

Overview of the NKS-R and NKS-B programs

Christian Linde – NKS-R
Kasper G. Andersson – NKS-B

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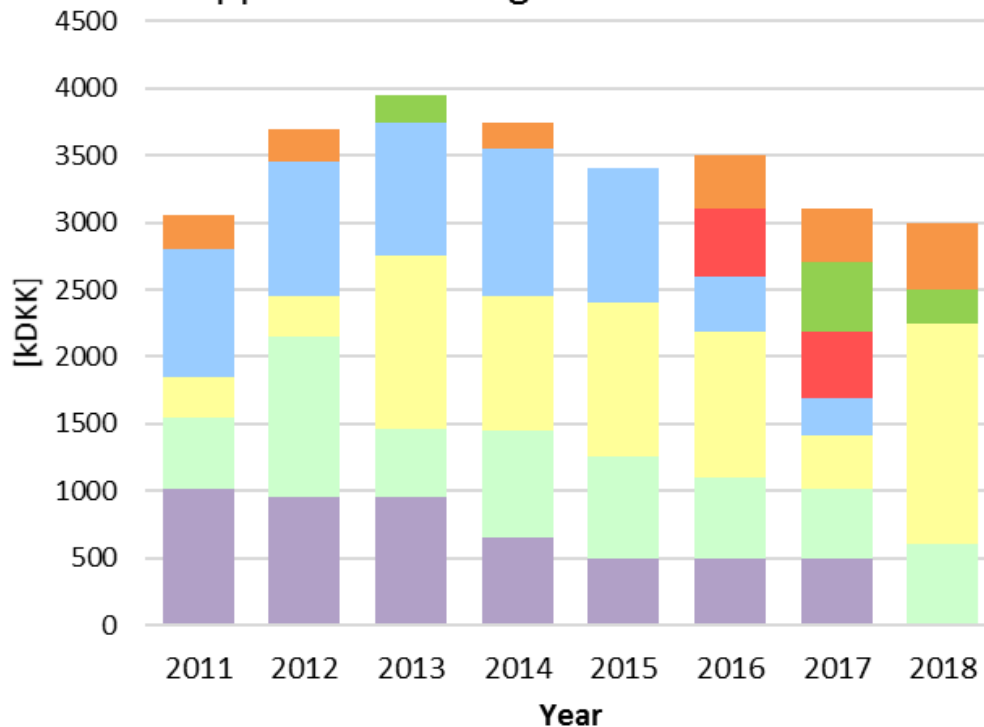
Aims of the NKS-R and NKS-B programs

The main aims of both the NKS-R and NKS-B programs are:

- To maintain and strengthen Nordic competence in the areas of nuclear safety and research
- To develop close informal networks between scientists, workers and end-users from the relevant Nordic authorities, organizations, industries and university departments that are concerned with the various aspects of nuclear safety and research.

NKS-R Funding 2011-2018

Approved funding - research areas



Annual funding ca 3.5 M DKK

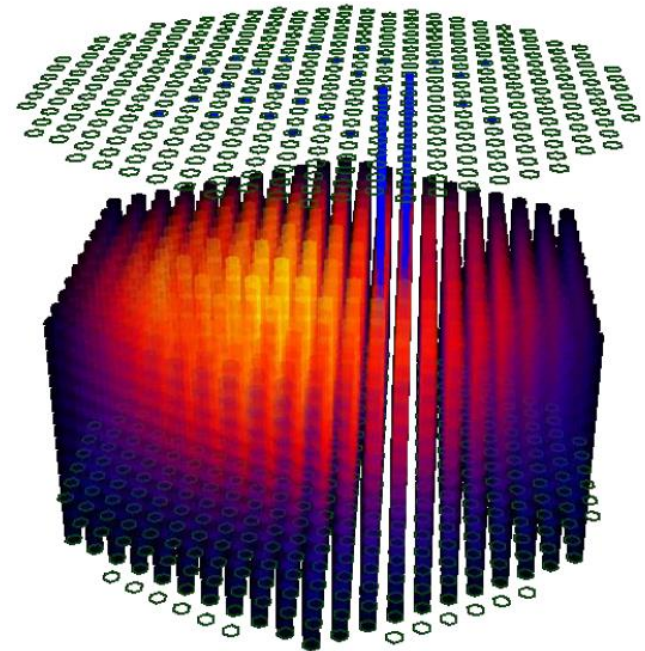


HYBRID – *Development of hybrid neutron transport methods and data visualization tools (2016-17)*

Modelling development - To combine:

- probabilistic (Monte Carlo) approach, which relies on tracking the individual lives of neutrons, and requires large computing power
- deterministic approach, which solves the problem in an approximate manner, but is based upon fast running algorithms.

Activity leader: Christophe Demazière (Chalmers)
William Beere (IFE Halden)



COPSAR - *Containment Pressure Suppression Systems Analysis for Boiling Water Reactors*

Activity leader: Markku Puustinen (LUT)

- Lappeenranta University of Technology (LUT)
- VTT Technical Research Centre of Finland
- KTH - Kungliga Tekniska Högskolan

Experiments on safety relief spargers, nozzles, blowdown pipes and a containment spray system at the PPOOLEX facility at LUT.

Modelling work at KTH (GOTHIC) and VTT (CFD)

11 NKS-reports available from COPSAR (2015-17)

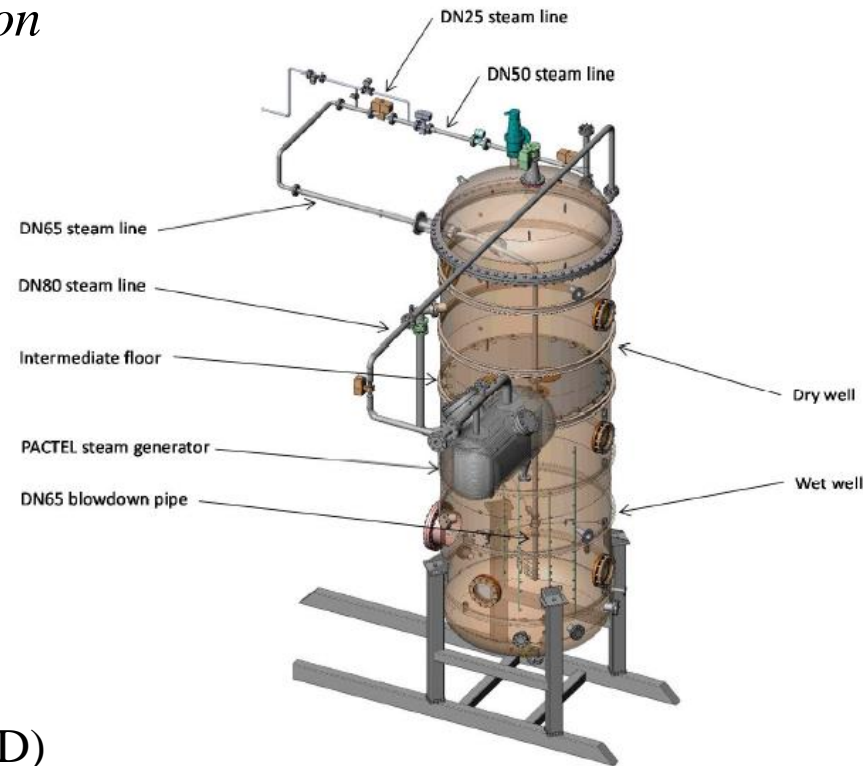


Figure 1. PPOOLEX test vessel.

NKS-R – Severe Accidents

SPARC - *Scenarios and Phenomena Affecting Risk of Containment Failure and Release Characteristics* [KTH, VTT, LRC (2016-18)] – Weimin Ma (KTH)

DECOSE - *Debris Coolability and Steam Explosion*
[KTH, VTT (2012-15)]

ATR - *Impact of Aerosols on the Transport of Ruthenium...* [CTH, VTT (2014-15)]

AIAS - *Adsorption of Iodine Oxide Aerosols on Surfaces* [CTH, VTT (2011-12)]

RASTEP - *Rapid Source Term Prediction*
[Scandpower (LRC), IFE (2011-12)]
Anders Riber Marklund (LRC)

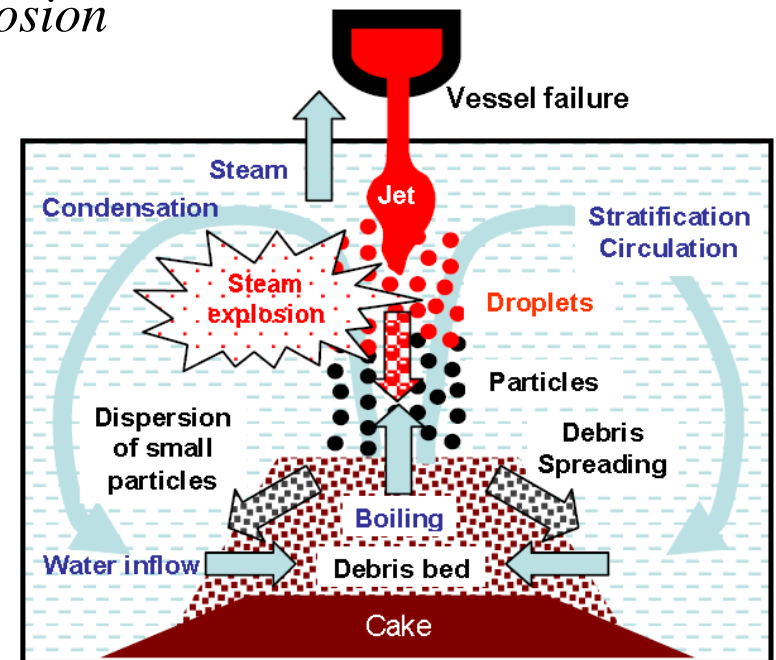


Figure 2.1. Severe accident phenomena in Nordic BWR.

Source: NKS-R SPARC report 2017 (NKS-395)

SITRON - *Site Risk of Nuclear Installations*

[Risk pilot (Fi), LRC, VTT, IFE (2018)] – Jan-Erik Holmberg (Risk Pilot)

FIREBAN - *Determination of fire barriers' reliability for fire risk assessment in NPP*

[LU, VTT, AAU, DBI, RAB (2016-18)] – Patrick van Hees (Lund U)

SYNTAGMA - *Synthetic Ground Motions to Support the Fennoscandian GMPEs*

[VTT, UU, GEUS, Clay Technology AB (2018)] – Ludovic Fülöp (VTT)

Poster: *Synthetic Ground Motions to Support the Near-field Seismic Hazard*

Prediction in Fennoscandia - Vilho Jussila (VTT) et al.

ADdGROUND, L3PSA, MODIG, DPSA, DIGREL, EXAM HRA, POOLFIRE

SC_AIM - *Safety culture assurance and improvement methods in complex projects*
[VTT, KTH (2016-17)] – Teemu Reiman/Kaupo Viitanen (VTT)

PLANS	<i>Planning Safety Demonstration</i>	2015
LESUN	<i>Learning from Successes in Nuclear Power Plant Operation to Enhance Organisational Resilience</i>	2015
ProCom	<i>Measuring Procedure Competence</i>	2014
HUMAX	<i>Maximizing Human Performance in Maintenance</i>	2013-14
SADE	<i>Safety Culture in Design and Implementation of Technological and Organizational Solutions - Improving Resilience of the Sociotechnical System throughout the Life-cycle</i>	2011-13
MoReMO	<i>Modelling Resilience for Maintenance and Outage</i>	2011-12

BREDA-RPV - *Barsebäck as Research and Development Platform, Extraction and Analysis of Reactor Pressure Vessel Material*

[KTH, VTT, CTH (2016 and 2018)] – Pål Efsing (KTH)/Ulla Ehrnsten (VTT)

NORDEC - *Challenges and Opportunities for Improving Nordic Nuclear Decommissioning* – István Szöke (IFE)

[IFE, NRPA, SSM, STUK, SIS, VTT, Vattenfall, Fortum, ÅF (2017-18)]

WRANC - *Warm Pre-Stressing – Validation of the Relevance of the Main Mechanisms behind Warm Pre-Stressing in Assessment of Nuclear Components*

[KTH, Inspecta, SINTEF (2017)] – Tobias Bolinder (KIWA-Inspecta)

DecomSem - Decommissioning seminars (2010 and 2013)

[IFE, NRPA, Dansk Dekommissionering, Ndcon, Fortum]

NKS-B Program: work areas and funding

Three program areas:

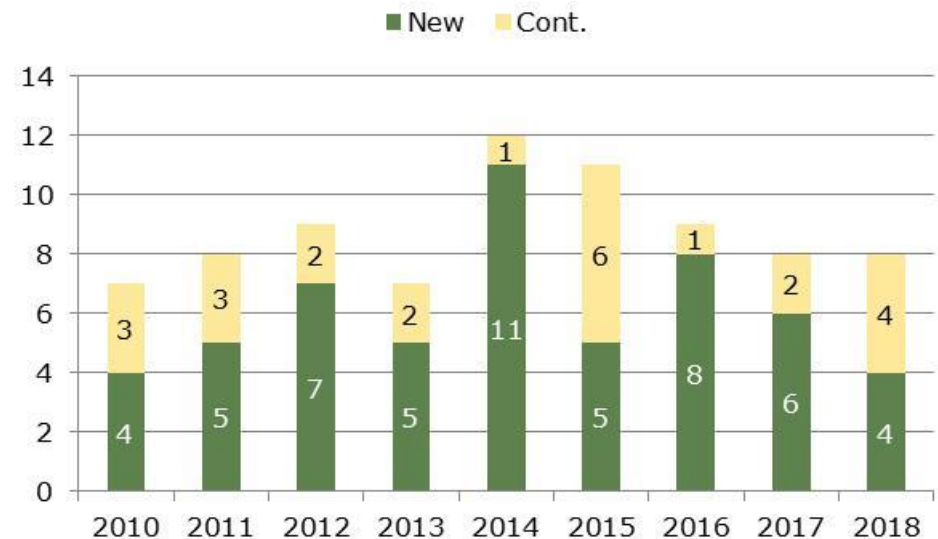
E: Emergency Preparedness
(Radiological and Nuclear)

**M: Measurement Strategies,
Technologies and Quality
Assurance**

**R: Radioecology and
Environmental Assessments**

(often difficult to distinguish
from each other)

NKS-B: Funded activities in Cfp 2010-18



Average funding per year: in
the region of 3.5 MDKK

NKS-B Program: selected activities (E)

MUD - *Meteorological Uncertainty of atmospheric Dispersion model results (long range)* [DMI, NMI, DTU, SSM, DEMA (2012-13)]

FAUNA - *Fukushima Accident: UNcertainty of Atmospheric dispersion modelling* [DMI, NMI, DTU, SSM, DEMA (2014-15)]

MESO - *MEteorological uncertainty of ShOrt-range dispersion* [DMI, NRPA, DTU, SSM, DEMA (2016)] – Steen Hoe (DEMA)

AVESOME - *Added Value of uncertainty Estimates of SOurce term and Meteorology* [DMI, NMI, FOI, PDC-ARGOS, DTU, SSM, DEMA (2017-18)]
– Jens Havskov Sørensen (DMI)

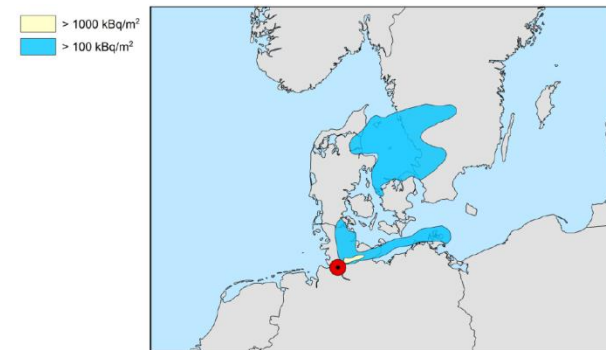
EPHSOGAM - *Early Phase Source Term Estimation From Gamma Spectra (a virtual exercise based on simulation)* [NRPA, STUK, DEMA, NMI, SSM, IRSA (2017)] – Mark Dowdall (NRPA)

NKS-B Program: selected activities (E)

MOMORC - *Mobile search of material out of regulatory control (MORC) – Detection limits assessed by field experiments* [Lund U., DEMA, STUK, IRSA, NRPA, Geo Survey of Norway, SSM (2016)]

AUTOMORC - *Improvement of automatic methods for identification of radioactive material out of regulatory control (MORC) by mobile gamma spectrometric search experiments* [Lund U., DEMA, STUK, IRSA, NRPA, Geo Survey of Norway, SSM (2017-18)] – Robert Finck (Lund U.)

NORCON - *Nordic Nuclear Accident Consequence Analysis (NPP accident consequence estimation exercise)*
[NRPA, IRSA, DEMA, Vattenfall, SSM (2014-15)]



NORCON Cs-137 deposition prognosis (NRPA)

NKS-B Program: selected activities (M)

MOBELRAD (2014) and **GAMFAC** (2015): Measurement exercises in the Belarussian Chernobyl exclusion zone. Field work collaboration experience [NRPA, FOI, DEMA, SSM, IRSA, Lund U.]

SEMUNARS (2015), **NORDUM** (2016) and **NEXUS** (2017): Examination of status and needs for Nordic drone measurements, and field exercises in natural and urban land areas. Experiences with different platforms and detectors. [Linköping U, STUK, NRPA, FDRA, U. Oulu, DEMA, Lund U.]

RAPID-TECH (2014-15): Automated use of radiochemistry techniques to reduce response time following a contaminating incident. Many potential uses including emergency preparedness. [DTU, STUK, FOI, IFE, Helsinki U.]

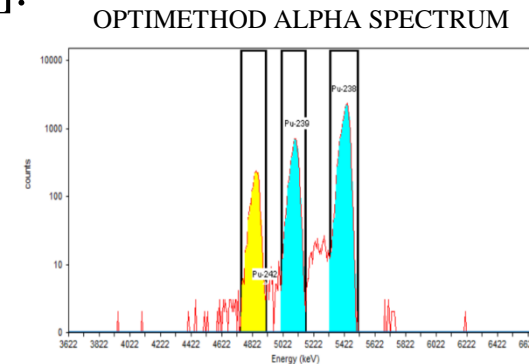
RADWORKSHOP (2018): Seminar, exercise, hands-on tutoring. Methods for radioanalytical chemistry for ‘difficult to measure’ radionuclides in decommissioning and waste management [DTU, STUK, NRPA, SSM] – Jixin Qiao (DTU).

NKS-B Program: selected activities (M)

GAMMARAY (2018): Latest of series of seminars on basic to advanced aspects for users with different backgrounds and needs. High-level experts gave talks [FOI, STUK, IFE, IRSA, DTU].

STANDMETHOD (2014-15): Establishment of Nordic standard radiochemical methods for radionuclides primarily of importance to nuclear industries [DTU, Studsvik, Forsmark, OKG, Rinhals, Loviisa, Olkiluoto].

OPTIMETHOD (2018): Simultaneous determination of isotopes of Pu, Am and Cm in reactor water samples [DTU, Olkiluoto, Chalmers U., SSM; SKB, FOI, Rinhals, Forsmark, Loviisa, OKG, Cyclife, U. Helsinki]



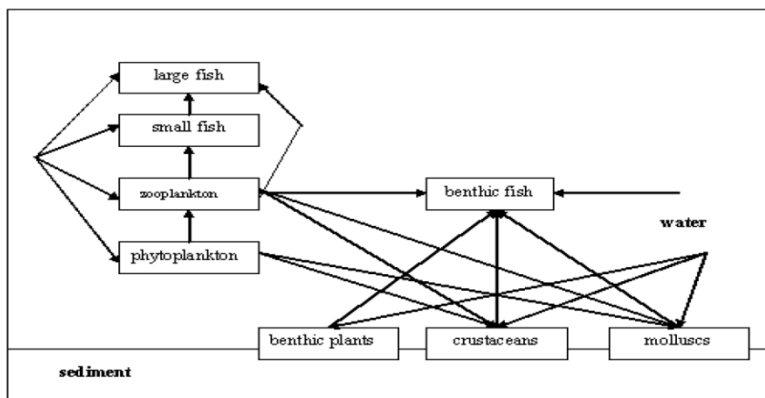
CONCORE (2015-16): Provide common Nordic, scientifically based recommendations for reliable characterisation of NORM contaminated objects. [SIS, DTU, NRP, SSM] – Per Roos (DTU)

NKS-B Program: selected activities (R)

NORCO (2016 + 2018) – *Nordic freshwater ecosystem micro-cosms pilot study* [NMBU, NRPA-CERAD, SU, STUK, UEF] – Tanya Hevrøy (NRPA)

NANOD (2018) - *Natural Radioactivity in Nordic Fish and Shellfish* [NRPA, STUK, DTU, GU, IRSA] – Mari Komperød (NRPA)

EFMARE (2014-16) – *Modelling of dispersion of radionuclides in water and estimation of resulting dose received via consumption of marine food* [NRPA, VTT, DTU, Frodskaparsetur Føroya, U. Gothenburg, U. Iceland, IRSA]



EFMARE: Schematic representation of a biokinetic model used in the work.

Joint NKS-R and NKS-B seminar 2019

For further information on the two NKS programs please refer to the two new journal papers from NKS:

Christian Linde, Kasper G. Andersson, Sigurður M. Magnússon and Finn Physant: Nordic research and development cooperation to strengthen nuclear reactor safety after the Fukushima accident, Nuclear Engineering and Technology, Elsevier (2018).

Kasper G. Andersson, Christian Linde, Sigurður M. Magnússon and Finn Physant: Joint Nordic nuclear research to strengthen nuclear emergency preparedness after the Fukushima accident, Journal of Environmental Radioactivity, Elsevier (2018).

Thank you for your attention!

Don't forget to visit the poster stands !

