



Strål
säkerhets
myndigheten

Swedish Radiation Safety Authority

NORDIC

P
S
A

GROUP

SSM funding of R&D activities related to Probabilistic Safety Assessment – Nordic PSA Group NPSAG

SSM Strålsäkerhetsdagar 6-7 november 2019

Per Hellström, SSM (Swedish Radiation Safety Authority), Sweden



Presentation outline

- ➔ Funding overview
- ➔ What is NPSAG?
- ➔ NPSAG Roadmap
- ➔ Examples of recent and ongoing R&D activities



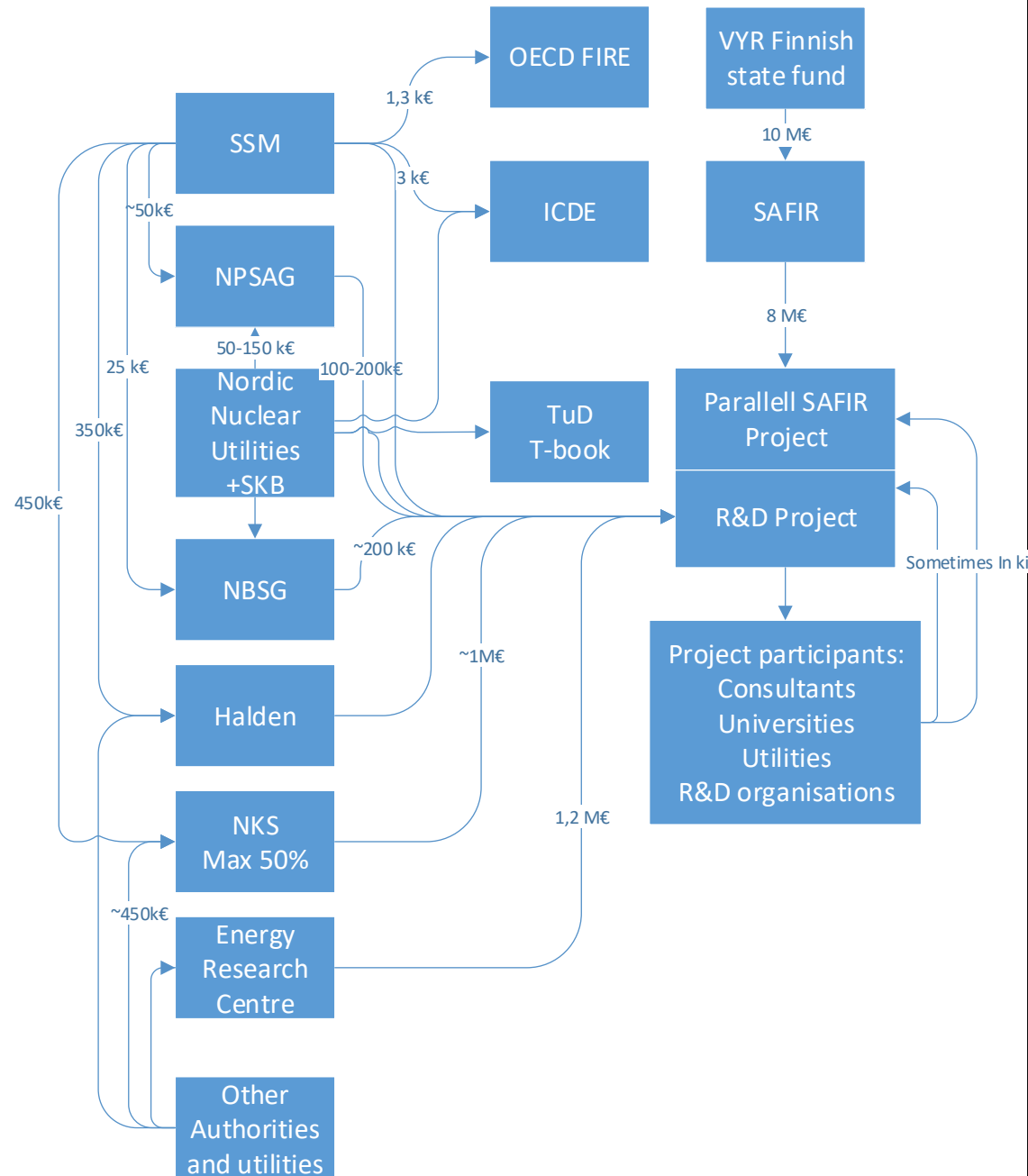
Overview of funding structure

Shows the funding flow from various R&D budgets to the different R&D projects

Rather complex with many stakeholders.

Many projects are co-funded by two or more sources

Many co-operation projects





NPSAG – Nordic PSA Group

- Founded December 2000
- A common forum for discussion of issues related to probabilistic safety assessment (PSA) of nuclear power plants, with focus on research and development needs
- Follows and discusses current issues related to PSA nationally and internationally, as well as PSA activities at the participating utilities.
- Initiates and co-ordinates research and development activities and discusses how new knowledge shall be used.
- Some facts:
 - Project portfolio varies from year to year, nowadays approximately 0,15 – 0,5 M€ - + in kind contributions
 - Full members: Forsmark, Ringhals, Oskarshamn, Olkiluoto and Fennovoima
 - Associate members: STUK, SSM and SKB

 - Maintains a roadmap
 - Meetings about three times a year
 - Organizes a yearly seminar and “Castle” meetings ~ every second year, 2019 the theme was uncertainty
 - Annual report
- WWW.NPSAG.ORG – General information, statutes, projects, reports. General information and many final reports public. Detailed project information restricted.



NPSAG Roadmap

- ➔ NPSAG Roadmap is a separate document providing basis for R&D priorities.
 - Where necessary go for more realism (supporting use of risk information)
 - Removing unnecessary conservatism, and better handling of uncertainties including conservatisms - identify, describe and communicate.
 - Improve the efficiency in PSA management including model development, review, calculations, PSA applications and the interpretation, documentation and communication of results.



NPSAG R&D scope

Modelling and data

Initiating events (internal and external hazards)
Success criteria
Sequence analysis
Systems analysis
Human reliability
Dependencies
Data
Quantification
Interpretation and presentation of results

PSA Quality

Scope, quality, documentation and other general issues

Applications

Applications



NPSAG Project Examples

Project	Status
Level 3 PSA	Started 2014, completed 2016
TuD – T-book	Ongoing activity
ICDE	Ongoing activity
SITRON – Site risk methods	Completed 2018
HRA dependencies	Completed 2016
HRA errors of commission	Completed 2018
Simplified seismic methods	Completed 2017
PROSAFE	2019-2020



Tud Office – T-book

- TUD office funded by utilities and development work co-ordinated via NPSAG
 - TUD database was started already in the middle of the seventies

- Provides up to date reliability data for use in the probabilistic analyses performed by the utilities.

- Main delivery – T-book
 - Current version 8 issued 2015
 - First edition issued in 1982
 - New version in start-up phase



ICDE – International Common Cause Data Exchange

- ICDE Project initiated by several countries in 1994.
- Since 1997 operated within the OECD NEA framework (4-year periods)
- Objective is to collect and exchange common-cause failure events
 - Basis for improving CCF modelling and quantification.
 - Basis for understanding CCF mechanisms and improving CCF defences
 - Data combined from several countries results in sufficient data for more rigorous analyses than country by country data



Some ICDE data

- ➔ Participating countries (9)
 - Canada, Finland, France, Germany, Japan, Sweden, Switzerland, the Netherlands and the United States

- ➔ Total ICDE budget ~1,4 MSEK per year
 - > about 160 kSEK for Sweden with even split on SSM, RAB, FKA and OKG

- ➔ Events cover different types of NPPs and more than 50% of all NPP units worldwide.

- ➔ Latest status report - 1637 reported events in ICDE



SITRON - Site Risk of Nuclear Installations

- Objective was to search for practical approaches for Nordic utilities to assess the site level risk based on the assumption that unit-specific PSAs are used as far as possible.
- The additional efforts needed to obtain a site level risk assessment practically means two tasks:
 - 1) to identify relevant inter-unit dependences, and
 - 2) to quantify the site level risk.
- Inter-unit dependences
 - Multi-unit initiating events, shared systems, structures and components, dependences in human actions, inter-unit common cause failures, and plant operating state combinations.
- SITRON provides guidance
 - how to perform the identification of dependences and how to select relevant dependences for quantification (screening).
- Conclusion is that quantification of site risk can be performed quite straightforward, given that the quality of the single-unit PSAs is sufficient.
- Site or multi-unit, multi-source assessment also hot topic for IAEA and NEA with several completed or ongoing activities

PROSAFE, a two year project 2019-2020

- Objective to improve the quality of safety assessment methods with respect
 - to safe and stable state definition,
 - assessment of extended (in time) scenarios, including human reliability analysis in such cases,
 - credit for repair and modelling different time windows.
- Literature review and questionnaire – main work in 2019
- Methods
 - HRA – how to account for available time
 - PSA – In which way can/should PSA be adjusted to account for safe state definition
- Pilot studies



Some important outputs from NPSAG activities

- SKI 2002:27 Guidance for External Events Analysis
- SKI 2004:04 Dependency Defence and Dependency Analysis Guidance
- SSM 2009:07 Dependency Analysis Guidance Nordic/German Working Group on Common Cause Failure analysis - Phase 2, Development of Harmonized Approach and Applications for Common Cause Failure Quantification
- VTT-R-11463-08 Methods for risk follow-up and handling of CCF events in PSA applications
- 2010:16 Guidance to Risk-Informed Evaluation of Technical Specifications using PSA
- 2010:35 Probabilistic Safety Goals for Nuclear Power Plants; Phases 2-4 / Final Report
- 2010:36 Guidance for the Definition and Application of Probabilistic Safety Criteria
- NKS419 SITE Risk Of Nuclear installations (SITRON)
- EXAM-HRA: Application guide, A Practical Guide to HRA and HRA Final Summary Report
- NPSAG 29-001:11 Level 3 PSA Guidance for Nordic Conditions



Main Conclusions

- Co-financing and co-operation with utilities provides for:
 - Active co-operation within the group
 - Active participation in many projects
 - Combined resources become cost effective for each organization
 - Often, results become implemented within a relatively short time.