Nordic nuclear safety research

Call for Proposals 2026

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Framework programme of the Nordic Nuclear Safety Research Programme (NKS)

1 General aspects

NKS activities are sought and carried out under two broad research programmes. The NKS-R programme focuses on reactor safety and technology, whilst the NKS-B programme covers issues related to e.g. emergency preparedness. New NKS activities are sought under annual call for proposals for each programme and decisions on funding are made by the NKS board. Where an activity proposal contains elements of interest to both the NKS-R and NKS-B programmes, the proposal may be treated as a 'cross-over' activity and treated accordingly as per the discretion of the NKS board. NKS activities only receive funding for 1 year at a time and will typically run from January to December. Where the overall scope of an activity is planned to be carried out over more than one year, additional funding must be sought through the annual call for proposals for each subsequent years work. Typically, a proposal for an NKS activity should include participation from at least two, preferably three, Nordic countries. A participant is an organisation that is included in the list of participants receiving funding in the proposal form. The participation could be in either direct involvement or by using the end results. Where applicable, applicants should consider inviting those Nordic countries that may have an interest in participating in the planned activity. In the certain cases where interest is restricted, a bilateral cooperation may be approved.

2 Objectives of the programme

The main objectives of the NKS programme are the following:

- 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, organisations, industries and university departments that are concerned with the various aspects of nuclear safety and research

Proposals submitted to annual call for proposals for both the NKS-R and NKS-B programmes should primarily address these main objectives. Equally, the technical/scientific and pedagogic merits of each proposal will be considered in the evaluation process, as well as whether the proposal will produce distinct and measurable goals. In addition, it is important that a proposal demonstrates that the output from the activity will be of use to at least one relevant end user group. To ensure a consistently high level of Nordic competence and qualification in the areas of nuclear safety and research in the long run, the involvement of young scientists and workers in NKS activities is actively encouraged. The Nordic universities and technical institutes have an important role in this respect and the active participation of PhD and MSc students will be viewed positively by the NKS board. Proposals should also demonstrate (where applicable) how the planned work builds on results from previous NKS activities and/or national and international research programmes. In this connection, NKS activities can be designed as 'pilot' studies before seeking larger funding from national and international research programmes for continuation of the work funded by NKS.

3 Types of NKS activities and expected output

NKS activities can be knowledge seeking and competence building taking the form of research activities, test exercises and information collation/review exercises or aim to spread and distribute knowledge and results through seminars, workshops and educational/training courses. Whatever the form of the planned activity, a final report will be required at the end of the year's work which will then be published on the NKS website.

3.1 Research activities

Research activities should be based on relevant novel investigations or the development of an area of research towards a Nordic perspective. Final reports for research projects should be produced in line with standards expected for scientific publications. Test exercises can take the form of measurement intercomparisons or activities that test competencies across the Nordic countries. Such activities should seek to address any problems highlighted from the exercise in the final report in order to increase knowledge and competencies where necessary. Information collation and review exercises should be designed to fill knowledge gaps or develop existing methodologies for use within Nordic

countries. Final reports from such activities should be in line with standards expected for research activities.

3.2 Seminars and workshops

Seminars and workshops should aim to develop or build upon existing informal networks and should be preceded by preparation work by participants. Experts from Nordic and/or non-Nordic countries can be invited to address seminars and workshops to provide additional value to these activities. Final reports for such activities should take the form of conference proceedings, containing extended abstracts from each speaker as well as a final overview of any discussions and conclusions. Presentations (slide shows) from such activities can be hosted on the NKS website but should not be included in the final report. Educational and training courses can contain practical and/or theoretical elements and may include exchange visits between organisations and institutes. Such activities are particularly relevant where they are aimed at young scientists and workers. Final reports for educational and training course should contain all course material presented as well as feedback from the participants.

4 NKS-R: NKS programme on reactor safety

Proposals for NKS-R activities (research, seminar and education) should fall into at least one of the following seven main subject areas:

- Thermal hydraulics
- Severe accidents
- Reactor physics
- Risk analysis & probabilistic methods
- Organisational issues and safety culture
- Decommissioning and management of reactor waste and spent fuel (excluding measurements)
- Plant life management and extension

Priority is given to activities in the area of operational reactor safety and to innovations which can be seen as future steps in nuclear technology. Cooperation with national and international research will also be taken into account in assessing activities.

The nuclear industry and authorities have a number of current challenges that are of particular interest under the NKS-R programme. These include safety aspects of the modernisation of old plants, harmonisation of safety requirements and standards, power upgrades, ageing issues, decommissioning and dismantling, waste disposal and new nuclear facilities including next generation plants and small modular reactors.

Activities within NKS-R typically involve experimental and computational studies of phenomena related to reactor safety, model development for risk and uncertainty assessments, analysis of human and organisational factors, or development of new methods for surveillance and enhancement of safety in daily

and long-term reactor operation or within decommissioning and waste management.

4.1 Examples of possible NKS-R activities

The list of examples given below is not comprehensive, and other proposals that can be associated with any of the categories below will be considered in the evaluation process.

Thermal hydraulics

- Thermal hydraulics and CFD-calculations
- Integration of different models

Severe accidents

- Transport and chemical behaviour of radiotoxic elements in severe accident conditions
- Molten corium and concrete interaction

Reactor physics

- Core instability/oscillation phenomena in BWR fuel
- Effects of higher burnup

Risk analysis and probabilistic methods

- Application of PSA for safety evaluation
- Harmonisation of fundamental definitions and concepts within the safety area

Organisational issues and safety culture

- Models and methods for safety reviews
- The safety culture influence on occurred events

Decommissioning and management of reactor waste and spent fuel (excluding measurements)

- Decommissioning and dismantling of research reactors
- Experiences from decommissioning projects

Plant life management and extension

- Thermal or mechanical fatigue
- Radiation damage on the reactor pressure vessel

5 NKS-B: NKS programme on emergency preparedness

Proposals for NKS-B activities (research, seminar and education) should fall into at least one of the following three main subject areas:

- Radiological and nuclear emergency preparedness
- Measurement strategy, technology and quality assurance
- Radioecology and environmental assessments

Emergency preparedness has been a major priority in all the Nordic countries for many years. One of the major challenges is the complexity of the systems and the need to integrate knowledge from many different areas (physics, chemistry, measurement techniques, environmental sciences, radiobiology, information and communication technology etc.). Continuous development and improvement is necessary and existing knowledge and tools must be made and kept operational. It will be important in the years ahead to build upon lessons learned from the experience gained following the demands of and response to the Fukushima accident both within and between the Nordic countries. The emergency preparedness in the Nordic areas, as well as in other countries, rests heavily on the experiences harvested after the Chernobyl accident, but the Fukushima accident has highlighted the need for complementary datasets and incorporation of more case specific considerations. Also, a revision of the perception of possible dose pathways and the duration of the emergency phase versus the recovery phase following a large nuclear power plant accident is necessary.

In addition to the threats from potential nuclear accidents, threats related to the possibility of malicious uses of radioactive or nuclear substances and even use of nuclear weapons are now seen as a major concern which can require specialized competence regarding, e.g., examination of operational emergency response systems to ensure adequate contextualisation to the nature of these novel types of threats, as well as special measurement/analysis techniques and radiation protection assessments.

Optimized use of national resources and the potential need for assistance between neighbouring countries is also a challenge. The communication with media and individual members of the public is an other challenge in such situations, and common Nordic views and approaches are important to maintain public confidence. Also methods for handling and mitigating the adverse societal impact of emergencies, and identifying acceptable solutions are important.

Issues related to decommissioning of nuclear installations will require increased attention in years to come. In this process, radioactive waste will be generated and in some cases releases of radioactivity may occur. Measurement and monitoring issues relating to decommissioning waste can be complex and require specialised developments, and are an important part of the NKS-B programme. The research has to a large extent focused on the behaviour of a few important radionuclides. This competence and knowledge must be

maintained and further developed to include a wider range of relevant radionuclides, and characterization of possible source terms is important. Other management issues relating to this waste than measurements and monitoring are dealt with under the NKS-R programme. Further the consequences of naturally occurring radiological matter, and matter with technologically enhanced concentrations of naturally occurring radionuclides are topics that merit further investigations.

Since 2004, uranium prices have increased sharply, leading to a higher interest in uranium prospecting, and also thorium, in several Nordic countries. Mining and milling for uranium and thorium, and also some other metals, give rise to waste rock and tailings with enhanced concentrations of radioactive substances from the natural series, and there is public concern about the radiation safety and environmental contamination. A wide range of monitoring and measurement techniques will be needed for risk assessments in general.

In the past, radiation protection criteria were developed only for humans, and it was assumed that by protecting man, other species would be protected to an acceptable degree. In recent years several problems have been identified with this existing tenet, with the result that systems for protection of flora and fauna, per se, are being developed and tested. Several knowledge gaps relating to this have already been identified, especially with regard to radionuclide uptake, transfer and biological response indicators. Furthermore, there is a need to obtain more experience in the practical application of environmental protection frameworks in typical Nordic environments.

5.1 Examples of possible NKS-B activities

The list of examples given below is not comprehensive, and other proposals that can be associated with any of the categories below will be considered in the evaluation process.

Emergency Preparedness *(in general, as well as specific tools)*

- Nuclear and radioecological emergencies and incidents causing public concern: lessons learned and implications for emergency preparedness
- Potential malicious (terrorist) uses of radioactive substances: security, assessments and emergency response
- Potential warfare use of radiological or nuclear devices: characteristics and emergency response
- Exercises and harmonization of activities
- Dose assessments and biodosimetry
- Countermeasures: effectiveness and practicability
- Information and communication: further development of systems and methods
- Decision support systems: integration of existing knowledge

Measurement Strategy, Technology and Quality Assurance

- Implementation of international standards and regulations in Nordic countries (e.g., foodstuffs, bulk materials)
- Sampling/measurement strategies for contaminated material, - areas, - foodstuffs
- Systems for mobile measurements
- Validation of methods for sampling and preconcentration of radionuclides
- Radionuclide analytical techniques and intercomparisons
- Measurements required in decommissioning and and reactor waste management
- Measurements of naturally occurring radionuclides

Radioecological Assessments

- Transport and ecological transfer of radionuclides in terrestrial environments
- Radioactivity in natural produce and foodstuffs produced in contaminated areas: temporal trends and seasonal effects
- Dose assessments from artificial and natural radionuclides
- Radiation effects in biota: studies of reference ecosystems and reference species for Nordic environments
- Case studies at locations with elevated concentrations of radionuclides
- Marine environments of special importance
- Syntheses of earlier radioecological studies of Nordic interest