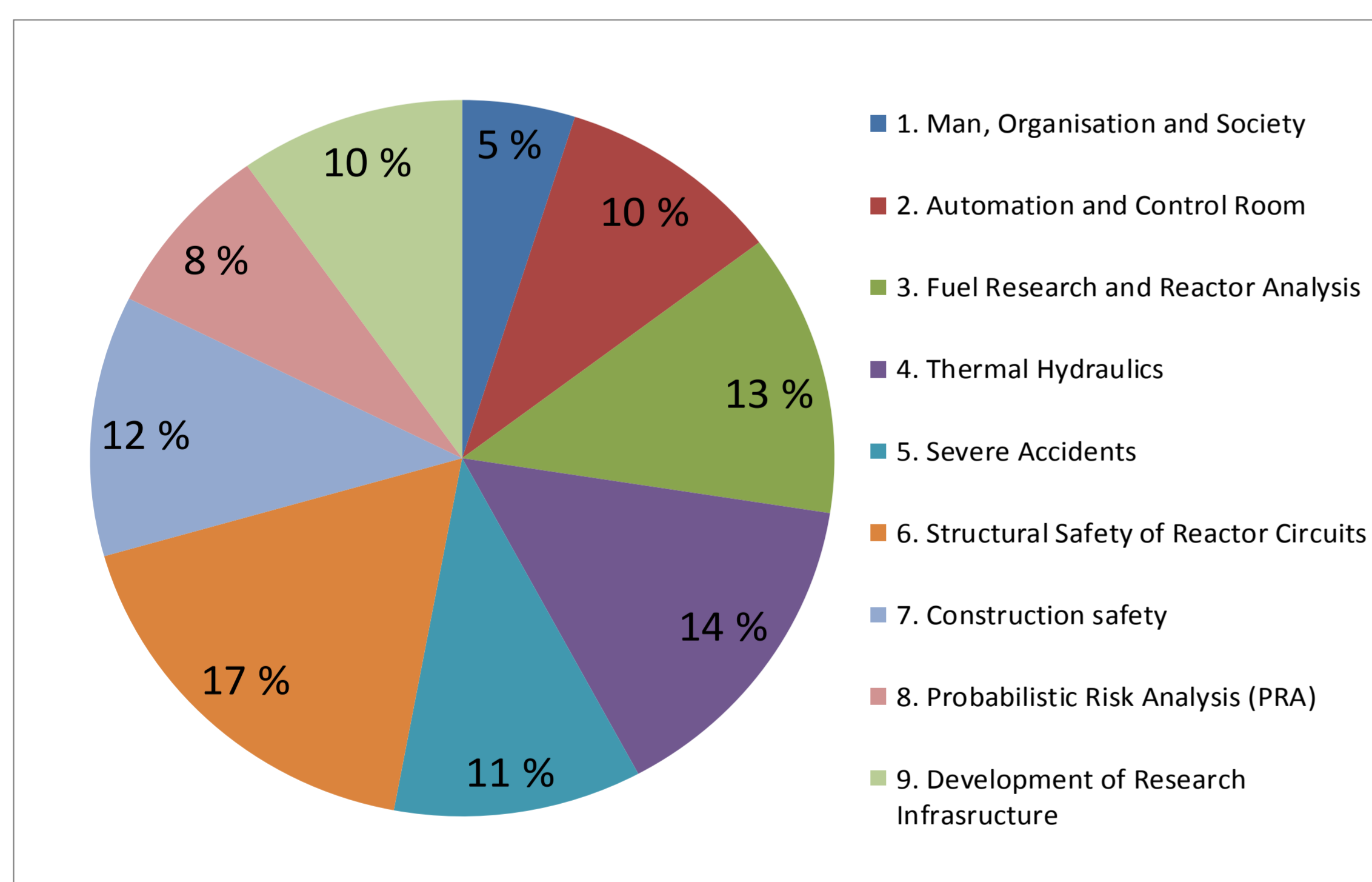
SAFIR2014 is a 4-year national technical and scientific research programme on the safety of nuclear power plants. The objective is derived from the chapter 7a "Ensuring expertise" of the Finnish Nuclear Energy Act. The programme is continuation to a series of earlier government-led nuclear safety research programmes.

The objective of the SAFIR2014 research programme is to develop and maintain experimental research capability, as well as the safety assessment methods and nuclear safety expertise of Finnish nuclear power plants, in order that, should new matters related to nuclear safety arise, their significance can be assessed without delay.

The annual volume of the programme is about 10 M€ and nearly 70 person years. Main funding organisations are the State Nuclear Waste Management Fund VYR with over 5 M€ and VTT with nearly 3 M€.

### Research areas

SAFIR2014 research programme is divided into nine areas. The distribution of funding in 2012 in research areas is following:



In 2012, research is carried out in 42 projects. VTT is the responsible research organisation in 35 of these projects. Other responsible organisations are Lappeenranta University of Technology, Aalto University and the Finnish Meteorological Institute. The projects aim both at high-quality applied research and developing and maintaining basic know-how.

### Research projects in 2012

#### Man, organisation and society

- Managing safety culture throughout the lifecycle of nuclear plants
- Sustainable and future oriented expertise

#### Automation and control room

- Coverage and rationality of the software I&C safety assurance
- Human-automation collaboration in incident and accident situations
- Safety evaluation and reliability analysis of nuclear automation
- Safety requirements specification and management in nuclear power plants

#### Fuel research and reactor analysis

- Criticality safety and transport methods in reactor analysis
- Three-dimensional reactor analyses
- Development of Finnish Monte Carlo reactor physics code
- Neutronics, nuclear fuel and burnup
- Extensive fuel modelling
- Radionuclide source term analysis

#### Thermal hydraulics

- Enhancement of safety evaluation tools
- Experimental studies on containment phenomena
- OpenFOAM CFD-solver for nuclear safety related flow simulations
- Numerical modelling of condensation pool
- Improvement of PACTEL facility simulation environment
- PWR PACTEL experiments
- Modelling of pressure transients in steam generators
- Uncertainty evaluation for best estimate analyses

#### Severe accidents

- Core debris coolability and environmental consequence analysis
- Chemistry of fission products
- Thermal hydraulics of severe accidents
- Transport and chemistry of fission products
- Reactor vessel failures, vapour explosions and spent fuel pool accidents

#### Structural safety of reactor circuits

- Environmental influence on cracking susceptibility and ageing of nuclear materials
- Fracture assessment of reactor circuit
- Monitoring of the structural integrity of materials and components in reactor circuit
- RI-ISI analyses and inspection reliability of piping systems
- Advanced surveillance technique and embrittlement modelling
- Water chemistry and plant operating reliability
- Fatigue affected by residual stresses, environment and thermal fluctuations

#### Construction safety

- Impact 2014
- Aging management of concrete structures in nuclear power plants
- Structural mechanics analyses of soft and hard missiles
- Seismic safety of nuclear power plants. Targets for research and education

#### Probabilistic Risk Analysis (PRA)

- Extreme weather and nuclear power plants
- Risk assessment of large fire loads
- PRA development and application
- FinPSA knowledge transfer

#### Development of research infrastructure

- Enhancement of Lappeenranta instrumentation of nuclear safety experiments
- Renewal of hot cell infrastructure

### International co-operation

Nearly all projects take part in international co-operation. Finland participates through SAFIR2014 in OCD/NEA experimental projects BIP-2, PKL-2, PRISME, ROSA-2, SCIP-2, SERENA-2, SETH-2, THAI-2 and Halden projects, and several OECD/NEA database projects. Nordic co-operation is organised through e.g. NKS and NORTHNET. Projects also have direct co-operation with utilities, safety authorities, universities and research organisations abroad.

