DRAFT

NKS(18)3
2018-05-18

Agenda for the board meeting in Copenhagen 28 June 2018

Place:
The Citadel, Kastellet, Kastellet 54, DK-2100 København Ø

Time: 10:00 to 17:00

1 Opening

2 Practical remarks
- Meeting secretary.
- Information from chairman and host.

3 Approval of the agenda

4 Minutes of the last board meeting (Reykjavik 18 January 2018)
- See draft minutes NKS(18)1 dated 2018-02-19.
- Review, discussion and decision.

5 Accounts 2017
- See distributed material: Financial Statements 2017, NKS(18)2 and Long-Form Audit Report, both dated 2018-06-28.
- Presentation by the auditor and the secretariat, discussion and decision.

6 Financial status for the current year
- See distributed material: Financial status report and financial programme specification, both dated 2018-06-08.
- Presentation, discussion.

7 News since last board meeting
- Report from the owners' group.
- News from the board members' organisations.
- Administrative news.

8 NKS R and B seminar 2019

- Presentation by the programme managers.
- Discussion, decision.

9 Research activities in 2019

- Call for Proposals.
- Preliminary budget 2019.
- Funding 2019.
- Discussion, decision.

10 NKS in the future

- Introduction by the chairman.
- Follow-up from the January board meeting.
- Presentation, discussion and decision

11 CfP evaluation process

- Introduction by the chairman.
- Action from the January board meeting.
- Presentation, discussion

12 R-part: status

- See material from Christian Linde: status report June 2018.
- Presentation by the programme manager.
- Discussion

13 B-part: status

- See material from Kasper Andersson: status report June 2018.
- Presentation by the programme manager.
- Discussion.

14 NKS articles

- Presentation by the programme managers.
- Discussion, decision.
-

15 Information activities

- The website, NewsLetters, NewsFlashes etc.
- Presentation, discussion.

16 Other issues

- Any other business.

17 Next meeting

- Next meeting will be in Stockholm January 2019.

18 End of meeting

DRAFT
NKS(18)1
2018-02-19

Minutes of the board meeting in Reykjavik 18 January 2018

Present: Sigurður M. Magnússon (Chair, IRSA), Anneli Hällgren (SSM), Charlotte Bro (DEMA), Jorma Aurela (TEM), Ole Harbitz (NRPA), Annelie Bergman (SSM), Astrid Liland (NRPA), Jens-Peter Lynov (DTU), Karin Andgren (Vattenfall), Mette Øhlenschlæger (SIS), Nici Bergroth (Fennovoima), Petri Kinnunen (VTT), Tuuli Pyy (Fortum), Christian Linde (SSM), Kasper Andersson (DTU) and Finn Physant (meeting secretary, FRIT).

Apologies: Atle Valseth (IFE) and Tarja Ikäheimonen (STUK)

1 Opening

The Chair (and host) opened the meeting and welcomed the participants. Regrets had been received from Tarja Ikäheimonen, who is ill. The Chair asked Jorma Aurela to pass on greetings and the best wishes for her recovery from the board. Regrets had also been received from Atle Valseth. Special welcomes were given to Anneli Hällgren as owner and board member (replacing Eva Simic) and Tuuli Pyy from Fortum as an observer. Tuuli Pyy is in the program group for the NKS 2019 seminar that met in connection with the board meeting. The Chair thanked Eva Simic for her contributions to NKS.

2 Practical remarks

Practical remarks about the meeting were given by the Chair. Finn Physant was appointed meeting secretary.

3 Approval of the agenda

The agenda was approved.

4 Minutes of last board meeting (Copenhagen, 8 June 2017)

The minutes were approved. Actions A to C noted in the appendix of the minutes of the last board meeting will be noted in parenthesis in these minutes when handled during this meeting.

5 News since last board meeting

a. Report from the owners' group meeting

The Chair informed about the outcome of the owners meeting on 17 January:

1. The owners had reached a comprehensive agreement on costs for the next three years.
   a. The annual fees of the PC's will be reduced by 50,000 DKK as of this year.
   b. The annual fee of the Chair will be reduced by 50,000 DKK as of this year.
   c. The fee of the Secretariat will be reduced by 2% annually, but no more than 10% total, starting with the new contract for 1 August 2018 – 31 July 2019.
2. The owners agreed to increase the funding of NKS-B by 250,000 DKK in 2018. The reduction in fees (for the PC's, the Chair and the Secretariat) will provide about 160,000 DKK and the rest will come from the reserve. The reserve will then be a little lower than previous years. The role of the reserve is to ensure that NKS can at any time meet financial obligations. The NKS owners are committed to ensure so if the very unlikely situation that the reserve is not sufficient occurs.
3. The owners had agreed that Sigurður will continue as Chair of NKS until the end of 2020.

These agreements provide stability in NKS for the next three years ensuring ample time for a thorough discussion and implementation of NKS future strategy and direction.

b. News from board members' organisations

The members informed each other about relevant news.

d. Administrative news

Finn Physant informed the board that the policy documents "This is NKS" and the folder from 2017 both are updated. A new folder will be published in 2018 shortly before the January 2019 seminar. The "Handbook for NKS applicants and activity leaders" version April 2016 is still valid.

Very positively it was noted that Karin Andgren had contacted SKB (the Swedish Nuclear Fuel and Waste Management Co.) and already before this meeting could announce that SKB for 2018 has signed up as a new NKS co-financier.

The board took note of the administrative news.

6 NKS in the future

The Chair opened this meeting item by thanking for all inputs received concerning the future of NKS (Action C).

Nici Bergroth (as chairman of the WG on the PC activities) presented the report from the WG. He thanked the other participating members: Astrid Liland, Carsten Israelson (DEMA), Emma Palm (SSM) and Karin Andgren – and the Chair and Jorma Aurela as observers. Nici Bergroth then presented the clear conclusions of the WG.

The Chair thanked Nici Bergroth and the workgroup for their work.

Based on the conclusions of the WG and the received inputs over the NKS future by owners and board members the Chair presented the document "Proposals and suggestions from reflections over NKS future directions by owners and board members" dated 17 January 2018. The Chair suggested that this meting item should focus on a thorough discussion of

proposals and suggestions in the document rather than the board members presenting their reflections. The board agreed to this.
All proposals and suggestions concerning policy and content of the NKS program were discussed and conclusions reached. A few will be discussed further at the 2018 June meeting. The document ”Conclusions – NKS Board 18 January” is attached to these minutes as appendix A. - Actions from meeting item 6 are found in the highlighted conclusions in appendix A.

7 Financial status

Finn Physant presented the distributed material: Financial status report and financial programme specification, both dated 18 December 2017. At this date the reserve was estimated to approximately 800,000 DKK - in accordance with last year’s budget decision of 18 January 2017. The Chair concluded that the financial status was as planned. – The board took note of the financial situation.

8 Agreements

The following four agreements were prepared for the board’s decision:
-R-part programme manager 2018 with Strålsäkerhetsmyndigheten
-B-part programme manager 2018 with DTU Nutech
-Secretariat from 1 August 2018 to 31 July 2019 with FRIT and
-Auditing of the accounts for 2017 with Dansk Revision.
All these agreements were approved with the following additional conclusions:
-The presented draft programme manager agreements were both reduced from 510,000 DKK to 460,000 DKK
-The presented draft secretariat agreement was reduced from 675,000 DKK to 660,000 DKK.
-The draft auditing agreement was approved as presented.

9 R-part: status and new activities

Christian Linde made a presentation of the status of the ongoing R-part activities. Overall the work in NKS-R is progressing according to plan. All eight activities started in 2016 and earlier have been completed. During 2017: 14 NKS-R reports have been published on the NKS website (including the revised report from ATR-2015). Of the activities commencing in 2017: six activities are basically progressing on schedule. A delay has been announced by HYBRID. Travel assistance has been granted to one young scientist. One seminar (L3PSA) and one workshop (NORDEC) have been carried out in 2017. Poster presentation and workshop participation were made by FIREBAN in 2017. WRANC made a presentation at ”Kärnteknikdagarna” and the PC’s (NKS-R&B) made a presentation at ”SSM’s Strålsäkerhetsdagar” – also in 2017.

Christian Linde presented the evaluation results and funding recommendations for CfP 2018. NKS-R received 15 proposals this year (5 continued and 10 new proposals), with a total funding request of 8396 kDKK. Three funding alternatives were presented based on the evaluations with a total budget equal to 3000 kDKK. After some discussions, the board favoured one of the funding alternatives in an elaborated form and agreed to fund the following six activities in 2018 (all amounts in kDKK):

BREDA-RPV	500
SPARC	600
FIREBAN	450
SITRON	600
SYNTAGMA	600
NORDEC	250

The total budget for these six activities is 3000 kDKK. The decision meets the funding requests from all activities except NORDEC. For NORDEC the approved funding is intended primarily as support for the workshop/seminar activities that are planned in 2018.

10 B-part: status and new activities

Kasper Andersson presented a status report for ongoing activities. In an overall view the activities are progressing well. There are no delayed activities started before 2017. The activities from 2017 are reported to be carried out on schedule with some acceptable delays. Young scientist travel assistance has been granted to 4 scientists. Both NKS-B seminars/workshops planned in 2017 have been carried out: GAMMASPEC and NORDIC ICP.

Kasper Andersson presented the evaluation results and funding recommendation for CfP 2018 – a total of 17 (of these 4 are continued) proposals were received. The total amount requested was 7915 kDKK from a budget of 3250 kDKK. After some discussion the board agreed to fund the following activities in 2018 (all amounts in kDKK):

AUTOMORC	454
OPTIMETHOD	450
RADWORKSHOP	370
GAMMARAY	362
NORCO II	460
AVESOME	436
RADSHIELD	427
NANOD	291

The total budget for these 8 activities is 3250 kDKK. Especially it was decided that GAMMARAY could not expect automatic funding for the same activity year after year and that NKS does not expect a proposal for a gammaseminar in the 2019 CfP. The PC-B will inform the activity leader about this.

11 Budget for 2018

Finn Physant presented a revised budget compared to the distributed budget proposal of 2 January 2018. This budget was based on the 2 January 2018 budget and revised according to the conclusions of the owners' meeting 17 January 2018. Besides this Nici Bergroth announced that Fennovoima raised their contribution with 750 EUR to a total of 10,750 EUR in 2018. - The budget approved by the board is attached to these minutes in appendix B.

12 NKS articles

Both PC's presented the status of the R and B articles, which both have been commented by the board. The plan is now to submit the articles for publishing in the spring of 2018.
Christian Linde will contact (one or more of) the journals:
-"Progress in Nuclear Energy"
-"Journal of Nuclear Engineering and Radiation Science"
-"Nuclear Enegineering and Technology"
Kasper Andersson has chosen (and had a first positive feed back from) the "Elsevier Journal of Environmental Radioactivity".
Jorma Aurela asked for links to these articles when published on the NKS welcome website. The secretariat will provide these links.
The PC's will report back about the articles to the board at its June meeting (Action A).

13 NKS R and B seminar 2019

The PC's reported about the progress of the seminar planning from the program committee. Key-note speaker Claire Cousins, Chairman of ICRP, had been contacted by the Chair. How to ensure more good speakers was discussed. The possibility of giving poster authors the chance of a short oral presentation was discussed.
Finn Physant presented the coordination group's first draft seminar budget, which was discussed by the board responding with a number of ideas. It was decided that there would be no video documentation of this seminar and it was decided to have a modest reception in the poster area.
The board decided that the seminar should be carried out during 2 days of the week 14-18 January 2019.
Annelie Bergman and Christian Linde will look into the possibility of SSM being formal buyer of the seminar venue on behalf of NKS.
Finn Physant will contact a seminar venue used earlier by NKS for a quotation.
The board supported the direction of the seminar planning as presented by the coordination group. The PCs will organize additional program committee meeting(s) and present an updated and more detailed seminar program at the June board meeting (Action B).

14 Information activities

Finn Physant informed the board about the status of the NKS information activities.
3 NewsFlashes and one NewsLetter have been distributed since the last board meeting including news on the last board meeting, CfP 2018, seminars, reports, young scientist travels etc. There is a list of more than 500 e-mail adresses, to which the electronic letters are sent. A new and updated version of the pamphlet "Nordic Nuclear Safety Research" will be produced in 2018.

15 Other issues

No other issues.

16 Next meeting

Next meeting will be held in Copenhagen (and probably in Kastellet) on 28 June 2018. The owners will meet on 27 June – also in Copenhagen. DEMA will host both these meetings.
There will be a meeting for one hour after the board meeting for evaluators to discuss the evaluation process etc.

17 End of meeting

Thanks for a good meeting were expressed by the Chair.

Sigurður M. Magnússon
Chairman

Finn Physant
Meeting secretary

Appendices:
A: ”Proposals and suggestions from reflections over NKS future directions by owners and board members” dated 17 January 2018 including ”Conclusions – NKS Board 18 January”
B: Budget decision for 2018 dated 18 January
C: Actions from the board meeting

Appendix A **17 January 2018.**

Proposals and suggestions from reflections over NKS future directions by owners and board members.

Conclusions - NKS Board 18 January 2018.

Policy:

Length, number and funding of projects:

DEMA:

- **Fund larger projects**, lasting up to three years. This would, other things equal, reduce the number of projects and thereby administration and would make it possible to fund Ph.D. projects in cooperation with research institutions, a step which could further enhance the quality of NKS' work.

SSM:

- One way of increasing the efficiency and thus use the funds better, could be to **let projects run on a longer term than one year,** thus avoiding some of the administration.

SIS:

- **Reduce the funding for each NKS-project** allowing more projects to receive funding.

VTT

- It might be reasonable to **concentrate on fewer topics** in NKS

Conclusion: *Discussion reflected different views within the NKS Board. PC´s to develop a discussion paper based on the discussion in consultation with the Chair. Draft paper to be circulated to board for comments in good time before June meeting. Decision at June meeting.*

Young researchers:

STUK:

- More emphasis on **participation of young researchers** in projects when funding projects.

SSM:

- Also for giving the networking factor more impact, **we suggest that the criteria of participating young scientists systematically are valued higher.**

VTT:

- NKS could **profile itself more towards young scientists.** The criteria of young scientists should be more clearly stated.

Conclusion: *Discussion reflected good agreement on the importance of active involvement of young scientists in NKS projects. Criteria of young scientists can come in play when ranking of projects is same/very similar i.e. the "yellow category" - fund if possible.*

PC's to see if text in CfP can reflect this importance better. Proposal at June meeting.

Prioritized areas:

DEMA:

- Yearly or every second year each owner gives a short presentation of the main areas in which his or her organization needs additional knowledge. An example could be "How to analyze a NPP accident from fall out measurements". These presentations could serve as **strategic guidelines for projects to be selected for funding**; the possibility for researches to come up with brand new areas should, however, not be ruled out.

Fennovoima:

- **Prioritization of certain research areas/topics** depending on need or on a yearly basis based on input from end users.

Conclusions: *The discussion reflected different views in the Board and that "prioritized areas" are implicit in our evaluation i.e. relevance for end users and mean ranking as well in final ranking. PC´s, in consultation with the Chair, to develop a discussion paper taking into account the discussion at the board meeting. Draft paper to be circulated to board for comments in good time before June meeting.*

Purpose of NKS.

DEMA:

- **Putting the purpose of the NKS a bit more precise**; maybe something along these lines: "to develop new knowledge and/or bringing existing new knowledge into the daily work for enhanced

nuclear safety and emergency management in the Nordic countries and doing so in a cost efficient way"

Conclusion: *for the owners to address.*

Evaluation of projects:

NRPA:

- We suggest to **create a possibility for the evaluators to discuss** their use of the criteria and to "calibrate" against each other.
- We should discuss whether there is **a need for a more strict definition and evaluation process for the decom-projects.** Some of them, and possibly even more in the future, are difficult to decide where to evaluate and finance – R or B?

Conclusion: *Evaluation process should be same for all projects. A one hour meeting between the evaluators together or separately for R and B will be organized in the margins of the June board meeting.*

Visibility of NKS and NKS work

VTT:

- **The reporting and report evaluation and acceptance of the work should be more visible in NKS.** The society does not make the best use of the obtained results at the moment. Highlights and achievements to be more visible. The wanted goals from NKS point of view could be emphasized more.
- **Visibility of NKS in European nuclear forums to be increased.** At the moment NUGENIA, SNETP, OECD NEA etc. are seen everywhere and even linked to each other. NKS is not so visible even if it is strongly linked with e.g. the SAFIR programme (and SAFIR itself is a well-known programme structure in Europe). But **this requires strategic decision from NKS whether we want to put NKS more on the frame or just keep it for ourselves.**

Conclusion: *There is an interest to enhance the visibility of NKS. The Communications group reporting to the chiefs will be asked to develop a draft communication strategy for NKS. Anneli Hällgren will be the contact between NKS board and the group. A few slides on NKS to be developed by PC´s for use at presentations of NKS projects at non NKS events.*

Number of countries participating in a project.

SSM:

- Today, there is a requirement that at least three countries support a project for it to be approved. Exceptions do occur however, when it comes to projects within nuclear safety. **We suggest these exceptions to be removed**, thus ensuring even more profits of networking to NKS and hereby improving the Nordic value.

Conclusion: *Discussion reflected very different views within the board. Exceptions to remain.*

Division between NKS B and NKS R.

VTT:

- **Critical evaluation of the division between NKS-B & -R.** It seems that in the future more and more topics may appear that could fit in either programme. Should the topical division between the programmes to be evaluated and perhaps redirected?

Conclusion: *The discussion confirmed the growing importance of decommissioning and management of radioactive waste. PC´s to develop this issu further before June board meeting.*

Normal scientific review procedures:

DEMA:

- **Use normal scientific review procedures.** In the conclusion of the SSM report from January 2016 it says: "NKS lacks routines for sufficient safeguarding against occasional deficiencies in the quality and/or scientific relevance of projects" and on page 20: "Program managers also review reports, for compliance with public standards, rather than for a full review of technical or scientific quality."

Conclusion: *The NKS board finds that the present evaluation process which is similar to that of EURATOM is appropriate and does not need to be changed.*

A higher priority to new cooperation constellations

SSM:

- New criteria that emphasizes **new cooperation constellations** before constellations which has already received funding is another suggestion.

Conclusion: *The suggestion was discussed. No actions needed.*

Size of the NKS board:

Vattenfall:

- Set **a funding threshold** for the minimum funding that is represented by one board member. Potential benefits from such a threshold is a smaller board and/or an increased funding.

Conclusion: *The suggestion was discussed – no action needed.*

Stop funding participation in projects:

DEMA:

- **Stop funding participation in projects** – if projects are needed in our organizations, we should not be paid to participate in them. Maybe an exception to this could be funding of invited speakers. This could as a positive side effect mean that we could fund an additional number of projects.

Conclusion: *The suggestion was discussed. No action needed.*

Quality assurance:

Vattenfall:

- **One final report per activity** (participating organisations are not allowed to send in separate final reports).

Conclusion: *The PC's will look at the wording of texts for applicants – maybe the CfP's and contracts could reflect this. The PC's will present proposal at the June board meeting.*

Reducing the number of contracts:

DEMA:

- reduce the number of contracts by **issuing contracts with project leaders only.** If the project leaders occasionally need to have others to undertake tasks which require funding (typically persons not employed by

the NKS organizations), the project leaders should have the possibility of paying this within the project budget. This could reduce the administrative costs of NKS considerably and release funds for more projects.

Conclusion: *The number of contracts was discussed. No action needed.*

Content.

Decommissioning and management of radioactive waste:

DTU NUTEC:

- DTU Nutech wishes NKS to continue very much in the same way as today, although some **more activity on decommissioning** could be desired

IFE:

- **Waste management and decommissioning** should be highlighted as a separate area and not as it is today included in both NKS B and NKS R. This means that part of the budget for a new Waste area should be taken from NKS B and NKS R. The size of the budget can be discussed. To ensure a meaningful start it could be on, for example 700 kDDK.

SIS:

- More emphasis on **management of radioactive waste** from non-nuclear energy production

STUK:

- Programmes could be diversified into **waste management** and ***non-proliferation***

Conclusion: *Discussion: requires an in depth discussion and consideration before a decision is made.*

The discussion reflected the increasing importance of these topics.

PC´s to develop further with interested board members and circulate a discussion paper in good time before June meeting.

This paper can possibly be contained in the paper on the division between the NKS B and R programmes.

Safety of research reactors:

IFE:

- **Safety at research reactors** should also be included in NKS R. Several of the projects today are relevant to both research reactors and nuclear power plants, but clarification of this in the mandate may lead to more project proposals.

Conclusion: *To be looked at and possibly made more clear – a proposal from IFE is welcomed.*

New NKS – B area: Research in nuclear applications of nuclear technology:

SIS

- The future NKS-B program would be more robust in the future with a separate "bullet" for research in the medical area. Enlarging and focusing on specific **research in medical applications of nuclear technologies** to become a new NKS-B area has to be financed separately. A model for financing by the medical industry producing nuclear medicines similar to the NKS-model for the nuclear industry could be investigated.

Conclusion: *Proposal supported by the NKS board. SIS to develop further.*

More emphasis on Seminars/workshops.

IFE:

- Seminars are a very good tool in this context (networking) and should be used to a greater extent in the future.

GR:

- Workshops with a specific focus are of particular importance (and could be used to a greater extent in the future.)

Conclusion: *WS´s and Seminars are and will be an important area of NKS cooperation. Proposals for WS's and Seminars will continue to be evaluated in the same way as other proposals.*

Costs.

Proposals and suggestions related to costs were not addressed at the board meeting since the owners had at their meeting on 17 January 2018 reached a comprehensive agreement on costs for the next 3 years as reflected in the minutes of the board meeting (agenda item 5 – report from the owners' meeting).

General:

IFE:

- There should be **a continuous process to reduce administrative costs**. Hence, there should be a new review of these costs to assess whether and how these can be reduced. It is important that most of the available funds are used in research.

NRPA:

- The administrative costs could be analyzed and discussed in more detail to decide whether a **modest reduction is achievable already for the coming year**.

Secretariat

DEMA:

- Continue our efforts to find ways of **reducing the costs of the secretariat**; if nothing else is possible we could – as is being done these years in Danish state administration – we could introduce a 2 % cut each year over the next 4 – 5 years.

NRPA:

- The Secretariat has served NKS in an excellent manner for many years. **The workload could probably be taken care of by one of the Nordic authorities.** NRPA could be a candidate for such a take-over. It is, however, impossible to judge the economic consequences without a thorough analysis. In addition, to decide such an approach only to "hide" costs is unacceptable.

PC´s:

NRPA:

- **The fee (for the PC´s) could, however, be negotiated with the organization** from which the PCs are recruited. Cost reduction might be a possibility when PCs are recruited from authorities´ organizations.

Chair:

DEMA:

- From 2019 make arrangements for **the chairmanship to rotate** between the owners for a period of 2 – 3 years and for **the cost of the chairmanship to be covered by the organization/country of the chairman.**

NRPA:

- In the future, the **fee for the chairperson should be negotiated** with the mother organization (one of the authorities in N, DK, S or F?).

Appendix B - NKS budget for 2018 - decision 18 January 2018

Budgets	Budget for 2018	Budget for 2018	Budget for 2017
	EUR	DKK	DKK
R-part			
Activities	402.960	3.000.000	3.100.000
Fee PC	61.787	460.000	510.000
Travels PC	6.716	50.000	50.000
Coordination/Young scientists' travel	6.716	50.000	50.000
R total	**478.180**	**3.560.000**	**3.710.000**
B-part			
Activities	436.540	3.250.000	3.100.000
Fee PC	61.787	460.000	510.000
Travels PC	6.716	50.000	50.000
Coordination/Young scientists' travel	6.716	50.000	50.000
B total	**511.760**	**3.810.000**	**3.710.000**
Seminar 2019			
Seminar 2019	13.432	100.000	0
Seminar 2016 total	**13.432**	**100.000**	**0**
Common			
Common various according to specification	26.864	200.000	200.000
Common total	**26.864**	**200.000**	**200.000**
Others			
Fee Secretariat	89.827	668.750	675.000
Fee Chairman incl. travels	57.758	430.000	480.000
Travels Secretariat	2.015	15.000	10.000
Others total	**149.599**	**1.113.750**	**1.165.000**
TOTAL	**1.179.835**	**8.783.750**	**8.785.000**
Expected incomes according to app. 1	**1.092.477**	**8.133.380**	**8.190.086**
Surplus	**-87.358**	**-650.370**	**-594.914**

Any deficits to be covered by the reserve available for the board, which according to the financial status report of 18 December 2017 is ca.:	807.686,00
Proposed budget for 2018	-650.370,48
Present reserve and surplus	157.315,52
Funding reserved for use in 2017, but not used, will amount to ca.:	160.000,00
Gain/Loss due to the development in exchange rates 2017-2018 ca.:	-190.000,00
Old reservations from before 2015, not claimed, amount to:	605.041,00
Total reserve end of January 2018: ca. DKK:	**732.356,52**
Total reserve end of January 2018: ca. EUR:	**98.370,23**

Specification of ”Common" for 2018

	2018	2018	2017
	EUR	DKK	DKK
Common			
Reports, materials etc.	2.519	18.750	26.250
Postage, fees	1.343	10.000	7.500
Equipment	0	0	5.000
Internet	9.402	70.000	70.000
Auditing, consulting	8.227	61.250	61.250
Information material	2.686	20.000	20.000
Various expenses	2.686	20.000	10.000
Common total	**26.864**	**200.000**	**200.000**

Appendix 1 for budget decision for 2018

Pledge for funding in 2018 - Incomes

	Proposal for 2018	Proposal for 2018	Actual for 2017
	EUR	DKK	DKK
SSM	462.218	3.441.165	3.541.265
TEM	350.000	2.605.715	2.602.040
BRS	50.370	375.000	375.000
GR	24.000	178.678	178.426
NRPA	81.301	605.280	654.560
Total EUR / DKK	**967.889**	**7.205.838**	**7.351.291**
SSM contribution SEK	4.550.000		
NRPA contribution NOK	800.000		
BRS contribution DKK	375.000		

	EUR	DKK	DKK
Fortum	27.000	201.012	195.153
TVO	27.000	201.012	195.153
Fennovoima	10.750	80.033	74.344
IFE	11.179	83.226	90.002
Forsmark	13.000	96.784	97.762
Ringhals	12.500	93.061	89.213
OKG	13.000	96.784	97.168
SKB	10.159	75.630	0
Total EUR / DKK	**124.588**	**927.542**	**838.795**
Complete EUR / DKK	**1.092.477**	**8.133.380**	**8.190.086**
IFE contribution NOK	110000		
SKB contribution SEK	100000		

Exchange rates 2017/18:

NKS 2018:	
DKK	100,0000
EUR	7,4449
NOK	0,7566
SEK	0,7563
NKS 2017:	
SEK 2017	0,7783
EUR 2017	7,4344
NOK 2017	0,8182

Appendix C

Actions from the board meeting
(if nothing else is mentioned to be taken by the coordination group):

A. Ref. item 6: Actions from meeting item 6 are found in the highlighted conclusions in appendix A.
B. Ref. item 10: The PC-B will inform the activity leader about this.
C. Ref. item 12: Jorma Aurela asked for links to these articles when published on the NKS welcome website. The secretariat will provide these links. The PC's will report back about the articles to the board at its June meeting.
D. Ref. item 13: The PC's will organize additional program committee meeting(s) and present an updated and more detailed seminar program at the June board meeting.
E. Ref. item 14: A new and updated version of the pamphlet "Nordic Nuclear Safety Research" will be produced in 2018.

The NKS Secretariat

NKS(18)2
2018-06-28

Financial Statements

for

The Nordic Nuclear Safety Research Programme

Central Business Registration no.:
38 64 98 68

2017

28 June 2018
Finn Physant
FRIT

Statement by Management

The Chairmann, Sigurður M. Magnússon and the NKS Secretariat have considered and approved the Financial Statements of The Nordic Nuclear Safety Research Programme (in the following referred to as 'NKS') for the financial year 1 January 2017 - 31 December 2017.

In our opinion, the Financial Statements provide a true and fair view of the organisation's assets, liabilities and equity, financial position as at 31 December 2017 and the results of the organisation's activities for the financial year 1 January 2017 - 31 December 2017.

In our opinion, the management's review includes a fair description of the issues dealt with in the management review.

The Management recommend the financial statement for approval by the Group of Owners.

Copenhagen, 28 June 2018

The Management:

Chairman	**NKS Secretariat**
Sigurður M. Magnússon	Finn Physant

We, the signers, as representatives of the owners of NKS hereby approve The Financial Statements for The Nordic Nuclear Safety Research Programme 2017.

Copenhagen, 28 June 2018

Group of Owners:

Sigurður M. Magnússon Iceland, chairman	Carsten Israelson Denmark	Jorma Aurela Finland
Ole Harbitz Norway	Anneli Hällgren Sweden	

Independent Auditors' Report

To the group of owners of NKS

Opinion

We have audited the Financial Statements of NKS for the financial year 1 January - 31 December 2017, which comprise income statement, balance sheet, notes and financial programme specification, including a summary of significant accounting policies, for NKS. The Financial Statements are prepared in accordance with the agreements and the accounting policies, which is decided by the Management, and which is described at page 12.

In our opinion, the Financial Statements give a true and fair view of NKS' financial position at 31 December 2017 and of the results of NKS' operations for the financial year 1 January - 31 December 2017 in accordance with the agreements and the accounting policies, which is decided by the Management.

Basis for Opinion

We conducted our audit in accordance with International Standards on Auditing (ISAs) and the additional requirements applicable in Denmark as well as in accordance with generally accepted government auditing standards. Our responsibilities under those standards and requirements are further described in the "Auditor's Responsibilities for the Audit of the Financial Statements" section of our report. We are independent of NKS in accordance with the International Ethics Standards Board for Accountants' Code of Ethics for Professional Accountants (IESBA Code) and the additional requirements applicable in Denmark, and we have fulfilled our other ethical responsibilities in accordance with these rules and requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

The Management's Responsibilities for the Financial Statements

The Management is responsible for the preparation of Financial Statements that give a true and fair view in accordance with the agreements and the accounting policies, which is decided by the Management, and for such internal control as the Management determines is necessary to enable the preparation of Financial Statements that are free from material misstatement, whether due to fraud or error.

In preparing the Financial Statements, the Management is responsible for assessing NKS' ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting in preparing the Financial Statements unless the Management either intends to liquidate NKS or to cease operations, or has no realistic alternative but to do so.

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the Financial Statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with ISAs and the additional requirements applicable in Denmark as well as in accordance with generally accepted government auditing standards, will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users of accounting information taken on the basis of these Financial Statements.

Independent Auditors' Report

As part of an audit conducted in accordance with ISAs and the additional requirements applicable in Denmark as well as in accordance with generally accepted government auditing standards, we exercise professional judgment and maintain professional scepticism throughout the audit.

We also:

- Identify and assess the risks of material misstatement of the Financial Statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of NKS' internal control.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the Management.
- Conclude on the appropriateness of the Management's use of the going concern basis of accounting in preparing the Financial Statements and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on NKS' ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the Financial Statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause NKS to cease to continue as a going concern.
- Evaluate the overall presentation, structure and contents of the Financial Statements, including the disclosures, and whether the Financial Statements represent the underlying transactions and events in a manner that gives a true and fair view.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

Statement on Management's Review

The Management is responsible for Management's Review.

Our opinion on the Financial Statements does not cover Management's Review, and we do not express any form of assurance conclusion thereon.

In connection with our audit of the Financial Statements, our responsibility is to read Management's Review and, in doing so, consider whether Management's Review is materially inconsistent with the Financial Statements or our knowledge obtained during the audit, or otherwise appears to be materially misstated.

Based on the work we have performed, we conclude that Management's Review is in accordance with the Financial Statements. We did not identify any material misstatement of Management's Review.

Independent Auditors' Report

Declaration on compliance with other legislation and other regulations

Opinion on legal-critical audit and performance audit

The Management is responsible for ensuring that the transactions covered by the Financial Statements comply with applicable appropriations, laws and other regulations as well as agreements and standard practice. The Management is also responsible that due financial consideration has been applied to the management of funds and operations of the activities included in the annual accounts. The Management is responsible for establishing systems and processes that support economy thrift, productivity and efficiency.

In conjunction with our audit of the Financial Statements, it is our responsibility to implement both legal-critical audit and performance audit of selected areas in accordance with generally accepted government auditing standards. In our legal-critical auditing, we assess with a high degree of certainty of the selected areas whether the examined transactions covered by the Financial Statements comply with the relevant provisions in appropriations, laws and other regulations as well as agreements and standard practice. In our performance audit, we assess with a high degree of certainty whether the systems, processes or transactions examined support due financial consideration for the management of the funds and operations of the activities included in the Financial Statements.

If we conclude, on the basis of the work we have carried out, that grounds for significant critical comments exist, we are under obligation to report on this in this statement.

We have no critical comments to report in this regard.

Roskilde, 28 June 2018

Dansk Revision Roskilde
Godkendt revisionsaktieselskab, CVR-nr. 14 67 80 93

Palle Sundstrøm
Partner, State-Authorised Public Accountant
Mne nr. : 10012

Management's review

2017 has been characterised by planned work/operation of the R (Reactor)-part and the B (Emergency Preparedness)-part.

A new Programme manager of the R parts has started the 1. January 2017.

In the course of 2017, the currency market for the Norwegian and the Swedish currency has developed in a negative direction, in comparison with the Danish currency and the EURO. The total foreign exchange loss at the end of the year is at DKK 196,021/ EUR 26,330/7,4449.

The Financial Statements are presented in DKK, but the amounts are also stated in EUR in a separate column.

The Financial Statements show a deficit of DKK 670,763 / EUR 90,097, which is consistent with decisions taken by the Board.

Subsequently, the equity as at 31 December 2017 constitutes DKK 6,489,081 / EUR 871,614.

In assessing the year's deficit and equity as at 31 December 2017, consideration must be made of the contracts for the R and B parts of DKK 5,727,744 / EUR 761,351, which is calculated at 31 December 2017, where invoices have not yet been received or where the work has not yet been completed.

It may also be noted that NKS in accordance with programme managers' statements has received external funding of around DKK 13,8 mio. / EUR 1.85 mio. in the form of un-charged contributions. The external funding is the work performed in connection with the implementation of activities for which invoices will not be sent.

Unused activity, coordination and travel funds for programmes for the year 2016 are returned to the reserve as are unused common programme costs for a total of DKK 567,118 / EUR 76,175.

Income statement 2017

Grants and interest income				Kurs 7,4449
Danish Emergency Management Agency	DKK	375.000,00	EUR	50.370,05
Ministry of Economic Affairs and Employment, FI	DKK	2.602.040,00	EUR	349.506,37
Icelandic Radiation Safety Authority	DKK	178.425,60	EUR	23.966,15
Norwegian Radiation Protection Authority	DKK	654.560,00	EUR	87.920,59
Swedish Radiation Safety Authority	DKK	3.541.265,00	EUR	475.663,21
Additional funding	DKK	838.794,77	EUR	112.667,03
Interest income	DKK	5.756,01	EUR	773,15
Total grants and interest income	**DKK**	**8.195.841,38**	**EUR**	**1.100.866,55**
Expenses				
R-Part	DKK	3.765.795,35	EUR	505.822,15
B-Part	DKK	3.561.928,21	EUR	478.438,69
Fees	DKK	1.147.500,00	EUR	154.132,36
Common program expenses	DKK	185.419,93	EUR	24.905,63
Travels	DKK	9.939,54	EUR	1.335,08
Exchange adjustments	DKK	196.020,89	EUR	26.329,55
Total expenses for the NKS programme	**DKK**	**8.866.603,92**	**EUR**	**1.190.963,47**
Income - Expenses	**DKK**	**-670.762,54**	**EUR**	**-90.096,92**

Balance sheet 2017

Assets:				**Kurs 7,4449**
Giro and bank accounts converted to DKK, Note 1				
DK/IS-giro 918-9297	DKK	1.368.489,35	EUR	183.815,68
FI-giro 800015-70837915	DKK	2.148.144,08	EUR	288.539,01
NO-giro 7874.07.06976	DKK	2.094.931,01	EUR	281.391,42
SE-giro 6 64 63-1	DKK	877.517,03	EUR	117.868,21
Giro and bank accounts total	DKK	6.489.081,47	EUR	871.614,32
Total Assets	**DKK**	**6.489.081,47**	**EUR**	**871.614,32**
Liabilities:				
Equity:				
Retained from previous years	DKK	7.159.872,01	EUR	961.715,00
Result of this year	DKK	-670.790,54	EUR	-90.100,68
Total equity	DKK	6.489.081,47	EUR	871.614,32
Total Liabilities	**DKK**	**6.489.081,47**	**EUR**	**871.614,32**

Notes

Note 1: Giro and bank accounts:	Currency		DKK	EUR
DK/IS-giro 918-9297:				
Holding 31.01.2018	**DKK**	1.368.489,35	1.368.489,35	183.815,68
FI-giro 800015-70837915				
Holding 31.01.2018	**EUR**	6.592,61	49.081,32	6.592,61
Giro deposits 31.01.2018	**EUR**	281.946,40	2.099.062,75	281.946,40
NO-giro 7874.07.06976				
Holding 31.01.2018	**NOK**	121.975,58	92.286,72	12.395,97
Giro deposits 31.01.2018	**NOK**	2.646.899,67	2.002.644,29	268.995,46
SE-giro 6 64 63-1:				
Holding 31.01.2018	**SEK**	1.160.276,38	877.517,03	117.868,21
Correction			0,01	
Total			**6.489.081,47**	**871.614,33**

Exchange rates pr. 31.12.2017

EUR	**744,49**
NOK	**75,66**
SEK	**75,63**

Notes

Financial programme specification - 31 January 2018

	DKK							EURO	7,4449	
Total	Budget from 16	Returned 16	Budget 17	Total budget 17	Payments made	Contracts signed, but not paid	Rest budget	Payments made	Contracts signed, but not paid	Rest budget
R-Part	2.807.695	-131.770	3.709.000	6.384.925	3.765.795	2.551.853	67.277	505.822	342.765	9.037
B-Part	3.445.290	-352.631	3.709.950	6.802.609	3.561.928	3.168.391	72.290	478.439	425.579	9.710
2016 seminar	-2.690	2.690	0	0	0	0	0	0	0	0
Fees	7.500	-7.500	1.155.000	1.155.000	1.147.500	7.500	0	154.132	1.007	0
Common programme exp.	77.851	-77.851	200.000	200.000	185.420	0	14.580	24.906	0	1.958
Travels	56	-56	10.000	10.000	9.940	0	60	1.335	0	8
Total	6.335.702	-567.118	8.783.950	14.552.534	8.670.583	5.727.744	154.207	1.164.634	769.351	20.713
	F_1	F_2	F_3	F	G	H_1	H_2	G	H_1	H_2

$F_1 + F_2 + F3 = F$

$F - G = H = H_1 + H_2$

Notes

Detailed financial programme specification - 31 January 2018

	DKK							EURO	7,4449	
Specifikation:	Budget from 16	Returned 16	Budget 17	Total budget 17	Payments made	Contracts signed, but not paid	Rest budget	Payments made	Contracts signed, but not paid	Rest budget
R-Part: Common program.	337.475	-87.475	585.000	835.000	527.687	255.000	52.313	70.879	34.252	7.027
Activities	2.430.220	-4.295	3.099.000	5.524.925	3.228.072	2.296.853	0	433.595	308.514	0
Travel young scientists	40.000	-40.000	25.000	25.000	10.036	0	14.964	1.348	0	2.010
B-Part: Common program.	332.951	-82.951	585.000	835.000	257.448	510.000	67.552	34.580	68.503	9.074
Preparedness	1.370.024	-155.000	2.083.950	3.298.974	1.756.768	1.542.206	0	235.969	207.149	0
Measurement	1.075.371	-48.750	1.016.000	2.042.621	1.236.250	806.371	0	166.053	108.312	0
Radioecology	546.014	-30.000	0	516.014	291.200	224.814	0	39.114	30.197	0
Waste	85.000	0	0	85.000	0	85.000	0	0	11.417	0
Travel young scientists	35.930	-35.930	25.000	25.000	20.262	0	4.738	2.722	0	636
2016 seminar	-2.690	2.690	0	0	0	0	0	0	0	0
Fee Secretariat	7.500	-7.500	675.000	675.000	667.500	7.500	0	89.659	1.007	0
Fee Chairman incl. travels	0	0	480.000	480.000	480.000	0	0	64.474	0	0
Reports etc.	13.719	-13.719	26.250	26.250	20.360	0	5.890	2.735	0	791
Postage etc.	-1.760	1.760	7.500	7.500	8.420	0	-920	1.131	0	-124
Equipment	15.000	-15.000	5.000	5.000	4.694	0	306	630	0	41
Internet	26.325	-26.325	70.000	70.000	56.875	0	13.125	7.639	0	1.763

Notes

Detailed financial programme specification - 31 January 2018

	DKK							EURO	7,4449	
Specifikation:	Budget from 2016	Returned 2016	Budget 2017	Total budget 2017	Payments made	Contracts signed, but not paid	Rest budget	Payments made	Contracts signed, but not paid	Rest budget
Auditing	0	0	61.250	61.250	73.750	0	-12.500	9.906	0	-1.679
Information material	14.608	-14.608	20.000	20.000	11.986	0	8.014	1.610	0	1.076
Various	9.959	-9.959	10.000	10.000	9.335	0	665	1.254	0	89
Travels Secretariat	56	-56	10.000	10.000	9.940	0	60	1.335	0	8
Diff.	0	0	0	0	0	0	0	0	0	1
Total	6.335.702	-567.118	8.783.950	14.552.534	8.670.583	5.727.744	154.207	1.164.634	769.351	20.713
	F_1	F_2	F_3	F	G	H_1	H_2	G	H_1	H_2

$F_1 + F_2 + F3 = F$ $F - G = H = H_1 + H_2$

Accounting policies

The Financial Statements is presented in accordance with the agreements and the accounting policies, which is decided by the Management.

The Financial Statements is presented in accordance with the same accounting policies as last year.

Recognition and measurement
The association uses the ”open post”-principle, which means, that all expenses, which is paid in the period 1/2-2017 - 31/1-2018, are included in the financial statements.

Conversion of foreign currencies
Transactions in foreign currencies are in the course of the year translated to the exchange rate at the beginning of the financial year. Giro and bank accounts, receivables and payables in foreign currencies, is translated at the exchange rates at the balance sheet date.

Realised and unrealised exchange differences is recognised in the income statement as financial income or financial expenses.

The income statement

Revenue recognitions
Income include grants for the financial year from the owners and the additional funding.

Expenses
Expenses include paid expenses for the financial year’s approved projects for respectively the R- and the B-part, including common program expenses and travels, activity supports and fees. The association is not taxable for VAT and therefore the expenses of the association is recognized including VAT.

Interest income
Interest income include interest income.

Income taxes
The association is not liable to pay tax.

Balance sheet

Cash and cash equivalents
Cash and cash equivalents include bankdeposit in giro and bank accounts in Denmark, Finland, Norway and Sweden.

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The Nordic Nuclear Safety Research Programme (NKS)

Central Business Registration No.: 38 64 98 68

Long-form audit report of 28 June 2018 regarding Financial Statements for 2017

Long-form audit report of 28 June 2018 regarding Financial Statements for 2017

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Long-form audit report of 28 June 2018 regarding Financial Statements for 2017

1 Audit of the financial statements

1.1 Introduction

As the appointed auditors for The Nordic Nuclear Safety Research Programme (NKS), we have audited the Financial Statements for the financial year 1 January 2017 - 31 December 2017 prepared by the NKS Secretariat.

The financial statements show the following results, assets and equity:

DKK / EUR	Current year	Last year
Result for the year	-670.763 / -90.097	-1.061.243 / -142.748
Equity	6.489.081 / 871.614	7.159.872 / 963.073

1.2 Conclusion on the executed audit - auditor's report

The audit performed has not given rise to significant remarks to the Financial Statements.

If the Financial Statements are carried in the existing form and if further, significant information does not appear during management's processing, we will provide the Financial Statements for 2017 with an unmodified audit opinion.

The audit has not included the management's review, but we have read the management's review. This has not given rise to remarks. On this background, it is our opinion that the information in the management's review is in accordance with the Financial Statements.

1.3 Scope and execution of the audit

The purpose, planning and execution of the audit, the auditor's responsibility and reporting as well as the Group of Owners responsibility have remained unchanged, which is why we refer to our letter of engagement dated 30 March 2011.

As preparation for the audit of the Financial Statements for 2017, we have discussed the expectations to the financial development for 2017 with the Management, including risks related to the association's activities. We have, furthermore, discussed risks connected to the presentation of accounts and the initiatives the Group of Owners has initiated for the management hereof.

On this background, we have prepared our auditing strategy with a view to targeting our work at significant and areas of risk. We have identified the following items and areas to which, according to our opinion, special risks of significant errors and insufficiencies in the Financial Statements are associated:

- Grants
- Project expenses
- Equity

On other areas, the risk of error in the Financial Statements is assessed as normal and the execution of the audit has therefore had a lesser scope.

Long-form audit report of 28 June 2018 regarding Financial Statements for 2017

The audit was executed with a view to verifying whether the information and amount specifications in the Financial Statements are correct. Analyses, review and assessment of administrative procedures, internal control systems and control procedures have been performed as well as a review and assessment of bookkeeping items and documentation for this.

The audit has also included an assessment of whether the prepared Financial Statements fulfil the auditing regulations of legislation and articles of association. In this regard, we have assessed the selected accounting policy, the Group of Owners accounting opinion as well as, moreover, the information submitted by the Group of Owners.

Furthermore, the audit has been planned and executed in accordance with the international auditing standards as well as generally accepted government auditing standards (legal-critical audit and performance audit) and, in addition to the financial audit, it also includes a review and assessment of whether due financial considerations have been taken with the administration of the funds covered by the accounts.

During the execution of the financial audit, we have checked whether the accounts are without significant errors and insufficiencies. We have also checked the Financial Statements' agreement with the underlying bookkeeping records as well as the Financial Statements' concordance with laws and regulations as well as with commenced agreements and the accounting policies, which is decided by the Management.

The performance audit has been executed as an integrated and parallel part of the financial audit and, among other things, has included random reviews of agreements and contracts, reports, analyses of expense and income items as well as an analysis of budget deviations.

The audit has been executed in connection with the preparation of the Financial Statements.

2 The executed audit

2.1 Legal-critical audit

We have during the execution of the financial audit, not identified terms, that gives us reason to suspect,

- that NKS in its work is not independent, and
- that NKS's funds are not used in accordance with the terms and conditions of NKS.

2.2 Administration

As in previous years, The NKS Secretariat is managed by FRIT ApS.

Agreement has been entered into on an extension of the agreement until 31 July 2019.

It must be noted that the Board has chosen to extend the agreement with Chairman of the Board, Sigurður M. Magnússon, up to and including 2020.

Long-form audit report of 28 June 2018 regarding Financial Statements for 2017

2.3 Attestation procedures

We have performed a follow-up on NKS Secretariat's procedures and internal controls regarding attestation procedures and have found reason to state the following:

Project expenses

We checked on a sample basis whether the supporting documentation is duly approved by the programme manager or by chairman, Sigurður M. Magnússon. This review has not given rise to any comments.

In addition, we have established that the Secretariat regularly sends programme status to the programme managers. The programme status is forwarded approximately every second month and at the latest on 31 January 2018. The programme status includes, for example, a ledger card for project expenses so that the programme manager can see the individual payments on the project for the current year.

Secretariat expenses

Remuneration for the Secretariat is controlled as per agreement and to the minutes of the board meeting. We checked on a sample basis whether the invoices has been approved by Sigurður M. Magnússon. This review has not given rise to remarks.

2.4 Authorisation to sign

The accounts manager, Finn Physant, owner of FRIT ApS, and chairman, Sigurður M. Magnússon, have authority to make withdrawals on NKS' giro and bank accounts jointly or individually together with Claus Rubin, who is a consultant for FRIT ApS.

Our assessment is that the above terms and conditions for authorisation to sign, in consideration of the few staff members, is appropriately organised.

2.5 Use of IT

In connection with our audit, we have performed a general review and assessment of the association's administrative use of IT, including of system, data and operation security.

Our assessment is that the association is dependent on IT in the daily business processes. However, the association's use of IT is not assessed as being a risk.

2.6 Non-corrected misstatements

Pursuant to the international auditing standards, we must account for non-corrected misstatements that are not insignificant, to the association's senior management.

We can inform, that there were no corrections to the draft for the Financial Statements.

Long-form audit report of 28 June 2018 regarding Financial Statements for 2017

2.7 Discussions with management on fraud

During the audit we have enquired the Management about the risk of fraud and the Management has informed us that according to their assessment, there is no particular risk that the Financial Statements can contain significant erroneous information as a result of fraud.

The Management has, furthermore, reported that they do not have knowledge of fraud or investigations in progress for assumed fraud.

During our audit we have not established conditions that could indicate or arouse suspicion of fraud of significance to the information in the Financial Statements.

3 Comments to the audit and financial statements 2017

For the individual items in the income statement and balance sheet we can supplement the presented Financial Statements for the year 2017 with the following:

3.1 Additional financiers

The additional financiers stated in the income statement may be analysed as follows in DKK:

	2017	2016	2015
Fortum Power and Heat Oy, Finland	195.153	195.891	189.812
TVO, Finland / Teollisuuden Voima Oyj, TVO	195.153	195.891	189.812
Fennovoima Oy, Finland	74.344	67.162	57.688
Forsmarks Kraftgrupp AB, Sweden	97.762	98.132	97.883
OKG Aktiebolag, Sweden	97.168	97.535	92.673
Ringhals AB, Sweden	89.213	89.550	89.323
IFE, Norway	90.002	92.236	89.323
Nordic Council of Ministers	0	0	100.000
Total financiers	838.795	836.397	906.514

The additional financiers are in accordance with the supporting documentation.

We have found that in 2017, there has been no new additional financier.

3.2 Insurance of internet banking and giro

We have found that NKS has no insurance against theft of the 4 internet banks/ -giro. In consideration of the current IT-crimes, we recommend that such insurance is to be signed.

3.3 Exchange rate adjustments

The exchange rate adjustments are mainly the result of foreign currency amounts being registered at the rate on 31 December 2016 throughout 2017. This gives deviations between the utilised rate and the actual rate.

We can report that the principle used does not affect the overall results, but just the allocation of the individual items in the income statement.

3.4 Budget balances brought forward from one year to the next

In the financial survey for 2017, budget figures for all expenses are specified. In addition, an amount transferred from 2016 of, in total, DKK 5,768,584 - cf. the accounts pages 10 to 11, first two columns.

We draw attention to the fact that the remaining budget for joint programme expenses, joint trips and fees similar to previously, have not been transferred from 2016 to 2017 and are thus transferred to NKS' equity (reserve).

It is furthermore noted that the coordination and travel expenses as well as activity expenses granted to the programme managers for the year 2017 that are not used/allocated similar to previous year will be transferred to equity. Thus, only the allocated activity expenses for R Part and B Part will be transferred from 2016 to 2017.

4 Performance audit

In accordance with generally accepted government auditing standards, we checked, for a number of selected areas, whether NKS has established business processes to ensure appropriate management of allocated funds. We performed our audit procedures to obtain limited assurance as to whether the management is conducted in a financially appropriate manner and whether the performance numbers disclosed are documented and adequate to cover NKS' operations in 2017.

According to our information, the grants (except for the grants contributed by Fortum Power and Heat Oy and TVO) are not earmarked for specific projects but for NKS' programmes as such. Based on this information, our audit was conducted on the basis of NKS' activities as a whole. During our audit, we checked that the grants from Fortum Power and Heat Oy and TVO have been employed as intended.

During our audit, we established that expenses incurred relate to individual projects and that the supporting documentation is duly approved. We noted that the programme and Secretariat budgets are kept. Finally, we checked on a sample basis whether reports have been prepared for completed projects.

As part of the performance audit, we must check whether the individual projects could be carried out in a more economical manner / efficiency. During our audit, no matters have come to our attention that cause us to believe that this is the case. However, we must state that our lack of technical expertise within nuclear safety means that we do not have the possibility to comment on this.

4.1 Agreement between bookkeeping records and Financial Statements

We noted that there is agreement between the performed bookkeeping and the prepared Financial Statements for the year 2017.

Long-form audit report of 28 June 2018 regarding Financial Statements for 2017

Similar to previous years, all deposits and payments in January 2018 have been included in the accounts as if they were settled before 31 December 2017. This utilised accounting policy does not affect the accounting result. Only the size of the cash available, receivables and debt are affected.

5 Statutory information, etc.

We have ascertained that on all essential areas, the association complies with the Danish Bookkeeping Act, including regulations on the storage of accounting records.

It is our opinion that the requirements of legislation on bookkeeping and storage of accounting records has been complied with. We have furthermore agreed that our archive material will be stored for 7 years after the expiry of the relevant financial year.

6 Economic crime

In accordance with the Danish Act on Approved Auditors and Audit Firms, we are obliged to check whether any management member has committed significant economic crime and under certain circumstances we must report our findings to legislative and enforcing authorities (primarily the Serious Economic Crime Squad and International Crime).

During our audit we have not come across conditions or indications that any management member have committed economic crimes.

7 Other tasks

In this financial year we have provided the following other services to NKS:

- Assistance with the preparation of the Financial Statements

A fee for the audit of the Financial Statements has similar to last year been agreed on, including assistance with the preparation of the Financial Statements, participation in accounting meetings and in board meetings as well as the translation to English of the accounts and long-form audit report, in the amount of DKK 49,000 excl. VAT. The amount has not been allocated as debt in the presented accounts.

Long-form audit report of 28 June 2018 regarding Financial Statements for 2017

8 Statements in connection with the audit

8.1 The Managements representation letter

As part of the audit of the Financial Statements, we have obtained confirmation from management of the Financial Statements' completeness, including that they contain all information on mortgages, guarantees, related parties, court cases, events after the balance sheet date as well as other complex auditable areas.

Management has further declared that all errors that have been presented to management are rectified in the Financial Statements. We have ascertained that the rectifications are included.

8.2 Auditor's statement

In compliance with the law regarding the approved auditors and audit firms, we state that:

- We comply with the statutory requirements for independence, and
- during the audit carried out, we have received all the information we have requested.

Roskilde, 28 June 2018

Dansk Revision Roskilde
Godkendt revisionsaktieselskab

Palle Sundstrøm
Partner, state-authorised Public Accountant

Presented at the board meeting on 28 June 2018

Sigurður M. Magnússon
Chairman

Carsten Israelson

Jorma Aurela

Ole Harbitz

Anneli Hällgren

Financial status - 08 June 2018

Incomes

DKK

Expected incomes this year	8.133.380	A = B + C
Received until now	7.552.365	B
Additional payments	581.015	C
Cash balance	9.271.962	D
Available funds	9.852.977	E = C + D

Budget and expenses

DKK

Total budget incl. transfer from earlier years	13.898.953	F = G + H
Paid until now	4.765.949	G
Rest budget incl. contracts signed, but not paid	9.133.004	H

Available

DKK

Reserve available for the board	719.973	I = E - H

Financial programme specification - 08 June 2018

	DKK							EURO	7,4449	
Total	Budget from 17	Returned 17	Budget 18	Total budget 18	Payments made	Contracts signed, but not paid	Rest budget	Payments made	Contracts signed, but not paid	Rest budget
R-Part	2.619.130	-110.277	3.560.000	6.068.853	1.817.617	4.151.236	100.000	244.143	557.595	13.432
B-Part	3.240.681	-634.331	3.810.000	6.416.350	2.089.057	4.227.293	100.000	280.602	567.811	13.432
2019 seminar	0	0	100.000	100.000	0	0	100.000	0	0	13.432
Fees	7.500	-7.500	1.098.750	1.098.750	767.500	331.250	0	103.091	44.494	0
Common programme exp.	14.580	-14.580	200.000	200.000	87.985	0	112.015	11.818	0	15.046
Travels	60	-60	15.000	15.000	3.763	0	11.237	505	0	1.509
Diff.	0	0	0	0	-1	0	1	0	0	0
I alt	5.881.951	-766.748	8.783.750	13.898.953	4.765.921	8.709.779	423.253	640.159	1.169.899	56.851
	F_1	F_2	F_3	F	G	H_1	H_2	G	H_1	H_2

$F_1 + F_2 + F3 = F$
$F - G = H = H_1 + H_2$

Detailed financial programme specification - 08 June 2018

	DKK							EURO	7,4449	
Specifikation:	Budget from 17	Returned 17	Budget 18	Total budget 18	Payments made	Contracts signed, but not paid	Rest budget	Payments made	Contracts signed, but not paid	Rest budget
R-Part: Common program.	307.313	-52.313	535.000	790.000	485.000	230.000	75.000	65.145	30.894	10.074
Activities	2.296.853	-43.000	3.000.000	5.253.853	1.332.617	3.921.236	0	178.997	526.701	0
Travel young scientists	14.964	-14.964	25.000	25.000	0	0	25.000	0	0	3.358
B-Part: Common program.	577.552	-67.552	535.000	1.045.000	510.000	460.000	75.000	68.503	61.787	10.074
Preparedness	1.542.206	-152.457	1.777.000	3.166.749	974.227	2.192.522	0	130.858	294.500	0
Measurement	806.371	-298.872	1.182.000	1.689.499	514.330	1.175.169	0	69.085	157.849	0
Radioecology	224.814	-110.712	291.000	405.102	90.500	314.602	0	12.156	42.257	0
Waste	85.000	0	0	85.000	0	85.000	0	0	11.417	0
Travel young scientists	4.738	-4.738	25.000	25.000	0	0	25.000	0	0	3.358
2019 seminar	0	0	100.000	100.000	0	0	100.000	0	0	13.432
Fee Secretariat	7.500	-7.500	668.750	668.750	337.500	331.250	0	45.333	44.494	0
Fee Chairman incl. travels	0	0	430.000	430.000	430.000	0	0	57.758	0	0
Reports etc.	5.890	-5.890	18.750	18.750	8.594	0	10.156	1.154	0	1.364
Postage etc.	-920	920	10.000	10.000	1.916	0	8.084	257	0	1.086
Equipment	306	-306	0	0	0	0	0	0	0	0
Internet	13.125	-13.125	70.000	70.000	27.475	0	42.525	3.690	0	5.712
Auditing	-12.500	12.500	61.250	61.250	50.000	0	11.250	6.716	0	1.511
Information material	8.014	-8.014	20.000	20.000	0	0	20.000	0	0	2.686
Various	665	-665	20.000	20.000	0	0	20.000	0	0	2.686
Travels Secretariat	60	-60	15.000	15.000	3.763	0	11.237	505	0	1.509
Diff.	0	0	0	0	-1	0	1	0	0	1
Total	5.881.951	-766.748	8.783.750	13.898.953	4.765.921	8.709.779	423.253	640.159	1.169.899	56.851
	F_1	F_2	F_3	F	G	H_1	H_2	G	H_1	H_2

$F_1 + F_2 + F3 = F$ $F - G = H = H_1 + H_2$

nks

nordic nuclear safety research

DENMARK FINLAND ICELAND NORWAY SWEDEN

A common Nordic view

Nordic problems need Nordic solutions. NKS aims to facilitate a common Nordic view on nuclear safety and radiation protection including emergency preparedness. This requires common understanding of rules, practice and measures, which may vary between countries, as well as with time. The work builds on a foundation of over sixty years of Nordic collaboration on related issues. Non-Nordic participation may be allowed under certain circumstances.

Securing Nordic competence and knowledge building

Through collaborative NKS activities, Nordic competence and capabilities are maintained and strengthened, and solutions to Nordic problems are disseminated through a sustained informal network. NKS publications are available cost-free on the internet. A special effort is made to engage young scientists and students, to ensure knowledge and expertise for the future.

Strengthening response capacities

By maintaining vital informal networks between Nordic authorities, nuclear power companies, scientists and other stakeholders, the region's potential for a fast, coordinated and targeted response to urgent issues is strengthened. Thereby, problems can be tackled quicker, more efficiently and consistently and at lower cost than if they needed to be addressed on a national scale.

Addressing current societal questions

NKS keeps an open eye to societal changes and events that might influence requirements and perception of nuclear safety, radiation protection and emergency preparedness in the Nordic countries. For instance the Fukushima accident prompted the arrangement of NKS joint reactor safety and emergency preparedness seminars on lessons learned and future implications for Nordic society.

NKS activities

These can take the form of research activities, test exercises or information collation/review exercises. Alternatively they can aim to harmonize approaches to common problems or spread and distribute knowledge and results through seminars, workshops and educational/training courses. Common to all NKS activities is that the results should be beneficial and made available to concerned end users in all Nordic countries. Aspects of nuclear safety, radiation protection and emergency preparedness may be combined in one activity.

Research areas

Areas of interest covered by NKS activities fall under two main programmes, NKS-R and NKS-B, which cover the following specified research areas.

NKS-R programme:

- Reactor safety
- Nuclear power plant life management and extension
- Decommissioning and handling of generated waste
- Organizational issues

NKS-B programme:

- Emergency preparedness
- Measurement strategy, technology and quality assurance
- Radioecological assessments
- Wastes and discharges

Some recent examples of NKS activities

Safety Culture in the Nuclear Industry

A good safety culture is an essential ingredient for ensuring safety in the nuclear industry. The predominant approaches for safety culture are based on the assumption of stable and relatively homogeneous organizations, which often does not apply to contemporary project-oriented and turbulent environments.

The theoretical and empirical work performed within the NKS-R activity SC_AIM resulted in the development of a preliminary framework for evaluating the applicability of safety culture assurance and improvement methods (NKS-381).

Extraction and Analysis of Reactor Pressure Vessel Material

Irradiation induced ageing of the weld material of the reactor pressure vessel (RPV) is a limiting factor from a long term operation perspective. The closed Barsebäck 2 reactor gives an opportunity to harvest samples from the RPV, which was manufactured and welded with the same technique and high amounts of nickel and manganese as most Nordic RPVs. A test program to analyze the as-aged material properties has been prepared within the NKS-R activity BREDA-RPV (NKS-385).

Unmanned Aerial Monitoring Platforms

With the forthcoming of small and inexpensive drone platforms, new possibilities for radiological surveys have arisen. Drones can be used as a supplement to existing measurement capabilities, enabling fast measurements in potential hazardous areas without danger to humans. The NKS-B activity NORDUM made a first approach to cover and compare different systems and approaches for use of drones in the Nordic countries, and the scope is expanded in the NKS-B activity NEXUS, including exercises for, e.g., urban environments (NKS-383).

Meteorological Uncertainty in Predicting Airborne Contaminant Dispersion

A series of NKS-B activities have looked into the influences of meteorological uncertainties on long-range atmospheric dispersion calculations. These have been found to be large depending on the weather situation, with significant implications for nuclear emergency preparedness and decision making. In the NKS-B MESO activity, the focus was on short-range dispersion models used up to about a hundred km distance. Results also here show large influences. A new activity, NKS-B AVESOME, combines uncertainties from meteorology and source term (NKS-380).

How to apply

Nordic companies, authorities, organizations and researchers can submit proposals for NKS activities under the NKS-R and NKS-B programmes. Usually at least three of the five Nordic countries should participate in an activity. Activities submitted under annual calls for proposals are assessed according to criteria important to the objectives of NKS, with final funding decisions made by the NKS board.

Do you have suggestions for a nuclear safety or radiation protection related activity? Contact us via www.nks.org

Financing of NKS activities

NKS is mainly financed by Nordic authorities, with additional contributions from Nordic organizations that have an interest in nuclear safety. The budget for NKS in 2017: about 9 million Danish kroner (€ 1.2 million). In addition to the funding sought from NKS, participating organizations are asked to provide a similar amount of in-kind contributions. This may take the form of working hours, travel expenses or laboratory resources. Without these in-kind contributions it would not be possible to carry out NKS activities.

Main financiers

- Danish Emergency Management Agency
- Ministry of Economic Affairs and Employment, Finland
- Icelandic Radiation Safety Authority
- Norwegian Radiation Protection Authority
- Swedish Radiation Safety Authority

Co-financiers

- Fennovoima Oy, Finland
- Fortum Power and Heat Ltd, Finland
- TVO, Finland
- Institute for Energy Technology (IFE), Norway
- Forsmark Kraftgrupp AB, Sweden
- OKG AB, Sweden
- Ringhals AB, Sweden
- Svensk Kärnbränslehantering AB, Sweden

The NKS website

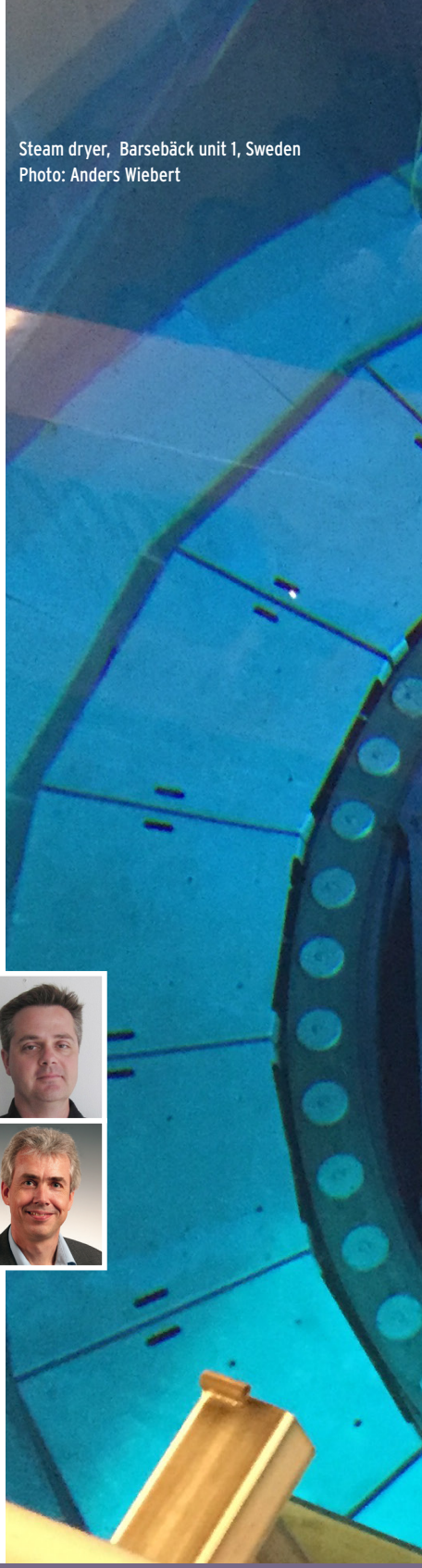
On the NKS website (www.nks.org) information is available on funding opportunities, travel support for young scientists, current activities and upcoming seminars. Presentations from seminars held are available for download as are reports from all completed NKS activities. It is also possible to discover more information on NKS and the history of Nordic co-operation in nuclear safety. For funding www.nks.org/handbook
For reports www.nks.org/reports

NKS email list

NKS sends out newsflashes and newsletters throughout the year providing information on call for proposals, upcoming seminars and published reports. If you wish to join the NKS email list please sign up at www.nks.org

NKS on LinkedIn

Follow NKS on LinkedIn at
https://www.linkedin.com/company-beta/16196099/



Steam dryer, Barsebäck unit 1, Sweden
Photo: Anders Wiebert

Contact

If you wish to learn more about NKS and NKS activities visit our website or contact the NKS secretariat.

nks@nks.org

Telephone +45 4677 4041

NKS Secretariat

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Christian Linde, NKS-R programme manager

Kasper Grann Andersson, NKS-B programme manager

Sigurður M Magnússon, NKS chairman

Finn Physant, NKS secretariat

nks
Nordic nuclear safety research

This is NKS

Nordic Cooperation Forum

NKS (Nordic Nuclear Safety Research) is a forum for Nordic cooperation and competence in nuclear safety, including emergency preparedness, serving as an umbrella for Nordic initiatives and interests. It runs joint activities of interest to financing organisations and other end users producing seminars, exercises, scientific articles, technical reports and other types of reference material. The work is financed and supported by Nordic authorities, companies and other organisations. The results which should be practical and directly applicable are used by participating organisations in their decision making processes and information activities.

The Nordic Approach

The Nordic region comprises five countries, i.e., Denmark (including the Faroe Islands and Greenland), Finland, Iceland, Norway and Sweden. Building on the foundation of a common cultural and historical heritage and a long tradition of collaboration, NKS aims to facilitate a common Nordic view on nuclear and radiation safety. A common understanding of rules, practice and measures, and national differences in this context, is an essential requirement. Through collaborative efforts problems may be tackled quicker, more efficiently, more consistently, and at a lower cost.

Why Nordic Cooperation on Nuclear and Radiological issues?

One reason to maintain this collaboration between the Nordic countries is the common challenges in relation to nuclear installations. While nuclear power plants are in operation in Finland and Sweden, research reactors have been operated in Denmark, Finland, Norway and Sweden. Clearly, exchange of operational expertise and new ideas can be beneficial. Some of the Nordic research reactors have been closed down and the experience gained in subsequent decommissioning may be useful in connection with the planned decommissioning of Swedish nuclear power reactors. Also knowledge exchange between Sweden's nuclear fuel production plant and other Nordic nuclear installations may be beneficial. The Fukushima accident highlighted the need for an effective operational emergency preparedness for accidents at nuclear installations. By continuously improving detection, response and decision aiding tools while maintaining an informal collaborative network between relevant stakeholders in the Nordic countries, the capacity and capability to respond optimally to an emergency is enhanced. Experience has shown that nuclear and radiological challenges to society are far from static, and the response systems require continuous development. Radiological issues need to be addressed coherently and effectively in the Nordic countries, and some of these are on the NKS agenda. They range from exposure to naturally occurring radioactive material in the environment to the threat of malicious use of radioactive material. In addition to the NKS cooperation there is an extensive co-operation between the Nordic radiation safety authorities regarding general radiation safety issues.

Nordic and International Benefits

NKS with its program for nuclear safety including emergency preparedness is of common benefit for all five Nordic countries. The hallmark of NKS is a spirit of sharing – all results are available free of charge on the NKS web site (www.nks.org), not only to the NKS family but also worldwide providing an international benefit of the NKS work. When quoting NKS material, a reference to the source will be appreciated.

Two Program Areas

NKS activities are divided into two program areas:
NKS-R: Reactor safety; Nuclear power plant life management and extension; Decommissioning and handling of generated waste; Organisational issues.
NKS-B: Nuclear and radiological emergency preparedness; Measurement strategy, technology and quality assurance; Radioecology and environmental assessments; Management of radioactive waste and discharges.

Owners and Financiers of NKS

The owners and main financiers are:
Danish Emergency Management Agency (DEMA, Denmark)
Ministry of Employment and the Economy (TEM, Finland)
Icelandic Radiation Safety Authority (GR, Iceland)
Norwegian Radiation Protection Authority (NRPA, Norway)
Swedish Radiation Safety Authority (SSM, Sweden)

The co-financiers are:
Fennovoima Oy (Finland)
Fortum Power and Heat Ltd. (Finland)
TVO (Finland)
Institute for Energy Technology (IFE, Norway)
Forsmark Kraftgrupp AB (Sweden)
OKG AB (Sweden)
Ringhals AB (Sweden)
SKB AB (Sweden)

Financial Contribution

In 2017 the contributions of the owners and additional financiers were more than 8 million Danish crowns (approximately 1.1 million euros). To this should be added contributions in kind by participating organizations, worth approximately the same amount, without which this program would not be possible.

Nordic nuclear safety research

NKS(16)4
2016-04-19

HANDBOOK FOR NKS APPLICANTS AND ACTIVITY LEADERS

April 2016

TABLE OF CONTENTS

1 INFORMATION FOR APPLICANTS

1.1 Subscribe to NKS News

Ensure that you will not miss any important information (regarding e.g. call for proposals) by subscribing to NKS News at: www.nks.org.

1.2 Who can apply?

Organisations such as universities, research centres, institutes and companies in the Nordic countries can apply for NKS funding for research activities. The activity budget should distribute the NKS funding between participant organisations from at least 3 Nordic countries (in some special cases, involvement of only 2 Nordic countries has been accepted in the NKS-R programme). Non-Nordic participation in NKS activities is possible, but NKS funding of Non-Nordic organisations is not possible. The activity leader must come from a Nordic country (i.e. work for a Nordic organisation).

1.3 What kind of work would be funded?

NKS funds work related to nuclear safety, including emergency preparedness, radioecology, measurement strategies and waste management, considered to be of importance to the Nordic community. The work should be of interest to the owners and financing organisations of NKS. The results must be of relevance, e.g., practical and directly applicable. The work can be in the form of scientific research, including experimental work, or joint activities producing seminars, workshops, courses, exercises, scientific articles, technical reports and other type of reference material. Examples of research topics can be found in the framework documents for NKS-R (http://www.nks.org/en/nksr/call_for_proposals/nks-r_framework_2015.htm) and NKS-B http://www.nks.org/en/nksb/call_for_proposals/nks-b_framework_2014.htm.

1.4 Requirements for NKS activities

The proposal shall fulfil the following requirements:

- Demonstrated compatibility with the current framework program
- NKS funded participation of organisations in at least three Nordic countries in all major activities (occasionally, two countries may be acceptable)
- Results of NKS activities are publicly available for free
- 50 % of the funding from own contribution

1.5 Criteria for NKS activities

The entire NKS program as well as the various activities is evaluated against the following criteria:

1. *Added Nordic value*
   Will the proposed activity lead to an increase in Nordic competence and/or building of informal networks within a relevant NKS-R framework area and how will this be achieved?
2. *Technical and/or scientific standard*
   How does the proposed activity demonstrate a suitable technical and/or scientific standard?
3. *Distinct and measurable goals*

What will the proposed activity deliver as a result of the proposed work programme in the year for which funding is applied for? It is important to ensure that it is clear to the evaluators what the proposed activity will set out to achieve.

4. *Relevance to NKS end-users*
   Is the proposed activity relevant to NKS end-users and which NKS end-users is the proposed activity targeting? It will strengthen the proposal if the interest of relevant end users is clearly demonstrated and not only assumed.
5. *Participation of young scientists*
   Will the proposed activity involve young scientists in the proposed work programme and if so, how? In this context, those studying towards a masters degree or a PhD and those in their first 4 years of their professional career after obtaining an academic degree would be considered as 'young scientists'
6. *Links to other national/international programmes*
   Does the proposed activity have a link to ongoing or past research programmes or activities? In particular, it should be clear where a proposed activity builds upon previously funded NKS activities.

1.6 What do I have to do in return for the money

The activity partners are expected to report the work carried out each year. The most common type of output is a scientific report at the end of the year. A report with clear results is requested even if the activity continues the next year. Other forms of reporting can be for example presentations and proceedings from a seminar. All material produced must be available for publishing on the NKS webpage, where they are free to be downloaded by anyone.

1.7 NKS financing

The NKS funding is granted for one year at a time. Generally, an activity will not receive more than 600 kDKK per year from NKS. The first 50% of the contribution is paid when an activity is started and the rest 50% when the final results of one year's work are available. The first part of the funding can be invoiced when a contract has been made between NKS and the activity leader.

1.8 Working language

The main working language in NKS is English. Applications for NKS funding as well as final reports and other material should be submitted in English. However, each working group determines its own language for meetings.

1.9 How do I apply?

It is up to the applicants themselves to find collaboration partners in the Nordic countries. The programme managers can help with getting into contact with Nordic organisations. NKS seminars are good places for networking. More information on ongoing research and all the published reports are available on the NKS website.

NKS funding is announced in the annual Call for Proposals. It is usually organised in September - October. All the necessary information, material and instructions are distributed on the NKS website. The Call for Proposals is also announced in the NKS electronic newsletter. The applicant is requested to fill in an application form. A voluntary annexe with further details about the proposal

may also be handed in. Detailed instructions on how to fill in the application form will be available when the Call for Proposal opens. The applicant is encouraged to read these instructions carefully. The applicants are expected to demonstrate that at least half of the necessary funding of the activity in question will be supplied by the participating organisations. In other words, the participants are expected to put in the same amount of money in the project as they are applying from NKS. These contributions may be work hours, travel expenses, etc. and should be clearly specified in the proposal form.

Please note that all funding by NKS includes possible VAT

1.12 What happens next

Proposals received before deadline are evaluated against the requirements by the NKS programme managers. Projects fulfilling these requirements are then evaluated against the criteria in section 1.5by the NKS board members. The board members have the right to use the help of external experts in the evaluation process if needed. Each proposal will be given marks based on how well the proposal fulfils the NKS criteria. Based on the evaluation results and the available budget, the programme managers make a suggestion for the next year's NKS-R and NKS-B programme. The suggestions are discussed at the January board meeting and the final decision of successful applicants is made by the board. The programme managers inform the applicants of the outcome as soon as possible after the board meeting.

1.13 Useful links for applicants

NKS webpage
Information about NKS
Owners and supporting financiers of NKS
The NKS-B programme
The NKS-R programme
Information about the Call for Proposals, NKS-B programme
Information about the Call for Proposals, NKS-R programme
NKS Seminars
NKS Reports
Travel support for young scientists: NKS-B, NKS-R

2 INFORMATION FOR ACTIVITY LEADERS

2.1 Contract

The Activity Leader will shortly after the Board's grant decision receive a contract template from the manager of the relevant NKS Programme, which is to be filled in with information on the activity deliverables or stages of work to be done, *always* including the submission of a final activity report (normally by the end of the funding year). In the contract template, the Activity Leader must also include a budget for each of the various activity partners, in line with the Board's decision. The contract is valid when signed by an authorised representative of the Activity Leader's organisation and by the Programme Manager. The NKS Programme Manager will have provided the contract template with a reference number (format: AFT/{R or B}({year}) {serial number}). This reference number is the identifier of the activity, and must be stated in all official management documents concerning the project (contracts, invoices, etc.). Contracts are generally for one year's work, and further continuation of activities is subject to submission and approval of a new proposal.

2.2 Invoices

When the contract is duly signed by both parties, the Activity Leader should inform the participants that they can invoice NKS for 50 % of their total contractual amount. When the work has been completed and the final report of the activity has been approved by the Programme Manager, the Activity Leader should inform the participants that NKS can be invoiced for the remaining 50 % of the amount. All invoices are to be addressed to the NKS Secretariat, but mailed to the relevant Programme Manager (NKS-R or NKS-B).

2.3 Activity progress reporting and communication

If deviations are foreseen from the agreed activity work schedule, the Activity Leader must immediately notify the Programme Manager so that any problems may be solved and contingency plans implemented if necessary. On request, the Activity Leader is also obliged to inform the Programme Manager of the state of progress at various stages of the activity.

2.4 Progress documentation if applying for continued funding

If participants in an activity wish to apply for funding for continuation of the activity, they need to document significant progress with the ongoing work (e.g., in relation to declared milestones and deliverables) in connection with the application for continuation.

2.5 Advertisement of dissemination activities

Events like seminars, workshops, courses and exercises connected to NKS activities need to be advertised timely and efficiently to be successful. NKS Programme Managers can help Activity Leaders in advertising these, e.g., through NewsFlashes sent to subscriber lists and posted on the NKS internet site http://www.nks.org/en/news/subscribe_to_our_newsletter/. It is however the responsibility of the Activity Leader and partners to plan and execute all aspects of the activities. Seminars should generally be open and not held exclusively for a closed circle of participants.

2.6 Travel support for dissemination activities

NKS particularly encourages participation of young scientists in NKS events to maintain a high level of competence in the longer perspective, and can offer travel support for this purpose

(http://www.nks.org/en/nksr/travel_assistance/). All other costs for NKS in connection with NKS activities are to be covered by the amount approved in the contract.

2.7 Final reporting of the activity

All NKS activities, regardless of their nature, must produce a final report that should be in the standardised NKS report format (see template/instructions: report template). **Please note**, that where an activity is anticipated to continue for more than one year, a final report is expected to be delivered after each year of the activity as funding cannot be guaranteed for continuing activities. Note that Activity Leaders must also supply a filled-in bibliographic datasheet (http://www.nks.org/en/this_is_nks/administration/) together with the final report.

Final reports from research activities or exercises aimed at filling knowledge gaps or developing methodologies should be in line with standards expected for scientific publications. Final reports from exercise activities in the form of intercomparisons or proficiency tests should seek to address any discrepancies or problems highlighted by the exercise, to increase knowledge and competencies where necessary. Final reports from seminar or workshop activities should contain extended abstracts from each presenter as well as a final overview of any discussions and conclusions. Presentation slides should not be presented in final reports. Final reports for educational and training courses should contain all course documents presented as well as feedback from participants. The conclusion of any NKS activity (and thus the final payment) is subject to the approval of the final report by the Programme Manager. In addition to the final report, activity participants are urged to disseminate activity results (with due credit to NKS) in scientific journal articles as well as at conferences, seminars and workshops. The Programme Manager in charge of the activity should be notified of any dissemination efforts.

The final report can be a paper and electronic report, or only an electronic one, but in both cases the report will be formally registered at the NKS and through the international library network. Printing costs of modest paper reports can be covered centrally by NKS (there is no need to use the activity funding for this), but printing of more sophisticated reports (e.g. thick reports using colour figures) may need to be included in the budget of the activity. Information about possible printing costs can be obtained from the NKS Secretariat.

2.8 Internet hosting of NKS activity material

All final reports of NKS activities are hosted on the NKS internet site (http://www.nks.org/en/nks_reports/). In connection with NKS events like seminars and workshops it is encouraged that the Activity Leader seeks the permission of the participants to publish presentations (slides) on the NKS internet site (http://www.nks.org/en/seminars/presentations/presentations.htm). Also information on other available software (e.g., as downloads) or hardware generated by NKS activities can be hosted on the NKS internet site (http://www.nks.org/en/nksb/supporting_material/). For further information contact the relevant Programme Manager.

Charter on personal data / Privacy policy

Personal data policy for Nordic Nuclear Safety Research (NKS)

NKS is as data controller obliged to protect your personal data, when you as user or guest are using NKS and the services offered by NKS, and aim at you feeling secure about NKS' handling of your personal data. NKS handles personal data about you according to this charter on personal data and governing law. Submission of personal data to NKS is shared with WebHouse ApS, the data processor.

1. NKS collects and uses your personal data

NKS collects information about you in the following instances:

1. When you sign up for receipt of NKS newsletters.
2. When you sign up for seminars or similar arranged by NKS.
3. When you wish to make use of NKS, information about you is collected in order to handle your approach to and/or your use of NKS, and in order to offer and supply you with relevant services for you.

Likewise your personal data are used in order to answer specific requests from you. In this connection NKS collects only the necessary information about you such as name, address, phone number and email address.

Your personal data are processed and stored only if you voluntarily have informed NKS about them for instance by filling in a signing up form for receipt of newsletters, for participating in a seminar or similar related to NKS.

2. NKS passes on your personal data

In certain cases NKS passes on your personal data, which is processed about you. Your personal data can be passed on for instance to:

- a. suppliers NKS cooperates with providing services for you for instance in connection with NKS' use of a printer when planning a seminar by production of name tags or similar
- b. other relevant third parties in connection with your use of NKS; or

- c. if it is demanded by a conviction or governing law.

The passing on of your personal data will only happen to the extent needed and to the necessary receivers making it possible to carry out the service you have requested for instance in connection with signing up to seminars and arrangements or signing up for newsletters from NKS.

3. NKS protects your personal data

NKS has technical and safety precautions to ensure, that your personal data neither accidentally nor illegally are erased, made public, lost, depreciated or made open to irrelevant persons, misused or in any other way handled contrary to governing law. NKS' safety procedures and processes are revised on an on-going basis in order to ensure reasonable technical and organizing safety precautions.

In practice it is not possible to establish 100 % safety and NKS therefore cannot guarantee that your personal data are protected against persons who deliberately attempts to bypassing NKS' safety precautions in order to access the data.

Therefore you are submitting your personal data on your own responsibility.

4. Your rights

If you want access to the information, which NKS is processing about you, you can contact NKS at nks@nks.org or phone +45 4677 4041.

You have the right to be informed about which personal data NKS processes about you. If it turns out that this information is incorrect or misguiding, you are entitled to make a request to NKS in order to have this information corrected, blocked or erased. Moreover you can at any time protest against information about you being processed any further.

You can request that your personal data are erased. In such case NKS cannot supply you with the services originally requested.

5. For how long does NKS store your personal data – on-going commitment to erase data

With NKS your personal data are stored as long as it is necessary in order to deliver the services, you have asked for, as long as it is necessary for a justified purpose, such as the administration of your use of NKS or as long as it is demanded by the law. If we as data controller and data processor are obliged to store the data about you from legislative reasons we store the data for as long as this legislation is ruling.

Your personal data are stored for a maximum of 5 years after the latest use and even longer if requested by governing law.

6. What happens if NKS changes this charter on personal data

NKS continously updates this charter on personal data in order to present you with as precise information as possible and in order to observe ruling law. This implies that NKS on an on-going basis will update and change this charter on personal data. In case of essential changes NKS will notify you by email. The version in force of this charter of personal data can be obtained from NKS on nks@nks.org

7. Contacts and questions

You are very welcome to contact us, if you have any questions concerning charter on personal data or the personal data, which we are collecting and processing about you:

NKS
Frederiksborgvej 399
Postboks 49
DK-4000 Roskilde
nks@nks.org
+45 4677 4041

Brønnøysundregistrene

Kundenr : 3398416
NORDISK KERNESIKKERHEDSFORSKNING NKS
P.O. Box 49
DK-4000 ROSKILDE
Denmark

05.06.2018

Registrering i Enhetsregisteret

Vi viser til melding mottatt 29.05.2018 med saksnummer 2018/1077174 for:

Navn/foretaksnavn:	NKS-FORENINGEN NORDISK KERNESIKKERHEDSFORSKNING
Adresse:	Frederiksborgvej 399, NKS-129 DK-4000 ROSKILDE Danmark
Org.form:	Norskreg. utenlandsk foretak

Enheten er registrert i Enhetsregisteret med organisasjonsnummer 920 914 926.

Registerutskriften viser hvilke opplysninger Enhetsregisteret har registrert. Opplysningene blir stående i Enhetsregisteret til vi får melding om endring eller sletting. Vennligst ta kontakt med Enhetsregisteret hvis noen av de registrerte opplysningene er feil.

I etterkant av nyregistreringen blir enkelte andre opplysninger registrert, bl.a. næringskode. Du har gratis tilgang til oppdatert registerutskrift via tjenesten "Produkter og tjenester fra Brønnøysundregistrene" i www.altinn.no. De fleste registrerte opplysningene kan du også se ved å bruke oppslagstjenesten "Nøkkelopplysninger fra Enhetsregisteret" på www.brreg.no.

Med hilsen
BRØNNØYSUNDREGISTRENE - Enhetsregisteret

Arnt Kristiansen
underdirektør

Robert Lande
saksbehandler

Eventuelle spørsmål kan rettes til Opplysningstelefonen på telefonnummer 75 00 75 00.

NKS Seminar 2019

Status update June 2018

Christian Linde
NKS-R Programme Manager

NKS Board meeting
Copenhagen, 28 June 2018

NKS Seminar Program Committee

- Astrid Liland (NRPA)
- Karin Andgren (Vattenfall)
- Tuuli Pyy (Fortum)
- Gísli Jónsson (GR Iceland)
- Kasper Andersson (NKS-B)
- Christian Linde (NKS-R)
- Finn Physant (NKS)

“Nordic nuclear and radiation risk estimation - Advances and uncertainties” (working title)

Reservation is made for Finlandshuset on 15-16 January 2019

- Start at 13:00 on Tuesday 15 January
- End at 15:30 on Wednesday 16 January
- ”Sibeliussalen” (80-120 participants)

- Afternoon coffee (day 1)
- Poster session + finger food (end of day 1)
- Lunch + morning/afternoon coffee (day 2)

“Nordic nuclear and radiation risk estimation - Advances and uncertainties” (working title)

Nordic nuclear safety research

Draft program (revised 180621)

Four theme sessions (15 min presentations + 5 min discussion)
ongoing and recent NKS R- and B-activities :

I. Uncertainties in estimating NPP risk processes
(SITRON, SPARC, FIREBAN, RASTEP)
II. Uncertainties in estimating accident risks to the population
(EPHSOGAM, AVESOME, AUTOMORC, MESO)
III. Risks and uncertainties in decommissioning and long-term operation
(NORDEC, SC_AIM, RADWORKSHOP, BREDA)
IV. NORM, waste management and risks to the environment
(CONCORE, NANOD, NORCO)
- Risks in protection of the environment (Debbie Oughton, UMB)

- Posters and mingling/reception – end of Day 1

“Nordic nuclear and radiation risk estimation - Advances and uncertainties” (working title)

Draft program (revised 180621)

Key speakers (30-45 min):

1) **Claire Cousins** (Chair of ICRP) – opening lecture on some areas of ICRP, ethics, risks, uncertainties and emergency preparedness
2) **Britt-Marie Drottz-Sjöberg** (NTNU) - talk on Interaction with society and associated risks and uncertainties
3) **Anneli Hällgren** (SSM) at the beginning of the second day for a presentation on “Securing competence”
4) **Kristina Gillin** (LRC) to be confirmed - Introduction lecture on risks during decommissioning
5) **Deborah Oughton** (UMB), on radiation protection of the environment in a Nordic perspective

"Nordic nuclear and radiation risk estimation - Advances and uncertainties" (working title)

Nordic nuclear safety research

Day 1: 13:00 – 13:10 Welcome (Sigurdur, others)
13:10 – 14:00 Key speaker No. 1: **Claire Cousins**, Chair of ICRP, talk on ICRP, ethics, risks, uncertainties and emergency preparedness (incl. discussion time)
14:00 – 14:20 NKS PC presentations

14:20 – 15:40 **Advances and uncertainties in estimating NPP risk processes:**
- NKS-R SITRON presenter on uncertainty in site level risk estimation (Jan-Erik Holmberg, RiskPilot Finland or Salvatore Massaiu, IFE)
- NKS-R SPARC presenter on uncertainty in risk estimation of containment failure and release characteristics (Weimin Ma, KTH or Anna Nieminen, VTT)
- NKS R FIREBAN speaker on "Determination of fire barriers' reliability for fire risk assessment in nuclear power plants" (Patrick van Hees, Lund University)
- NKS-R RASTEP presenter on NPP processes and source term prediction uncertainties (Joakim Klug or Francesco Di Dedda, LRC)
- Discussion

15:40 – 16:10 Coffee

“Nordic nuclear and radiation risk estimation - Advances and uncertainties” (working title)

Nordic nuclear safety research

Day 1: 16:10 – 16:50 Key speaker No. 2: **Britt-Marie Drottz-Sjöberg**, talk on Interaction with society and associated risks and uncertainties

16:50 – 18:10 **Advances and uncertainties in estimating accident risks to the population:**

- NKS-B EPHSOGAM presenter on uncertainty in predicting source term on the background of measurements (Mark Dowdall, NRPA)
- NKS-B AVESOME speaker on uncertainties in predicting plume radionuclide concentrations (Jens Havskov Sørensen, DMI)
- NKS-B AUTOMORC speaker on uncertainty in measurements for long term risk management (Robert Finck or Christopher Rääf, Lund U.)
- NKS-B MESO speaker on uncertainties in risk estimation in decision support systems (Steen Hoe, DEMA or Jonas Lindgren, SSM)
- Discussion

18:10 – 18:15 Practical info about posters and reception

18:15 – 20:00 Posters and mingling/reception

"Nordic nuclear and radiation risk estimation - Advances and uncertainties" (working title)

Day 2:

08:30 – 09:00 Key speaker No 3: **Anneli Hällgren** (SSM) on securing competence

09:00 – 09:40 Key speaker No. 4: **Kristina Gillin (LRC) to be confirmed** Introduction lecture on risks during decommissioning

09:40 – 10:20 **Risks and uncertainties in decommissioning and long-term operation (I)**

- NKS-R NORDEC speaker on "Challenges and opportunities for improving Nordic nuclear decommissioning" (István Szöke, IFE)
- ?? Speaker: on-going and planned decommissioning activities in the Nordic countries (requested by OH)
- Discussion

10:20 – 10:50 Coffee

10:50 – 11:50 **Risks and uncertainties in decommissioning and long-term operation (II)**

- NKS-R SC-AIM speaker on "safety culture during decommissioning" (Teemu Reiman, VTT)
- NKS-B RADWORKSHOP speaker on uncertainties and pitfalls in measurements for decommissioning waste classification (Jixin Qiao, DTU)
- NKS-R BREDA speaker on "Studies on irradiated material from the reactor pressure vessel at Barsebäck" (Pål Efsing, KTH)
- Discussion

"Nordic nuclear and radiation risk estimation - Advances and uncertainties" (working title)

Day 2: 11:50 – 1300 Lunch

13:00 – 13:40 Key speaker No. 5: **Deborah Oughton** (UMB), on radiation protection of the environment in a Nordic perspective (Debbie Oughton, UMB)

13:40 – 14:40 **NORM, waste management and risks to the environment**
- NKS-B CONCORE presenter on characterisation of industrial NORM waste including uncertainties (Charlotte Nielsen, SIS, Kresten Breddam, SIS or Per Roos, DTU)
- NKS-B NANOD presenter on risks from naturally occurring radionuclides in diet (Mari Komperød, NRPA)
- NKS-B NORCO II presenter on conclusions and uncertainties of microcosm studies of risk (Tanya Hevrøy, NRPA or Clare Bradshaw, Stockh. U.)
- Discussion

14:40 – 15:10 Summary and conclusion (Astrid and Karin)

15:10 – 15:30 Thanks/Closing (SMM)
End of seminar at 15:30

(Coffee)

Seminar draft program revised 180621

Nordic nuclear and radiation risk estimation - Advances and uncertainties: (title to be improved!)

Day 1:

13:00 – 13:10 Welcome (Sigurdur, others)
13:10 – 14:00 Key speaker No. 1: **Claire Cousins**, Chair of ICRP, talk on ICRP, ethics, risks, uncertainties and emergency preparedness (incl. discussion time)
14:00 – 14:20 NKS PC presentations

14:20 – 15:40 **Advances and uncertainties in estimating NPP risk processes:**
- NKS-R SITRON presenter on uncertainty in site level risk estimation (Jan-Erik Holmberg, RiskPilot Finland or Salvatore Massaiu, IFE)
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- NKS R FIREBAN speaker on "Determination of fire barriers' reliability for fire risk assessment in nuclear power plants" (Patrick van Hees, Lund University)
- NKS-R RASTEP presenter on NPP processes and source term prediction uncertainties (Joakim Klug or Francesco Di Dedda, LRC)
- Discussion

15:40 – 16:10 Coffee

16:10 – 16:50 Key speaker No. 2: **Britt-Marie Drottz-Sjöberg**, talk on Interaction with society and associated risks and uncertainties

16:50 – 18:10 **Advances and uncertainties in estimating accident risks to the population:**
- NKS-B EPHSOGAM presenter on uncertainty in predicting source term on the background of measurements (Mark Dowdall, NRPA)
- NKS-B AVESOME speaker on uncertainties in predicting plume radionuclide concentrations (Jens Havskov Sørensen, DMI)
- NKS-B AUTOMORC speaker on uncertainty in measurements for long term risk management (Robert Finck or Christopher Rääf, Lund U.)
- NKS-B MESO speaker on uncertainties in risk estimation in decision support systems (Steen Hoe, DEMA or Jonas Lindgren, SSM)
- Discussion

18:10 – 18:15 Practical info about posters and reception

18:15 – 20:00 Posters and mingling/reception

Seminar draft program revised 180621

Day 2:

Coffee from 08:00

08:30 – 09:00 Key speaker No 3: **Anneli Hällgren** (SSM) on securing competence

09:00 – 09:40 Key speaker No. 4: **Kristina Gillin (LRC) to be confirmed** Introduction lecture on risks during decommissioning

09:40 – 10:20 **Risks and uncertainties in decommissioning and long-term operation (I)**
- NKS-R NORDEC speaker on "Challenges and opportunities for improving Nordic nuclear decommissioning" (István Szöke, IFE)
- ?? Speaker: on-going and planned decommissioning activities in the Nordic countries (requested by OH)
- Discussion

10:20 – 10:50 Coffee

10:50 – 11:50 **Risks and uncertainties in decommissioning and long-term operation (II)**

- NKS-R SC-AIM speaker on "safety culture during decommissioning" (Teemu Reiman, VTT)
- NKS-B RADWORKSHOP speaker on uncertainties and pitfalls in measurements for decommissioning waste classification (Jixin Qiao, DTU)
- NKS-R BREDA speaker on "Studies on irradiated material from the reactor pressure vessel at Barsebäck" (Pål Efsing, KTH)
- Discussion

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- NKS-B NORCO II presenter on conclusions and uncertainties of microcosm studies of risk (Tanya Hevrøy, NRPA or Clare Bradshaw, Stockh. U.)
- Discussion

14:40 – 15:10 Summary and conclusion (Astrid and Karin)

15:10 – 15:30 Thanks/Closing (SMM)
End of seminar at 15:30

(Coffee)

Nordisk kärnsäkerhets forskning
Finn Physant Christensen
P.O Box 49
Fredriksborgvej 399, NKS 129
DK-400 ROSKILDE
Danmark

STOCKHOLM, 31 Maj 2018

Bästa Finn Physant Christensen,

Med hänsyn till din förfågan har vi nöjet att bekräfta nedanstående arrangemang hos Finlandshuset Konferens.
Du finner detaljerna för er konferens i denna bekräftelse och vi ber dig se över de programpunkter som är bokade för att se att de möter era önskemål.

För att bokningen ska ses som definitiv behöver vi ha en signerad bekräftelse tillbaka till oss

Har du några frågor eller funderingar är du välkommen att höra av dig till oss.
Vi ser fram emot att få välkomna dig som gäst här till oss!

Med vänliga hälsningar
Finlandshuset, Stockholm

Mellin Nina
Receptionschef
:

Bekräftelse

Organisatör:	Nordisk kärnsäkerhets forskning Finn Physant Christensen	Kontakt på plats:	
Adress:	P.O Box 49 Fredriksborgvej 399, NKS 129 DK-400 ROSKILDE Danmark	Er referens:	Mellin Nina
Kommunikation:	Mobiltelefon: +45 30680861	Bokningsnummer:	8021
Bokningsnamn:	Nordisk kärnsäkerhets forskning NKS	Ankomstdatum:	15/01/2019
		Avresedatum:	17/01/2019
		Typ av konferens:	
		Status:	Tentative

Tisdag, 15 Januari 2019

Tid	Arrangemang	Pers.	Lokal	Sittning		Pris
13:00 - 20:00	Konferens	80	Sibeliussalen	Biosittning	Halvdag	12,750.00 SEK
14:30 - 15:30	Eftermiddagskaffe	80	Foajén	Restaurangsittning		Inkluderad
18:00 - 20:00	Mingel	1	Foajén	Restaurangsittning		Inkluderad

Mat & Dryck

Foajén — **14:30 - 15:30**

80 Pers.
Kaffepaus p.p **86.00 SEK**
Kaffe/thé och kakor

Foajén — **18:00 - 20:00**

1 Pers.
Meny

En flaska mousserande vin	395.00 SEK
En flaska husets röda/vita vin	345.00 SEK
Starköl 50 cl	65.00 SEK
Mineralvatten 33cl	20.00 SEK
***	
Snittar/Canapeer	49.00 SEK
Snacks	20.00 SEK

Teknik

Sibeliussalen — **13:00 - 20:00**

1 Dataprojektor
1 Ljudanläggning
2 Headset
2 Bärbar mikrofon
1 Trådlös internet

Informationstavla

13:00 - 20:00 Sibeliussalen NKS - Nordisk kärnsäkerhetsforskning

Onsdag, 16 Januari 2019

Måltidspaket 80 personer 426.00 SEK per person

Tid	Arrangemang	Pers.	Lokal	Sittning		Pris
08:00 - 16:00	Konferens	80	Sibeliussalen	Biosittning	Heldag	25,875.00 SEK
08:00 - 17:00	Matsal	20	Topeliussalen	Enligt önskemål		Specialpris
08:30 - 09:30	Förmiddagskaffe	80	Foajén	Restaurangsittning		inkl. i paket
12:00 - 13:00	Lunch	80	Bakfickan	Restaurangsittning		inkl. i paket
14:30 - 15:30	Eftermiddagskaffe	80	Foajén	Restaurangsittning		inkl. i paket

Mat & Dryck

Foajén 08:30 - 09:30

80 Pers.
Kaffepaus **inkl. i paket**
Kaffe/thé och smörgås

Bakfickan 12:00 - 13:00

80 Pers.
Konferenslunch **inkl. i paket**
Lunchbuffe
Lättöl/vatten, kaffe/the

Foajén 14:30 - 15:30

80 Pers.
Kaffepaus **inkl. i paket**
Kaffe/thé och kakor

Teknik

Sibeliussalen 08:00 - 16:00
1 Dataprojektor
1 Ljudanläggning
2 Headset
2 Bärbar mikrofon
1 Trådlös internet

Topeliussalen 08:00 - 17:00
1 Dataprojektor
1 Ljudanläggning
1 Trådlös internet

Bokningens totala värde inklusive moms: 80,479.00 SEK

All prices are incl. VAT

Cancellation policy:

In case of cancellation later than 4 weeks before the first day, you will be charged 75% of the agreed price

In case of cancellation later than 2 weeks prior to the event's first day you will be charged 100% of the agreed price.

At day conferences you can cancel a maximum of 10% of the ordered number of participants until 11:00 am, seven working days before the event's first day.

In case of cancellation of Sibeliussalen later than 8 weeks before the event's first day you will be charged 75% of the contract price.

Pre-payed amounts are not due to payment unless this has been agreed between the facility and the customer, see Visita´s contract rules section 3.

Moreover Finlandshuset Conference applies Visita´s general conditions for conferences and other events, see appendix.

Please return a signed copy of the confirmation so that it is received no later than the

We look forward to seeing you as guests of Finlandshuset Conference.

NKS Secretariat
P.O. Box 49
DK-4000 Roskilde

Nordisk kärnsäkerhets forskning
Finn Physant Christensen

Mellin Nina
Receptionschef

ROSKILDE 1.6 2018
place, date

STOCKHOLM, 01/06/2018

Visita´s Cancellation policies

These general terms apply, subject to being annexed to the order confirmation or will otherwise be agreed upon between the parties that they should apply.

1. Definitions
An Event takes place on premises provided, with or without accommodation and/or refreshments, e.g. for conferences or when ordering meeting or conference rooms.
Customer means the person – legal or natural – who isliable to pay for the Event. Supplier means the faciiity that supplies the event.
Order Value means the contract price of the entire order or the total of the number of participants ordered multiplied by the contract price per participant per day plus the price of services ordered separately.

2. Orders
Orders may be placed orally or in writing. The Supplier shall confirm receipt of orders in writing.

3. Advance payment
An advance payment of 25 percent of the confirmed price shall be payable within 10 days of the invoice date. Invoices for the amount of the advance payment shall be sent out immediately as a booking is confirmed. If the advance payment is not made, the order is not binding on the Supplier.

4. Special wishes at time of order
If the Customer has any special wishes concerning e.g. special food, pets, etc., these shall be made known at time of order. The same applies if the Customer requires special security arrangements.

5. Valuable property
If the Customer wishes to bring property of high value and to store it in the Supplier's storage rooms, baggage rooms or safe, he shall so inform the Supplier. In the event of theft or similar, the Supplier shall be liable to make compensation only if the Supplier by a written confirmation has undertaken to be responsible for the property.

6. Cancellation
Cancellations must be made in writing. In the event of cancellation less than four weeks before the first day of the Event, the Customer shall compensate the Supplier with a certain percentage of the full Order Value. The applicable percentage shall be set forth in the Supplier's order confirmation. In the event of a partial cancellation, the compensation shall refer to the cancelled part.

7. Payment
The Customer shall be liable for all costs arising from the order. If participants are each to pay anything themselves, this must be approved by the supplier. The failure of any participant to show up for any ordered meal shall not entail any entitlement to a reduction in the price. Payment shall be made as agreed. If an agreement has been made for payment against invoice, the Customer shall make full cash payment within 20 days of the invoice date. If the time for payment is exceeded, the Supplier shall be entitled to charge late payment interest from the due date at the current Swedish reference rate with a surcharge of eight percentage points. Invoices shall be subject to an invoicing charge.

8. Reservation on price changes
a) If the Supplier wishes to reserve the right to increase prices, he must clearly inform the Customer thereof in the written order confirmation.
b) The Supplier shall inform the Customer as soon as a surcharge is imposed.

9. Force majeure
Strikes, lockouts, conflagrations, explosions, wars or warlike conditions, substantial restrictions on supplies and other circumstances outside the Supplier's control entitles the Supplier to cancel the agreement without any liability in damages.

10. Liability for property /infliction of damage
The Supplier shall not be strictly liable for property kept in hotel rooms or on the Supplier's premises. Should it prove that the Supplier or his employees have acted recklessly or negligently or otherwise bear the blame for property being lost or damaged, the Supplier shall be liable for the lost/damaged property. The Supplier shall also be liable for property kept in storage rooms locked by the Supplier, unless such property is of particularly high value (see clause 5). The Customer shall, for his part, be responsible for damage that he himself or his participants negligently inflict upon the Supplier.

11. Disputes
To resolve legal disputes or uncertainties relating to conferences and other events, the Disciplinary Board of
Visita is at the disposal of both parties free of charge. Visita's corporate members have undertaken to adhere to the decisions of the Disciplinary Board.

Applicable from 1 January 2006.

Visita, Sveriges Hotell- och Restaurangföretagare ¤ Box 3546 ¤ 103 69 Stockholm ¤ **T +46 8 762 74 00** ¤ info@visita.se

15.6.2018 / FP

Dear all

We have prepared the following draft seminar budget – still including quite some uncertainty - as indicated below. – The big uncertainty is of course still the number of participants. This has so far been set at 120. With the reservation made in Finlandshuset for 15 and 16 January 2019, we now use the figures from this reservation (all figures including VAT):

Needed:

Conference room – 15 and 16 January 2019: 38,625 SEK

Day 1 – afternoon coffee break: 86 SEK per person – 10,320 SEK

Day 2 – meal package – full day: 426 SEK per person – 51,120 SEK

Travel expenses – speakers: 50,000 SEK

Book of abstracts: 20,000 SEK

Roll ups, tags, pens etc.: 10,000 SEK

Needed – in total ca. 180,000 SEK

———

Very nice to have:

Reception day 1 in the evening: ca. 30,000 – 50,000 SEK.

———

Besides this we have also considered:

A new NKS pamphlet updated in 2018 and printed for the seminar can be produced by means from the ordinary 2018 budget.

At the moment we think it's very difficult to be more specific about the budget, so we are looking very much forward to your comments.

Conclusion: The funding for the seminar from the board is (as already in the 2018 budget) 100,000 DKK and a reservation of 100,000 DKK for the 2019 budget, which should be fully sufficient. Of course still depending very much on the final number of participants. 200,000 DKK corresponds to ca. 265,000 SEK.

Best regards
Kasper, Christian and Finn

NKS in the future:
Length, number and funding of projects – discussion paper

Introduction

This paper is developed by the PC's in consultation with the NKS Chair as a reflection on the different views that were presented under the topic "NKS in the future - Length, number and funding of projects" at the NKS Board meeting in Reykjavik on 18 January 2018.

The following suggestions to improve the use of available funding were highlighted at the January meeting:[1]

- DEMA: *Fund larger projects, lasting up to three years. This would, other things equal, reduce the number of projects and thereby administration and would make it possible to fund Ph.D. projects in cooperation with research institutions, a step which could further enhance the quality of NKS' work.*
- SSM: *One way of increasing the efficiency and thus use the funds better, could be to let projects run on a longer term than one year, thus avoiding some of the administration.*
- SIS: *Reduce the funding for each NKS-project allowing more projects to receive funding.*
- VTT: *It might be reasonable to concentrate on fewer topics in NKS*

Some additional input was received in response to the first draft of this paper that was sent to the NKS Board on 23 March 2018.

- Vattenfall: *No additional comments. Agree with conclusions.*
- DTU: *The draft is an excellent platform for discussions. No additional comments.*
- NRPA: *The process with annual projects like today is beneficial. Successful projects can apply for a continued financing, if they have delivered the report and application for further financing on time. Having projects with longer duration and no annual deliverable, would not be desirable as it might slow down the activity pace and it would take longer for the PC to discover any problems in deliveries. The amount granted to each project is appropriate, as is the number of proposals for the time being. We do not see any need to change this. Annual calls will ensure the possibility for the Board to change focus on a short notice if new, emerging topics arise that they would like to address specifically. There should be a maximum sum for arranging workshops/seminars, e.g. 250 or 300 000 DKK. If a series of workshops is financed, it would be appropriate to have it not more often than once every two years.*
- SSM: *The correct title is "Decomissioning incl. Decomissioning Waste", which means research on spent fuel is not included.* (The comment is handled in the discussion paper on "Division between NKS R and B").

This paper is intended to provide input for further discussions on this topic at the next NKS Board meeting in Copenhagen in June 2018. Data from the NKS Board decisions following the Calls for

[1] Draft minutes, Appendix A: "*Proposals and suggestions from reflections over NKS future directions by owners and board members" dated 17 January 2018 including "Conclusions – NKS Board 18 January*".

Proposals (CfPs) during the years 2010-2018 are presented together with an analysis on the funded networks and activities within the different research areas of the R- and B-programmes. Some aspects related to the above suggestions are discussed to support the general recommendation from the PC's to keep the current funding model.

Data on funded activities in CfP 2010-18

Below are some statistics on the length and number of funded activities in NKS-R and NKS-B during the years 2010-18.

NKS-R

There are 30 activities labelled as "new" from the NKS board decisions within NKS-R during the years 2010-18. There were 42 decisions on continued activities during the period, of which five proposals were selected in 2010 as continued activities from previous years.

The distribution between new and continued proposals is shown in Figure 1. On average half the approved proposals in each call are new and the other half are continued activities. The average length of the projects that were started 2010 or later and that have been completed until now, is ca two years.

The total number of launched activities is 72 and 35 different acronyms are found for NKS-R activities during this period, see Table 1. The 35 acronyms are represented by ca 12 networks, i.e. groups of organizations. The most active organizations are VTT, IFE, KTH, CTH and Chalmers (CTH). Risk Pilot, Risö and Lund University (LU) are also involved in several activities.

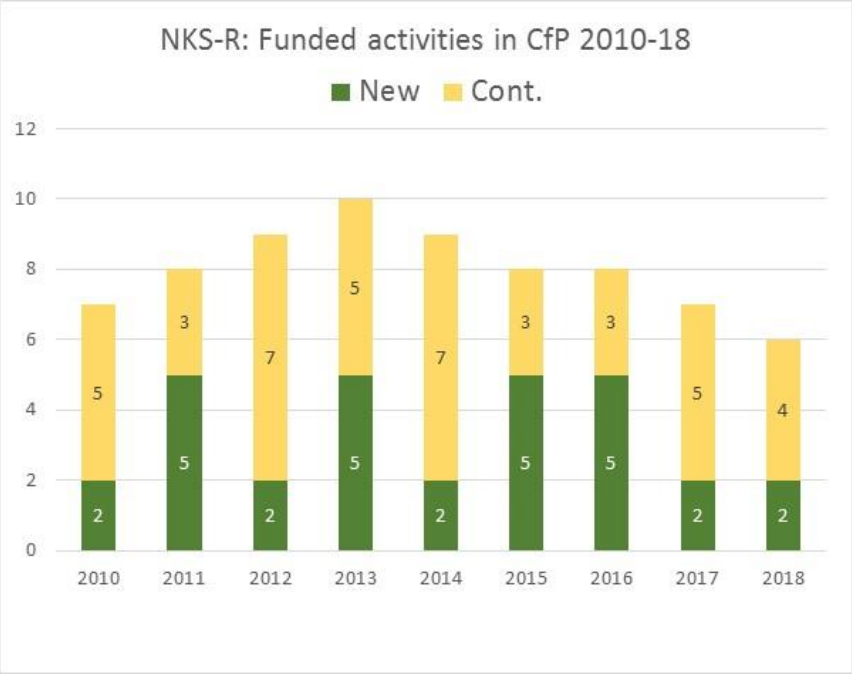

Figure 1. New and continued activities for NKS-R in 2010-18.

NKS-B

There are 55 activities labelled as “new” from the NKS board decisions within NKS-B during the years 2010-18. There were 24 decisions on continued activities during the period, of which three proposals were selected in 2010 as continued activities from previous years.

The distribution between new and continued proposals is shown in Figure 2. On average about 70 % of the approved proposals in each call are new and the rest are continued activities. The average length of the projects that were started 2010 or later and that have been completed until now, is ca 1.3 years.

The total number of launched activities is 79 and 55 different acronyms are found for NKS-B activities during this period, see Table 2. The 55 acronyms are represented by a relatively high number of individual activity networks, although some longer-term networks (with a few changing members) have existed in the period. The most active organizations are NRPA, SSM, STUK, DTU, DEMA, IRSA, IFE and FOI, although, e.g., DMI, U. Gothenburg, U. Lund and SIS have also been involved in many of these activities.

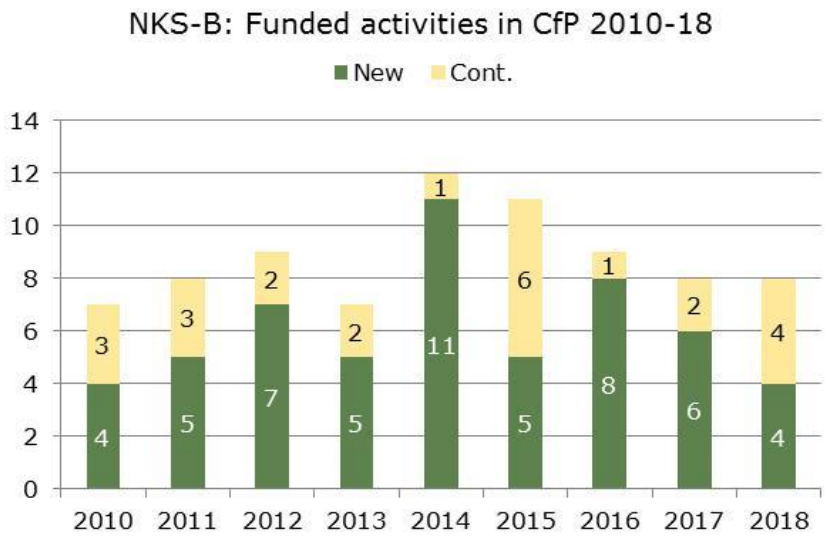

Figure 2. New and continued activities for NKS-B in 2010-18.

NKS-R Research areas

Thermal Hydraulics (TH)

The area has been dominated by the collaboration between Lappeenranta University (LUT), VTT and KTH. LUT is providing data from thermal hydraulics experiments from a unique facility relevant to Finnish and Swedish boiling water reactors (BWR). VTT and KTH are using the data for analytical work with computational models. The POOL project started in 2007 and was followed by ENPOOL in 2011 and COPSAR in 2015.

The network between Lund University (LU), VTT and some other partners is also found in this area (POOLFIRE). This network is also found under Risk Analysis and Probabilistic Methods (FIREBAN).

Severe Accidents (SA)

There are essentially two networks within this area that have been supported by NKS, one network for fission product chemistry (NROI, AIAS and ATR by CTH and VTT) and one coupled to physical phenomena during severe accidents (INCOSE and DECOSE by KTH, VTT and SPARC, which also involves LRC).

RASTEP, which was run in 2011-12 used Probabilistic Methods but is classified as a Severe Accident project due to the application in this area. DPSA and SPARC are also involving Probabilistic Methods in severe accident research.

Risk Analysis and Probabilistic Methods (RA/PM)

There are about four networks involved in this research area.

There is an overlap in some activities where Probabilistic Methods are used for studies of Severe Accidents (e.g. SPARC). The network between KTH, VTT and LRC appears also in this area in the project DPSA and L3PSA.

Another network is found between Lund University (LU), VTT and some other partners. There projects (POOLFIRE and FIREBAN) are classified as different research areas, thermal hydraulics and risk analysis, respectively.

A third network is found between VTT, Risk Pilot and some other partners (DIGREL, MODIG and SITRON).

A fourth network is found between VTT and some other partners (ADdGrOUND and SYNTAGMA).

Exam-HRA was a one-year activity led by ES-konsult/ÅF.

Organisational Issues and Safety Culture (Org/SC)

There are essentially two organisations leading activities in this area.

There is one network led by VTT (MOSACA, SADE and SC_AIM).

Another network is led by IFE (MoReMo, HUMAX, ProCom, LESUN and PLANS).

Reactor Physics (RP)

There is one network between IFE and Chalmers (IACIP and HYBRID).

Plant Life Management and Extension (PLMX)

New reactors was a topic included in this area with project from a network between VTT, IFE and Risö (NOMAGE and Nordic-Gen4 (Seminars)).

Lately projects related to ageing have involved KTH, Inspecta and others (BREDA-RPV and WRANC).

Decommissioning incl. Decommissioning Waste (Decom)

IFE has led workshop/seminar activities with many partners (Decom-seminars and NORDEC).

NKS-R characteristics

Some of the research areas are represented by a handful of partners from the major organisations in the Nordic countries. This is apparent with Thermal Hydraulics, Reactor Physics and Severe Accidents since many years, which are areas that are covering topics that are specific for reactor safety but not to other areas. Many activities are highly specialized and performed at a high international level. The activities receive continued funding simply because they are delivering good research. The level of co-funding is usually high. The POOL-ENPOOL-COPSAR collaboration between LUT, KTH and VTT in the area of Thermal Hydraulics is one example of a long term engagement from NKS-R. The collaboration of KTH, VTT and LRC is also representing a strong axis in Severe Accident research, which has received long term support from NKS-R.

A high degree of reactor specific research is also found in the area of Plant Life Management and Extension and the area of Decommissioning incl. Decommissioning Waste. The areas of Risk Analysis & Probabilistic Methods and Organisational Issues & Safety Culture show more variety in partner constellations. A reason for this difference might be that the latter two areas are not solely related to reactor safety. They most likely involve aspects from other business areas as well, which makes room for a larger variety of collaboration partners.

NKS-B Research areas

Emergency Preparedness (E)

Many different topics have been dealt with in E activities in this period. However, some networks have carried out several activities in the period. These include a network headed mainly by SSM on dosimetry (PIANOLIB, THYROID, THYROIDSEM) – this was placed under the E heading although it might be a better fit under the M (measurements) heading, a network headed by DMI on atmospheric dispersion (MUD, FAUNA, MESO, AVESOME), and two networks headed by NRPA on respectively mobile measurements (MOBELAD, GAMFAC) and measurement exercises (ORPEX, GASMAT) - both under E and not M. There is also a network headed by Lund U. on identification of radioactive material out of regulatory control (MOMORC, AUTOMORC).

Measurement Strategy, Technology and Quality Assurance

Here there have been quite many activities, but only one real long-term network. This is however the longest living of all on the NKS-B side, producing the gamma spectrometry seminars/workshops that have run in 8 of the 9 nine years, although the activity name has usually been changed from year to year, and activities have had many different leaders from five organisations/countries (IFE, DTU, FOI, IRSA, STUK). The network has following a decision made at the January 2018 NKS Board meeting been informed that no proposals will be accepted on this topic for activities in 2019.

Radioecological Assessments (R)

Here the long-term network activities have primary focused on releases to the aquatic environment (COSEMA, EFMARE) – headed by NRPA, VTT or DTU, and radiochemistry methods for various applications (RADIOANALYSIS, RAPID-TECH, STANDMETHOD, OPTIMETHOD) – headed by DTU. The

former of these networks has emerged (with some changes) from the earlier PARDNOR network, which however worked with an entirely different topic: consequence modelling parameters for contaminated agricultural areas.

Waste and Discharges (W)

While there have been a few proposals in the W area over the period in question, none of these have been supported for financing.

NKS-B characteristics

Compared with the parallel R area, the NKS-B seems to have had more activities that are not strongly related to each other. The reason for this may be sought in the typical co-financing models, where NKS-R financing often enters a large money pool that is used together with larger sums from other financiers to finance more ambitious – and thus often more long-lasting projects. However, it is also clear from this analysis that more ambitious NKS-B activities can run over a number of years, producing valuable 'stand-alone' results each year. By changing focus somewhat in each year such networks have managed to keep proposals attractive, and results can together constitute a bigger picture.

Since gamma spectrometry proposals with (mostly) new titles have been submitted for nearly all years as 'new' proposals, the numbers of actually new NKS-B activities can be said to be slightly overrated in Figure 2. Another feature of NKS-B is that proposals can often fit under several of the NKS-B research areas. For instance, a radioecology (R) activity to investigate radioecological (perhaps radionuclide uptake) model parameters may also be placed under the M research area, as it would typically involve measurements, and under the E research area if the radioecological model is intended for emergency management decision support. Sometimes, for instance gamma seminar proposals have been submitted under E, although mostly under M.

Discussion

Financial stability - Funding for several years would make it easier for partners to have a long term planning for their projects as the financial situation would be more secure.

Less funding in the annual calls - However, there would be less funding available for other applicants in the annual calls if a portion of the funding is already taken by activities that are running for more than one year. This might reduce the level of interest for researchers to apply to NKS.

Less flexibility for NKS board to shift focus - Less available funding in the annual call would provide less flexibility for the NKS board to support upcoming areas of interest or to change priorities

Less new networks - Less available funding is also affecting the opportunities to support new networks and collaborations.

Minor effects on PC workload - The effect on the workload for PCs would depend on the level of reporting we would expect from an activity that are running for several years. Status reporting would be unaffected but the question comes whether we would still ask for an annual report, or if it would be sufficient with a final report after the final year. However, the final report after several years of research is likely to be more extensive than after one year, so the workload for PCs may not be affected after all.

Less efficient quality control - Quality control would be affected negatively if less reporting is expected for continued activities. The one-year maximum for funding offers an annual check-point for quality control of the projects. The evaluators and the board are taking part in this quality control by approving continued proposals. It would be difficult to stop an ongoing project after the first year, in case it does not meet the quality expectations. Also, if there is not a requirement to deliver annual progress reports in fully publishable quality for upload on the NKS website, and no understanding that the project will not continue without this, there is a risk that the timely delivery and quality of progress reports will decline, and not make it possible to adequately judge the quality of the ongoing work.

Minor effects on evaluators' workload - The number of proposals for evaluation would decrease slightly as the continued activities do not need to participate in the calls the following years. However, the number of rejected proposals is likely to be the same, unless we have less applicants submitting proposals. For example, if three out of six activities are continuing for more than one year, then there would be the option of selecting three new proposals for funding. If the application rate is unaffected, then there would still be about twelve proposals for evaluation every year instead of fifteen.

Minor effects on contracts and invoicing – There would be less contracts but contract writing is not very time consuming. The number of invoices would not be affected by the length of the contract, unless the full amount is paid at the beginning of each year instead of having it divided into two parts.

Funding more activities each year – This might be possible if we lowered the maximum funding for each activity. This might increase the diversity of activities (depending on proposals), but reduce the achievable progress in one year. As it takes time to write a proposal, we should not expect that the number of proposals would increase accordingly. We could thus end up financing some proposals of less quality.

Funding fewer activities each year – This would make it possible to do more each year in an activity. However, to increase funding for each activity significantly, a reduction would be needed of the number of possible operating networks from the current typically 6-8 to probably maximum 4-5 in each programme, which would mean a serious reduction in diversity compared with the topics we have covered under the many research areas so far.

Recommendations

The recommendation is to keep the current model with one-year contracts. Single exceptions may possibly be justified if there are clear reasons to support an activity for several years. However, on the background of current experience it is difficult to see that the advantages of such a change would generically outweigh the disadvantages.

The maximum level of funding is reasonable based on the current NKS budget. For NKS-R it normally allows funding for about six activities per year, and for NKS-B for about eight activities per year. More details from the applicants on how the funding is to be used could give better understanding of whether the funding requests are reasonable. However, this would also make the application writing and reviewing processes more complex and time-consuming.

Table 1.

Area	2010	2011	2012	2013	2014	2015	2016	2017	2018	Networks
TH	POOL[a]									LUT, VTT, KTH
TH		ENPOOL	ENPOOL	ENPOOL	ENPOOL					
TH						COPSAR	COPSAR	COPSAR		
SA	INCOSE[b]									KTH, VTT, LRC and others
SA			DECOSE	DECOSE	DECOSE	DECOSE				
SA							SPARC	SPARC	SPARC	
SA				DPSA	DPSA					
SA		RASTEP	RASTEP							
RA/PM				L3PSA	L3PSA	L3PSA	L3PSA			
SA	NROI[c]									CTH, VTT
SA		AIAS	AIAS							
SA					ATR	ATR				
RA/PM	DIGREL	DIGREL	DIGREL	DIGREL	DIGREL					VTT, Risk Pilot and others
RA/PM						MODIG				
RA/PM									SITRON	
TH		POOLFIRE	POOLFIRE	POOLFIRE						LU, VTT and others
RA/PM							FIREBAN	FIREBAN	FIREBAN	
RA/PM						ADdGROUND	ADdGROUND			VTT and others
RA/PM									SYNTAGMA	
RA/PM				Exam HRA						

a) POOL began in 2007.
b) INCOSE began in 2009.
c) NROI began in 2008.

(Yellow marks the first year of the activity)

Area	2010	2011	2012	2013	2014	2015	2016	2017	2018	Networks
Org/SC	MOSACA[d]									VTT, KTH and others
Org/SC		SADE	SADE	SADE						
Org/SC							SC_AIM	SC_AIM		
Org/SC		MoReMO	MoReMO							IFE, VTT and others
Org/SC				HUMAX	HUMAX					
Org/SC					ProCom					
Org/SC						LESUN				
Org/SC						PLANS				
RP	IACIP[e]									IFE, CTH
RP							HYBRID	HYBRID		
PLMX		NOMAGE								VTT, IFE, Risö
PLMX			Nordic-Gen4		Nordic-Gen4					
PLMX							BREDA-RPV		BREDA-RPV	KTH and others
PLMX								WRANC		
Decom	Decom-sem			Decom-sem						IFE and many others
Decom								NORDEC	NORDEC	

d) MOSACA began in 2008.

e) IACIP began in 2008.

(Yellow = first year activity)

Reflections on prioritized areas.

Based on discussion note from the NKS Chair to the NKS Board on 15 Feb. 2018.

Background:

One of the issues discussed at the January meeting of the NKS board regarding the future direction of NKS was that of prioritized areas and more considerations of strategic guidelines for projects to be selected for funding.

From the draft minutes of the January meeting there is the following outcome of the discussion.

Conclusions: *The discussion reflected different views in the Board and that "prioritized areas" are implicit in our evaluation i.e. relevance for end users and mean ranking as well in final ranking. PC´s, in consultation with the Chair, to develop a discussion paper taking into account the discussion at the board meeting. Draft paper to be circulated to board for comments in good time before June meeting.*

In the e-mail of 15 February the following was offered for the Board´s consideration:

1. The question is if it is advantageous for NKS to narrow the scope of CfP and only accept applications in some pre-determined areas of work (prioritized areas) or to give applications in some pre-determined areas of work higher priority than applications in other areas covered by NKS. The prioritized areas could change from one CfP to the next as decided by the NKS board. The conclusion of such a change would be that the research area was considered to be more important than the other present NKS criteria, e.g. technical standards, measureable goals or young scientists.

2. In the past there have been some rather loose guidelines for potential applicants in the framework documents, for instance on the B side mentioning the importance of learning and compiling new data from the Fukushima accident for the Nordic preparedness. This was intended as guiding examples of where application focus could be beneficial, thus increasing inspiration for new ideas, rather than setting limitations for what applications are accepted.

3. There is need a consensus among the NKS owners on which research areas are most important to focus on in order to change (narrow) the scope of CfP. The process to identify these areas is not straight forward and requires a good overview of not just what is in the immediate interest of the NKS owners and "tillægsfinanserere " but also a careful consideration of long-term strategy for the (strategic) research needed. The process of obtaining consensus may even be more difficult given the very different marks the same application is given by different end-users i.e. regulators and industry. This can be clearly seen in the evaluation of the last CfP.

4. Narrowing the scope of CfP would probably give fewer (and not necessarily more useful or better) activity proposals for the NKS board to choose between. It is probable that NKS would need to compromise on quality and fund projects that would not be funded if the number of applications was higher. The number of proposals NKS receives through the CfP has been satisfactory in most years. The applicants have a fair chance of receiving funding, up to 50 %, which is quite high. The broad scope of CfP as is now has not been a problem in terms of number of proposals received or funding requested versus available funding.

5. The CfP´s have been open to a broad range of applications that fall within the NKS scope of activities. In the present evaluation process there are clear criteria (priorities) according to which the applications for funding are evaluated. Through this process, in particular through the criteria "relevance for end-users" as well as in the overall mark, ranking and funding recommendations "end ? users" (evaluators) priorities (" prioritized areas ") are reflected. This can be clearly seen by looking at the evaluation of the last CfP. Thus one can say that the prioritized areas is addressed in the present process but not in a formal way.

In conclusion it is not clear to me at all if it would be advantageous for NKS to narrow the scope of CfP´s with focus on pre-determined areas of work. I look forward to your views and input before the end of February.

Comments on discussion note from the NKS Board:

21.1.2018 Ole H

Dear all,

Thanks to the chairman for sharing some thoughts with the Board. I understand the possible negative consequences of narrowing the CfP too much. However, it has happened before that we have given signals regarding on which topics we especially welcome proposals (e.g. decom and waste).

I think it is worthwhile every May/June Board meeting to spend some (more) time discussing and possibly adjusting the CfP-framework on R and B. Having read, again, the B-framework, an observation is that it covers all aspects of EPR. Based on an analyses of recent years profile of the funded program, it could be reached a consensus within the Board on which parts of the B-framework where we really wish to see proposals.

Best regards Ole

21. feb – SMM

Dear Ole

Many thanks for your input. It may well be that the Framework is too broad but the consequences of any change needs to be carefully assessed before implementation. A text in the CfP clearly saying that NKS welcomes in particular proposals addressing …. Or similar could work. The proposal to discuss and possibly adjust the CfP-framework on R and B at the May/June meeting is good.

Looking forward to input from other members of the NKS board.

Best regards, Sigurður

26. Feb Anneli H

Dear all,

with a special thanks to the chairman for inviting us to have all to comment on the draft discussion paper already now. As far as I can see, the draft will provide an excellent basis for our discussions in June.

Kind regards Anneli

26. Feb SMM

Dear Anneli

Many thanks. I share your view that the draft is a good basis for the discussion to take place at the June meeting.

Best regards, Sigurður

30. Feb Jorma to SMM

Dear Colleagues,

as February 30 is now, I know what you others have been writing, but my honest opinion is, that we should not start to prioritize CfP more than is done with the normal development in the research, ie. that everyone is now talking of decommissioning etc. And I would use "thought number 4" to back my opinion. And because I am not even an evaluator I can testify that our system is most probably bring nice fruits.

Best regards, Jorma

3. March Carsten to SMM

Dear Board Members,

Sorry for my late reply to this - hope that my views can still be considered.

I agree that priority should always be given to projects of the highest quality. The consequences of having a too narrow scoop for applications could be fewer applications and, as Sigurdur mentions, a risk that we will not be able to identify projects of high enough qualities within a prioritized area.

The number of applications to NKS is, as it is now, acceptable - but not overwhelming. Narrowing the scope of CfP could bring down the number of applications to a level where it would be difficult to justify the amount of funding and effort that is put into the NKS organisation.

Having said that - noting wrong with signalling to potential applicants, if certain research areas are of particular high interest for NKS (Fukushima, decommissioning, etc). However, there should not be any amount of funding sat aside for prioritized areas, as funding should always follow the best projects.

As for the B-program, the present description of funded activities pretty much covers all aspect of EPR and, as far as I am concerned, it could be expanded with fx. decommissioning and waste. Then that would not be to narrow the scope, but to expand it.

I am looking forward to discuss this further at the upcoming NKS meeting in Copenhagen.

Best Regards, Carsten

5. March Tarja

Hi all,

I agree with Carsten.

With best regards, Tarja

5. March SMM to the NKS Board.

Dear Carsten, dear all

Many thanks for your reflections. It seems that there is good agreement with the way forward.

The reflections of 15. February will serve as “discussion paper” for the discussion to take place at the June board meeting.

Best regards, Sigurður

14/5 2018:

Conclusion:

Comments from the NKS board indicat broad support for the conclusions of the discussion note and that the note is a good starting point for the discussion to take place at the NKS board meeting in June. There are suggestions that NKS could give signals regarding on which topics NKS especially welcomes proposals (e.g. decom and waste) and that it is worthwhile every May/June Board meeting to discuss and possibly adjust the CfP framework on R&B.

14.5.2018

SMM

Division between NKS-B and NKS-R

Introduction

This paper is developed by the PC's in consultation with the NKS Chair as a reflection on the different views that were presented under the topic "Division between NKS-B and NKS-R" at the NKS Board meeting in Reykjavik on 18 January 2018.

The following suggestion on the division between NKS-B and NKS-R was noted at the January meeting:[1]
VTT: Critical evaluation of the division between NKS-B and NKS-R. It seems that in the future more and more topics may appear that could fit in either programme. Should the topical division between programmes be evaluated and perhaps redirected.

As pointed out by NRPA in an email sent on 12 February 2018, 'the division between R and B is primarily challenged when it comes to decommissioning and waste management proposals'. This viewpoint is supported by comments from reviewers of NKS CfP2018 proposals. Also, as discussed at the January Board meeting, the attention on decommissioning and waste management problem solutions would be expected to increase over the following years in the Nordic area, and more NKS activity proposals in this field are thus expected. An effort is particularly needed to draw clearer borders between the two NKS programmes in this context, whereas there seems to be a clear-cut and logical distribution of other current working areas between the two NKS programmes. IFE even suggested that the area of waste and decommissioning could become a separate NKS area in addition to R and B[1]. However, this would require considerable administrative changes in NKS, and at this time it does not seem to be justified by the number of related proposals. NRPA on 30 April 2018 supported the 'option 1' described in page 5 of this document, but wrote that a certain percentage of the CfP budget might be earmarked for decommissioning activities. As outlined in a separate discussion note[2], 'prioritised areas' for CfP's could be problematic for a number of reasons. 'SIS proposed more emphasis on management of radioactive waste from non-nuclear energy production, and STUK suggested a diversification into waste management and non-proliferation[1].

It was recently correctly pointed out by SSM that the 'B' programme is not limited to 'beredskap', although the letter 'B' originated from that word. Although it may be tempting to replace the letter 'B' with one that can easier be explained by the programme's content, it may be expected that a change of the established R & B approach (where the letters are now detached from their original meaning) could lead to some confusion and mistakes on the user side at least over the first years.

This paper is intended to provide input for further discussions on this topic at the next NKS Board meeting in Copenhagen in June 2018. A description is first given of the current definitions in our supporting texts (particularly the two Programme Framework Documents) in our website. Then an overview follows of characteristics of recent relevant activities. This leads to a section with possible solutions to the problems, particularly giving detailed descriptions of the implications of each of 3 identified options. Finally, the

[1] Draft minutes, Appendix A: "*Proposals and suggestions from reflections over NKS future directions by owners and board members" dated 17 January 2018 including "Conclusions – NKS Board 18 January*".
[2] "Reflections on prioritized areas", discussion note from the NKS Chairman to the NKS Board by email, 15 Feb. 2018.

changes required in connection with the recommended option are outlined together with those required from each of the two alternatives.

Current status:

NKS Guidance documents and texts

In the current NKS-R Framework, the research area 'Decommissioning, including decommissioning waste' is exemplified by the following topics:

- Decommissioning and dismantling of research reactors
- Involvement of the Nordic stakeholders
- Legal requirements in the Nordic countries on decommissioning projects
- Experiences from decommissioning projects

In the corresponding NKS-B Framework the research area 'W: Waste and Discharges' is exemplified by these topics:

- Waste and discharges from decommissioning activities
- Cost assessments of decontamination measures and remediation
- NORM waste from uranium mining and milling
- Interventions and clean-up operations
- Disposal of radioactive sources

There is an apparent overlap between R and B when it comes to waste from decommissioning, since there is an NKS-R area labelled 'Decommissioning, including decommissioning waste' but 'waste and discharges from decommissioning activities' is used as an example for B-activities in the area of 'W: Waste and Discharges'.

Moreover, the NKS-B programme comprises 'measurement strategy, technology and quality assurance' (e.g., 'radionuclide analytical techniques and intercomparisons') focusing on measurement processes rather than measurement purposes (which may for example be classification of decommissioning waste).

The following text related to decommissioning is taken from the NKS-B Framework:

'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, management and monitoring issues relating to decommissioning waste can be complex and require specialised developments. During the last 30 years or so, significant amounts of experience and knowledge regarding consequences of radioactive discharges, fallout and environmental radioactivity have been gained. 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'.

In the NKS-R Framework, the following text is found:

'Priority is given to activities in the area of operational reactor safety. Other operational or economic issues should be given lower priority. Ongoing national and international research (and cooperation with such programmes) will also be taken into account in assessing activities.

The nuclear industry and nuclear 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 uprates, ageing issues, decommissioning and dismantling, waste disposal and new nuclear facilities'.

These categorisations and texts have not in the past led to conflicting treatments or questions from the applicant community, although they seem to have remained rather unchanged over more than 10 years. In connection with CfP2018 new interpretations of the unclear texts arose among the applicants (together with new proposal coordinators). The CARBTECH proposal on carbon-14 radiochemistry and measurement in connection with decommissioning was originally submitted to NKS-R, but the indicated research area was 'measurement strategy' which belongs to the NKS-B programme (neither NKS-R nor NKS-B supported the financing of this proposal).

The CfP 2018 proposal COCOS, on corrosion of copper canisters for repository of waste fuel, was submitted to NKS-B but not considered eligible since there were only two Nordic countries involved. Therefore, it was hastily resubmitted to NKS-R for evaluation under 'decommissioning incl. decommissioning waste'. The reviewers of NKS-R argued that this proposal belonged to the B programme under the 'waste management' heading, since it was dealing with another type of waste than decommissioning waste. However, historically a wider definition of waste has been applied in the NKS R programme (see below) and it can be discussed whether a proposal dealing with management of fuel waste from the nuclear industry belongs in the B programme.

Recent relevant NKS activities

The decommissioning related activities that have run in NKS over at least the latest 8 years seem to have largely fallen in two categories:

(i) B activities on **measurement** of 'difficult to measure' radionuclides, which particularly pose a problem in relation to decommissioning waste exemption procedures, some of which may equally well be used for other purposes such as emergency management, and some of which are directed more specifically at radionuclides and materials relevant to decommissioning.

(ii) R activities on essentially **all other** aspects of decommissioning than radionuclide analysis (over decades, the number of such activities has actually been rather limited, but both activity categories would be expected to increase in number with the current increasing interest for decommissioning issues).

Over the same period there has only been one proposal to NKS-B under the waste and discharges heading (SAFEBORE in CfP2018), and this was not funded, as some NKS reviewers found that the scope lay outside the working area of NKS.

A total of eleven activities on 'difficult to measure' radionuclides have run in the latest eight years. All proposals were submitted to NKS-B ('measurement strategy, technology and quality assurance') and all activities ran under NKS-B. A look at the organisations that have participated in these (Table 1) confirms that many of the organisations involved generally have much greater experience in measuring radionuclides than in decommissioning operations. By far most of the activities have been led by DTU.

Table 1. Organisations participating in min. 2 of the 11 'difficult-to-measure' NKS-B activities 2011-2018

Organisation	Number of activities
DTU	11
STUK	6
SSM	5
FOI	5
IFE	5
U. Helsinki	4
NMBU	3
NRPA	2
ALS Scandinavia	2
NPP's	2

It should also be noted that a search in the NKS report base under 'NKS-R decommissioning' shows some 50 NKS-R reports. About 40 of these are from the 1980's and 1990's and were made under a research area simply called 'waste'. The reports in this area deal with many types of waste, low and medium level waste, final repositories and sometimes include waste fuel and reactor waste from operation. A search under 'NKS-B decommissioning' shows 30 reports (dating back to 1993). The essential topic in all these is measurement techniques. A search under the NKS-B research area 'Management of radioactive waste and discharges' shows only 3 reports (2 old reports on measurement techniques and one more recent report on non-nuclear waste management – the task commissioned in 2015 by the Nordic Council of Ministers).

Possible solutions and their implications:

Various solutions to the problem may be envisaged:

One possible way of dealing with it, which has been suggested by VTT in a mail dated 12 February 2018, is that 'if the project aims at development of some new technology to be used e.g. in decommissioning, it should be part of the NKS-R. But, if the project aim is that it applies some already existing knowledge to solve some e.g. decommissioning procedure or process that has already radiation safety aspects, it should then be part of NKS-B'. However, it may well prove difficult for an applicant to judge, for example, which measurement techniques can be considered to be new and existing technology in this context. A very careful and more nuanced wording would be needed, and it seems currently not clear how to make the cut.

Another concern in setting the border between the two programmes in relation to decommissioning and waste treatment is that the distribution between proposals in NKS R and NKS B should ideally reflect the

available funding for each programme area. As shown in Table 2, we currently have an almost exact balance (over the latest 5 years) between the numbers of proposals received for each programme. The NKS-R activities are generally a bit more expensive, which means that a bit fewer R activities than B activities can actually be financed.

Table 2. Amounts of money applied for and number of NKS-R and NKS-B proposals 2014-2018

	MDKK applied for		Number proposals		Funded proposals		Budget, MDKK	
	R	B	R	B	R	B	R	B
2014	9.0	8.2	17	18	9	12	3.75	4.5
2015	7.8	5.1	16	13	8	10	3.4	3.4
2016	8.5	6.8	20	19	8	9	3.5	3.5
2017	6.9	6.4	14	16	7	8	3.1	3.1
2018	8.4	7.9	15	17	6	8	3.0	3.25
SUM	40.6	34.4	82	83	38	47	16.75	17.75

To clarify things and avoid confusion in the future, without affecting the balance that we have, three options were considered and analysed:

OPTION 1.

- Under the NKS-B heading 'Measurement strategy, technology and quality assurance' we add the following example: ***'techniques related to analysis of radionuclides in decommissioning waste samples'***. The expertise, both in terms of proposal applicants and reviewers, is here on the NKS B side.
- The NKS-R area 'Decommissioning, including decommissioning waste' becomes '***Decommissioning and reactor waste management (excluding measurements)***'. Decommissioning waste management (e.g., dimensioning of barriers) should be considered part of the nuclear energy production cycle and thus logically placed under the NKS-R programme. By adding 'reactor' this comprises both waste from decommissioning and fuel waste, but not waste that does not arise as an implication of nuclear power production. The COCOS proposal showed that fuel waste management proposals may be expected, although it was the first in recent times.
- As for the NKS-B heading 'Management of radioactive waste and discharges', no such activity has run in the latest 8+ years. There are five example points given in the framework program of what this heading comprises. These are: (i) Waste and discharges from decommissioning activities, (ii) Cost assessments of decontamination measures and remediation (iii) NORM waste from uranium mining and milling, (iv) Interventions and clean-up operations and (v) Disposal of radioactive sources. The first point is moved to the NKS-R programme. As for the 2nd point, cost assessments of decontamination measures and remediation, and the 4th point, interventions and clean-up operations, these are traditionally covered under emergency preparedness, and should really not be addressed in isolation (many NKS activity examples). If these are excluded (and we include TENORM in-line with the comments from SIS at the January meeting) we are left with **'management of non-nuclear radioactive waste including NORM/TENORM and disposal of radioactive sources'**, which could not possibly be confused with NPP waste management under NKS-R.

OPTION 2.
This option would be to include 'Decommissioning waste' in the B-area 'W: Waste and Discharges'. By doing so, all activities related to waste and analytical measurements would be covered by NKS-B. 'Decommissioning, except waste management and analytical measurements', would then belong to NKS-R. So far, the only thing that makes option 2 different from option 1 is that it places decommissioning waste repository construction and operation under NKS-B. Option 2 however so far does not implicitly offer a solution to the problem on where to place fuel waste management proposals. Placing this in the NKS-B programme together with all other waste management issues may look tempting, as it makes 'smooth' headings, but does construction and maintenance of facilities for nuclear fuel waste and decommissioning waste really belong in the NKS-B programme?

OPTION 3.
This option would be to have all activities related to decommissioning within NKS-R, including decommissioning waste and analytical measurements connected to decommissioning. NKS-B would then comprise 'measurement strategy, technology and quality assurance (except that related to decommissioning)'. Other waste issues would then still be associated with NKS-B ('NORM/TENORM waste management and disposal of radioactive sources'). It should be noted that as some measurement techniques may be used both in radioecological/emergency preparedness studies and in decommissioning studies, there may still be proposals that fall in both the R and the B area. Again, fuel waste management would need separate handling under a new area of the NKS-R programme. It should also be noted that this option, moving 'decommissioning waste measurement' proposals from NKS-B to NKS-R would be expected to increase the number of NKS-R proposals and equally reduce the number of NKS-B proposals, which is perhaps not what we need at this time.

Recommendations:

In short, the recommendation is to implement *Option1*:

(i) Changing the NKS-R work area 'Decommissioning, including decommissioning waste' to 'Decommissioning and reactor waste management (excluding measurements)'.
(ii) Clarifying in the framework text that the NKS-B work area 'Measurement strategy, technology and quality assurance' also comprises measurements on decommissioning waste samples.
(iii) Changing the NKS-B work area 'Management of radioactive waste and discharges' to 'management of non-nuclear radioactive waste including NORM/TENORM and disposal of radioactive sources'.

Alternatively, *Option 2* would be:

(i) Changing the NKS-R work area 'Decommissioning, including decommissioning waste' to 'Decommissioning excluding waste management and analytical measurements'
(ii) Including decommissioning waste in the NKS-B area.

(iii) Either creating a new NKS-R work area on fuel waste management, or putting fuel waste management under the same NKS-B heading as all other types of waste.

Option 3 would involve:

(i) Changing the NKS-B work area 'Measurement strategy, technology and quality assurance' to 'Measurement strategy, technology and quality assurance (excluding that related to decommissioning)'.
(ii) Including analytical measurements for decommissioning, as well as decommissioning waste management, in the NKS-R decommissioning work area.
(iii) Changing the NKS-B work area 'Management of radioactive waste and discharges' to 'NORM/TENORM waste management and disposal of radioactive sources'.
(iv) Creating a new NKS-R work area on fuel waste management.

NKS-R Status

June 2018

Christian Linde
NKS-R Programme Manager

NKS Board meeting
Copenhagen, 28 June 2018

Summary

Overall the work in NKS-R is progressing according to revised plans

- Status for the 7 activities from CfP 2017:
  - 2 activities completed (NORDEC and SC_AIM)
  - 3 activities planned to be completed in June/July (FIREBAN, SPARC and COPSAR)
  - 2 activities be completed later in 2018 (HYBRID and WRANC)

- Status for the 6 activities from CfP 2018:
  - Contracts signed for all activities - No delays reported
    (BREDA-RPV, FIREBAN, SITRON, SPARC, SYNTAGMA and NORDEC)
  - TVO support agreement signed
  - Fortum support agreement expected in June (submitted 27 April)

Status for activities from CfP 2017

Activity	Partners	Contract number	Final report received	Files sent to Risö	Report number
COPSAR	LUT	AFT/NKS-R(17)114/1	2018-03-22	2018-04-25	
	KTH	AFT/NKS-R(17)114/2			
	VTT	AFT/NKS-R(17)114/3			
FIREBAN	LU	AFT/NKS-R(17)119/7			
	VTT				
	AAU				
	DBI				
	RAB				
HYBRID	CTH	AFT/NKS-R(17)120/8			
	IFE				
SC_AIM	VTT	AFT/NKS-R(17)121/4	2018-01-31	2018-02-02	NKS-405
	KTH				
SPARC	KTH	AFT/NKS-R(17)122/9			
	VTT	AFT/NKS-R(17)122/10			
	LRC	AFT/NKS-R(17)122/11			
NORDEC	IFE	AFT/NKS-R(17)123/5	2018-01-31	2018-02-01	NKS-404
	NRPA				
	SSM				
	STUK				
	SIS				
	VTT				
	Vattenfall				
	Fortum				
	ÅF				
WRANC	Inspecta	AFT/NKS-R(17)124/6			
	KTH				
	SINTEF				

partly completed (LUT)

(July)

(December)

Delays at IFE as reported in December 2017

completed

(June)

completed

(September)

Delayed measurements at SINTEF

Status update on HYBRID 2017

1) The technical work at Chalmers and VTT is completed. The final report for their part of the project will be prepared and delivered to NKS in the early fall of 2018.

2) IFE has not been able to identify a suitable student for a Masters or Bachelors project. Alternatives to student participation are currently being considered involving resources from another project where relevant development work is being done (HRP). If knowledge can be transferred to HYBRID, then IFE is confident that it will be able to submit a completed report by December 2018.

Christian Linde
NKS-R Programme Manager

New NKS-R reports published on website

NORDEC

- NKS-404: *Challenges and opportunities for improving Nordic nuclear decommissioning* (Feb 2018)

SC_AIM

- NKS-405: *Safety Culture Assurance and Improvement Methods in Complex Projects – Final Report from the NKS-R SC_AIM* (Feb 2018)

SPARC

- NKS-408: *Phenomena Threatening Containment Integrity and Evaluating Source Term Characteristics* (June 2018)

COPSAR

- *PPOOLEX spray tests on mixing effects in condensation pool*
- *Mixing Test in PPOOLEX with Sparger in Centre Position*
- *General description of SEF-POOL test rig*
- *Characterizing tests in SEF-POOL facility*

4 reports from LUT
- to be published as appendices to main report

NKS-R seminars/conferences/publications

FIREBAN

- Workshop for PRA Integration (Probabilistic Risk Assessment) at VTT – November 2018

NORDEC

- Open workshop in Lillehammer – December 2018

Status for activities from CfP 2018

Activity	Title	Leader	Partners	NKS number	Contract number	Total funding kDKK	Partner funding kDKK	Contract received
BREDA-RPV	Barsebäck RPV trepan studies	KTH	KTH	NKS_R_2016_118	AFT/NKS-R(18)118/1	500	150	2018-02-21
			VTT				250	
			CTH				100	
FIREBAN	Determination of fire barriers's reliability for fire risk assessment in NPP.	LU	LU	NKS_R_2016_119	AFT/NKS-R(18)119/2	450	104,9	2018-02-13
			VTT				104,9	
			AAU				104,9	
			DBI				104,9	
			RAB				30,4	
SITRON	SITe Risk Of Nuclear installations	Risk Pilot (Fi)	Risk Pilot	NKS_R_2018_125	AFT/NKS-R(18)125/3	600	100	2018-02-02
			LRC				100	
			VTT				100	
			IFE				300	
SPARC	Scenarios and Phenomena Affecting Risk of Containment Failure and Release Characteristics	KTH	KTH	NKS_R_2016_122	AFT/NKS-R(18)122/4	600	255	2018-03-28
			VTT				224	
			LRC				121	
SYNTAGMA	Synthetic ground motions to support the Fennoscandian GMPEs	VTT	VTT	NKS_R_2018_126	AFT/NKS-R(18)126/5	600	277	2018-02-14
			UU				46	
			GEUS				46	
			CTH				231	
NORDEC	Challenges and opportunities for improving Nordic nuclear decommissioning	IFE	IFE	NKS_R_2017_123	AFT/NKS-R(18)123/6	250	175	2018-02-19
			NRPA				6,25	
			SSM				6,25	
			STUK				6,25	
			SIS				6,25	
			VTT				12,5	
			Vattenfall				12,5	
			Fortum				12,5	
			ÅF				12,5	

NORDEC - revised plan due to funding cut

Tasks

T1: Work meetings (discussions)

- Video/phone discussions will be held with the project partners around the main Nordic decommissioning challenge areas identified in 2017.
- Opportunities and models for establishing a platform enhancing Nordic collaboration within the main Nordic decommissioning challenge areas will also be discussed.

T2: Workshop preparation

- Presentations will be prepared by the project partners with focus on opportunities for enhancing collaboration within main Nordic decommissioning challenge areas.
- Demonstrations will be prepared by the project partners presenting new concepts related to the main Nordic decommissioning challenge areas and collaboration of Nordic countries.
- Administrative and technical preparatory work for the workshop will also be done within this task.

T3: Workshop

- An open workshop will be held with the project partners and invitees. The workshop is planned to be held as a mini-workshop immediately following a larger international workshop organised by the project coordinator (Lillehammer, December 6-7).

T4: Reporting

- A final report, mainly consisting of presented material and summaries from the workshop, will be prepared.

Main focus on work meetings and workshops!

Travel assistance for young scientists

Tiina Lavonen – Research Scientist at VTT (30 y.o.) M.Sc. planning for Ph.D.

"VTT is currently preparing for the decommissioning of FIR1 (TRIGA type) research reactor and we have done and are currently doing the characterization analysis for research reactor waste and construction materials. My part has been to analyze the original composition of different materials from FIR1 with HR ICP-MS. I would like to participate in ICP conference, Nordic Plasma Conference (10-13 June in Loen, Norway) and do a poster about our characterization analysis with HR ICP-MS."

NKS-R article

nks
Nordic nuclear safety research

Nordic research and development cooperation to strengthen nuclear reactor safety after the Fukushima accident

Christian Linde[1,2], Kasper G. Andersson[1,3], Sigurður M. Magnússon[1,4] and Finn Physant[1,5]

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NKS-R STATUS REPORT

Christian Linde
NKS-R Programme Manager
June 2018

Table of contents

1 Overall status summary

This report provides a short overview of the status of the NKS-R programme.

All contracts from the Call for Proposals (CfP) 2018 were signed by the end of March and the six activities are now ongoing according to plan.

Two activities from from CfP 2017 are completed (NORDEC and SC_AIM) and the NKS reports have been published, see below. A report from VTT SPARC in 2016 has been published in addition to the final report that was delivered in August 2017. LUT has submitted four reports that will be included as appendices to a main report for COPSAR that is expected in June. Reports from SPARC and FIREBAN are expected in June/July. Delays have been reported from HYBRID and WRANC.

Summaries of the acitivites with status updates are presented in Chapter 2 (2017 activities) and Chapter 3 (2018 activities).

1.1 Published NKS reports

The following reports have been published within the NKS reports series since the last board meeting in January.

Report nr	Project	Report Title	Published
NKS-404	NORDEC	*Challenges and opportunities for improving Nordic nuclear decommissioning*	2 Feb 2018
NKS-405	SC_AIM	*Safety culture assurance and improvement methods in complex projects*	2 Feb 2018
NKS-408	SPARC*	*Phenomena Threatening Containment Integrity and Evaluating Source Term Characteristics*	8 Jun 2018

*) The final report NKS-408 contains the contributions from VTT in 2016 that were missing in the SPARC final report NKS-395 that was published in August 2017.

LUT has submitted four reports describing the experimental work that has been performed in the COPSAR activity in 2017. These reports will be included as appendices to a main report that will be completed as soon as the contributions from KTH and VTT are available (expected publication in June).

Project	Partner	Report Title	To be published
COPSAR	LUT	*PPOOLEX Spray Tests on Mixing Effects in Condensation Pool*	As appendix in June
COPSAR	LUT	*Mixing Test in PPOOLEX with Sparger in Centre Position*	As appendix in June
COPSAR	LUT	*General Description of SEF-POOL Test Rig*	As appendix in June
COPSAR	LUT	*Characterizing Tests in SEF-POOL Facility*	As appendix in June

1.2 Seminars and publications in 2018

Project	Seminar date
FIREBAN	Workshop for PRA Integration – November 2018
NORDEC	Open workshop in Lillehammer – December 2018

1.3 Young scientist travel support

A request for travel support has been received from Tiina Lavonen – Research Scientist at VTT (30 y.o.) M.Sc. planning for Ph.D.

"*VTT is currently preparing for the decommissioning of FIR1 (TRIGA type) research reactor and we have done and are currently doing the characterization analysis for research reactor waste and construction materials. My part has been to analyze the original composition of different materials from FIR1 with HR ICP-MS. I would like to participate in ICP conference, Nordic Plasma Conference (10-13 June in Loen, Norway) and do a poster about our characterization analysis with HR ICP-MS.*"

2 Summary and status of activities initiated in 2017

Seven activities were were initiated in CfP 2017 (Table 1). Five of the activities were continued activities and two were new (NORDEC and WRANC). Two activities are completed (NORDEC and SC_AIM) and one is partly delivered (COPSAR).Final reports from COPSAR, SPARC and FIREBAN are expected to be delivered in June/July. Delays have reported from HYBRID and WRANC with expected deliveries later in 2018.

Summaries of the activities are presented in the following sections.

Table 1. NKS-R 2017 activities

Acronym	Activity title	First invoice	Second invoice	Report number	Expected Delivery
COPSAR	*Containment Pressure Suppression Systems Analysis for Boiling Water Reactors*	√			June[a]
FIREBAN	*Determination of fire barriers's reliability for fire risk assessment in NPP*	4/5			July
HYBRID	*Development of hybrid neutron transport methods and data visualization tools*	1/2			Dec
NORDEC	*Challenges and opportunities for improving Nordic nuclear decommissioning*	5/9	4/9	NKS-404	Done
SC_AIM	*Safety culture assurance and improvement methods in complex projects*	√	√	NKS-405	Done
SPARC	*Scenarios and Phenomena Affecting Risk of Containment Failure and Release Characteristics*	√			June
WRANC	*Warm Pre-Stressing – Validation of the relevance of the main mechanisms behind Warm Pre-Stressing in assessment of nuclear components*	2/3			Sep/Oct

a) Four reports were received from LUT in March. The reports will be included as appendices to a single main report for COPSAR.

2.1 COPSAR

Containment Pressure Suppression Systems Analysis for Boiling Water Reactors

Research Area: Thermal Hydraulics

Summary

Thermal hydraulics experiments on the behaviour of a safety relief sparger (SRV) and a containment spray system are carried out at the PPOOLEX facility at Lappeenranta University of Technology (LUT). The effectiveness of mixing a thermally stratified water pool due to injection through a sparger is studied. Modelling work is done at VTT Technical Research Centre of Finland Ltd (VTT) and at Kungliga Tekniska Högskolan (KTH).

Activity leader: Markku Puustinen, Lappeenranta University of Technology (LUT)
Funded organizations: LUT, VTT, KTH
Funding: 493 kDKK

Status: Partly delivered, final report expected in June 2018. Contributions have been received from LUT, see below.

2.1.1 Reported work from LUT

LUT has submitted four reports describing the experimental work that has been performed. These reports will be included as appendices to a main report that will be completed as soon as the contributions from KTH and VTT are available. The reports from LUT are summarized below.

a) **Report Title:** *PPOOLEX Spray Tests on Mixing Effects in Condensation Pool*

Authors: Lauri Pyy, Tatu Hovi, Markku Puustinen, Antti Räsänen, Eetu Kotro

Abstract: This report summarizes the results of the spray tests carried out in the PPOOLEX facility at LUT. The main purpose of the tests was to study mixing of a thermally stratified pool with the help of spray injection from above. An additional goal was to obtain data, particularly PIV measurement data, for improving simulation models related to spray operation in CFD and system codes as well as to contribute to the development of the EMS and EHS models by KTH.
The initial temperature difference between the bottom and the top layer of the pool before the initiation of spray injection varied from 29 °C to 32 °C.
First, the cold spray water penetrated the water surface causing mixing in the top layers. Then an internal circulation process took place in the pool at the elevation of the thermocline between the cold and warm water as the cold and therefore more dense sprayed water pushed its way downwards. Most of the pool water volume mixed during the tests as the downwards penetrating mixing process continued. However, the tests were terminated before complete mixing of the pool was achieved.
For the analysis of the PIV results, all the tests could be separated to three phases. In first phase, the movement of the particles is minor, the whole particle ensemble moves in unison, and there are indications that there is no mixing involved. In the second phase, the optical environment does not suit to PIV measurement at all. The last phase starts after the mixing has occurred in the PIV measurement area and the optical environment enables PIV to be executed to some extent in a normal manner by averaging velocity fields. However, the dynamical characteristics of the flow makes the analysis of the results difficult.

Keywords: condensation pool, spray, mixing
Publication date: Received in March, to be published as appendix to main report in June 2018.

b) **Report Title:** *Mixing Test in PPOOLEX with Sparger in Centre Position*

Authors: Markku Puustinen, Jani Laine, Antti Räsänen, Eetu Kotro, Kimmo Tielinen

Abstract: This report summarizes the results of the sparger pipe test (SPA-CT1) carried out in the PPOOLEX facility at LUT in 2017. The test facility is a closed stainless steel vessel divided into two compartments, drywell and wetwell. Steam was blown through the vertical DN65 sparger pipe to the condensation pool filled with sub-cooled water.

The main objective of the test was to study how the change of the sparger pipe position to the pool centre affects the stratification/erosion/mixing behaviour during steam discharge via the sparger pipe. Particularly, the effect on the elevation and thickness of the thermocline between the cold and warm water volumes and on the temperature profile of the pool were of interest. The SPA-T8R test done earlier with the sparger pipe away from the pool centre acted as a reference case. A secondary

goal was to obtain data for the development of the EMS and EHS models to be implemented in GOTHIC code by KTH.

The general behaviour during the stratification/erosion/mixing phases is almost identical in the new sparger test and in the earlier reference test. The initial uniform temperature profile first changes to a stratified situation and eventually back to an almost uniform and mixed situation at the end of the final mixing phase. During the erosion phase the thermocline moves slowly downwards and the thickness of the transition region seems to be almost the same in both tests.

The moving of the sparger pipe to the centre axis of the pool seems to have only a slight effect on the elevation of the thermocline as well as on the temperature profile in the pool.

Keywords: condensation pool, mixing, sparger
Publication date: Received in March, to be published as appendix to main report in June 2018.

c) **Report Title:** *General Description of SEF-POOL Test Rig*

Authors: Kimmo Tielinen, Antti Räsänen, Eetu Kotro, Ilkka Saure

Abstract: The SEF-POOL test facility has been designed together by KTH and LUT. It has been constructed by the Nuclear Engineering research group at LUT. The work has been part of the SAFIR2018/INSTAB and NKS/COPSAR projects.

The EHS and EMS models have been proposed by KTH for simulation of steam injection into a pool filled with sub-cooled water. The models have been implemented in the GOTHIC code and validated against the PPOOLEX experiments with blowdown pipes.

Now the concepts of the EHS and EMS models are being extended to SRV spargers and validation has been carried out against PANDA and PPOOLEX experiments done with a model of a SRV sparger. This validation effort has shown that the injection angle, total momentum, and momentum profile have a large effect on the pool behaviour. Uncertainty on these parameters exists and therefore the SEF-POOL separate effect test facility has been constructed at LUT in order to measure/define the effective momentum and reduce the uncertainty of the simulations.

This report provides a facility description of the SEF-POOL test rig. The report presents the basic requirements and design principles of the facility. The geometry and the main operational parameters as well as the installed instrumentation are introduced. The appendixes include figures to supplement the SEF-POOL geometry and instrumentation presented in the main text. The flexibility of the facility provides appropriate possibilities to extend the facility set-up according to the future research needs.

Keywords: sparger, condensation pool, effective momentum
Publication date: Received in March, to be published as appendix to main report in June 2018.

d) **Report Title:** *Characterizing Tests in SEF-POOL Facility*

Authors: Markku Puustinen, Jani Laine, Antti Räsänen, Eetu Kotro, Kimmo Tielinen

Abstract: The SEF-POOL test facility has been designed together by KTH and LUT. It has been constructed by the Nuclear Engineering research group at LUT and it will be used for the validation of the EHS and EMS models proposed by KTH for simulation of steam injection into a pool filled with sub-cooled water. The models have been validated against the PPOOLEX experiments with blowdown pipes and are now being extended to SRV spargers.

This report presents the key observations from the preliminary/characterizing tests conducted with the SEF POOL facility. Steam-to-water and water-to-water injections have been done. One test has been done with water injection into an empty pool. The main goal has been to test different options for the force measurement and to provide data for KTH for preliminary comparison of theoretical effective momentum with values calculated based on directly measured force.

The tests revealed that some modifications to the facility are needed. Most importantly, the arrangement for the direct force measurement was changed.

A quick analysis by KTH showed that the steam momentum can be roughly predicted by the theoretical estimate and the frequencies obtained with the fast pressure transducer correlate well with the correlations proposed in the literature. A strong temperature dependence, i.e. larger momentum as the pool temperature increases, was noticed.

Lower pressure inside the propulsion volume than the ambient pressure in the pool resulted to a lower force measurement than the true jet momentum. LUT and KTH will continue working on the design to solve this issue so that the actual tests to be used for the validation of the EMS model can be carried out in 2018.

Keywords: sparger, condensation pool, effective momentum
Publication date: Received in March, to be published as appendix to main report in June 2018.

2.2 FIREBAN

Determination of fire barriers's reliability for fire risk assessment in NPP

Research Area: Risk Analysis & Probabilistic Methods

Summary
The scope of the project is to investigate and assess the reliability of fire barriers in NPP during realistic fire scenarios to support the plant-scale risk assessment. The objective is to establish data and methods to determine the conditional probabilities for failure of fire barrier. Statistics, literature review, calculation and specific unique designed fire tests will be used as methods. The next steps in the process are the final definition of criteria for reliability and also further calculation supported by fire tests.

Activity leader: Patrick van Hees, Lund University
Funded organizations: LU, VTT, AAU, DBI, RAB
Funding: 393 kDKK

Status: Delay in the second-year report has occurred but the report is expected to be delivered by 1 July.

2.3 HYBRID

Development of hybrid neutron transport methods and data visualization tools

Research Area: Reactor Physics

Summary
The purpose of the present project in neutron transport modelling is to combine both probabilistic and deterministic approaches in order to obtain fast running methods (thanks to the deterministic route) and accurate results (thanks to the probabilistic route). The so-called response matrix method was the method investigated in the first phase of the project undertaken in 2016 with NKS support. This method was originally derived in the early seventies in a pure deterministic sense. In this project, the computation of the collision probabilities required for applying the method is carried out using a probabilistic solver instead.

The outcome is enhanced visualization tools. This requires the construction of an adequate data management system with visualization capabilities. In sum, the technology is supporting the efficient development of reactor core simulations, useable first for research purposes by Chalmers, and later by commercial companies.

In 2017, the project will involve 2 MSc students under the supervision of senior scientists, and make use of the complementary expertise from Chalmers University of Technology (deterministic neutron transport), the Technical Research Centre of Finland - VTT (probabilistic neutron transport), and the Institute for Energy Technology - IFE (visualization tools).

Activity leader: Christophe Demazière, Chalmers University of Technology
Funded organizations: Chalmers, IFE
Funding: 493 kDKK

Status: Delays - some reports are expected in the early fall of 2018. The activity will be completed in December 2018.

1) *The technical work at Chalmers and VTT is completed. The final report for their part of the project will be prepared and delivered to NKS in the early fall of 2018.*

2) *IFE has not been able to identify a suitable student for a Masters or Bachelors project. Alternatives to student participation are currently being considered involving resources from another project where relevant development work is being done. If knowledge from another project can be transferred to HYBRID, then IFE is confident that it will be able to submit a completed report by December 2018.*

Summary of the situation concerning the development of a hybrid neutron transport solver (Chalmers and VTT)

Work performed
Since the last status report submitted on December 14th, 2017, the focus of the work was put on:

- *Reducing the computational cost of the calculations of the probabilities in the hybrid method.*
- *Extending the methodology to systems containing more regions.*

- *Calculating the solution for a larger system (4 fuel assemblies of 17x17 PWR design) from Monte Carlo.*
- *Calculating the solution for a larger system (4 fuel assemblies 0f 17x17 PWR design) using the hybrid method.*

Achieved milestones

Concerning the development of a hybrid neutron transport solver, the following milestones have been achieved as of May 30th, 2017:

- *A revised procedure to estimate from Serpent the probabilities required in the response matrix method was developed. The goal of this revision was to lower the computational cost associated to the computation of the probabilities, so that larger system with more regions could be considered. More specifically, the probability for neutrons emitted from a fuel region to first interact in a fuel region was reduced, all other aspects being kept identical, from 30 min to 9 min. The procedure to estimate the probabilities when neutrons were emitted from the moderator was also improved.*
- *A larger system containing more regions and corresponding to 4 fuel assemblies of a 17x17 PWR design was developed. The emphasis for the choice of this system was to have more regions for each local problem in the matrix response, so that a larger system could be modelled for the global problem in the matrix response.*
- *Calculations with a pure Monte Carlo approach were completed.*
- *Calculations with the hybrid method were completed, either using in each local problem 1 fuel cell or 2x2 fuel cells.*
- *Comparisons between the hybrid and pure Monte Carlo solutions are being finalized.*

Summary of the situation on data storage and visualization (IFE)

The work at IFE was to focus on comparisons of different database solutions. This was planned as a project by a Masters or Bachelors project with the Østfold University College or the University of Oslo. Unfortunately, a suitable student could not be found.

The proposed work on visualization has been put on hold so this work can be conducted in parallel, and that we can better ensure that the NKS project can be completed in its entirety, or terminated without cost to NKS.

These delays have put back the completion of this project.

Alternatives to student participation are currently being considered. IFE is conducting several database related projects with synergies to this HYBRID project. This includes the transfer of HRP operational and experimental data to new data platforms. Some of the development work for these projects will have direct relevance for the proposed HYBRID project. It's being investigated if knowledge gained in these projects can be transferred to the HYBRID project. If this is possible then IFE is confident that it will be able to meet its commitments to this NKS project and submit a completed report by December 2018.

2.4 NORDEC

Challenges and opportunities for improving Nordic nuclear decommissioning

Research Area: Decommissioning incl. decommissioning waste

Summary
In this project a study is conducted on how decommissioning is regulated, planned and performed in the Nordic countries, identify where the main challenges lie, collect best practices and share experiences between the Nordic participants. The contributions for this project comes from regulators, operators and contractors, thus having a wide span of stakeholder involvement. The Norwegian Radiation Protection Authority (NRPA), Swedish Radiation Safety Authority (SSM), Danish Health Authority (SIS), Finnish Radiation and Nuclear Safety Authority (STUK), the energy companies Fortum and Vattenfall, the consulting firm ÅF of Sweden, VTT Technical Research Center of Finland, and Institute For Energy Technology (IFE) in Norway are participating in the project. The project involves collecting experiences from completed and ongoing decommissioning-related activities in Sweden, Finland, Denmark and Norway. The experiences' evaluation aims to identify possible improvements in processes, methods and tools. The project is fostering collaboration among Nordic stakeholders through sharing of challenges and best practices.

Activity leader: István Szőke, Institute for Energy Technology
Funded organizations: IFE, NRPA, SSM, STUK, SIS, VTT, Vattenfall AB, Fortum, ÅF
Funding: 524 kDKK

Status: Completed in February 2018.

2.4.1 Final report NKS-404

Report Title: *Challenges and opportunities for improving Nordic nuclear decommissioning*
Authors: Espen Nystad, Grete Rindahl, Claire Taylor, István Szöke, Sizarta Sarshar

Abstract: The overall goal of the NorDec project has been to explore challenges related to how decommissioning regulation is applied, and how projects are planned and performed in the Nordic countries, as well as collect best practices and share experiences between the Nordic stakeholders. The contributions for this project came from a wide range of stakeholders, including regulators, operators and contractors, and via the use of questionnaires, interviews and a workshop. The most frequently reported decommissioning challenges were: 1) Developing and maintaining competence and motivation; 2) Regulatory oversight and decision making; and 3) Safe and effective waste characterization and clearance. Workshop participants discussed around identified challenges and possible solutions enabling organisations to build up suitable competence for overcoming these issues. This report presents the results from the project.

Keywords: Decommissioning, regulation, challenges, lessons learned
Publication date: 2 Febr 2018
ISBN 978-87-7893-492-5

2.5 SC_AIM

Safety culture assurance and improvement methods in complex projects

Research Area: Organisational Issues and Safety Culture

Summary
The activity aims to increase understanding on how to improve nuclear safety culture in complex project settings (e.g. in the presence of multiple organizations interacting, diverse background of personnel, etc.). The practical goals of the projects are to identify and specify methods to improve and facilitate safety culture in complex projects and to identify and specify methods to assure safety culture in complex projects.

Activity leader: Kaupo Viitanen, VTT Technical Research Centre of Finland
Funded organizations: VTT, KTH
Funding: 279 kDKK

Status: Completed in February 2018.

2.5.1 Final report NKS-405

Report Title: *Safety Culture Assurance and Improvement Methods in Complex Projects – Final Report from the NKS-R SC_AIM*
Authors: Kaupo Viitanen, Nadezhda Gotcheva, Carl Rollenhagen, Teemu Reiman

Abstract: A good safety culture is an essential ingredient for ensuring nuclear safety. The predominant approaches for safety culture improvement are based on the assumption of stable and relatively homogeneous organizations, which often does not apply to contemporary project-oriented and turbulent environments. This research activity aims to provide guidance for methodical safety culture change in complex nuclear industry projects, and how to utilize existing safety culture tools or create new ones to support this effort. A set of twelve principles of safety culture change were developed that summarize the essential good practices of leading safety culture change. The principles are based on up-to-date practical experience and theories in the fields of systems thinking, organizational management and safety science. The principles are related to the generic characteristics of safety-critical project environments to illustrate their relevance in the context of complex projects. We propose that these principles are instrumental in leading safety culture activities in an informed manner, and to avoid mechanistic or superficial methods. Guidelines for the implementation of safety culture ambassadors were developed on the basis of the empirical work carried out in the Nordic nuclear power industry. Safety culture ambassadors group is novel method for safety culture improvement which aims to support the development of good safety culture by involving safety-conscious individuals from different parts of the company in safety culture activities. The guidelines can be utilized as a reference for practitioners in the nuclear power industry aiming to implement the method.

Keywords: Safety culture, safety culture improvement, project management, organizational change
Publication date: 02 Febr 2018
ISBN 978-87-7893-493-2

2.6 SPARC

Scenarios and Phenomena Affecting Risk of Containment Failure and Release Characteristics

Research Area: Severe Accidents

Summary
A robust severe accident management strategy is paramount for minimizing the environmental impact in the case of a severe accident involving melting of a reactor core. Both physical phenomena (deterministic) and accident scenarios (stochastic) are sources of uncertainties in the assessment of effectiveness of the accident mitigation. Adequate approaches are necessary in order to address both deterministic (epistemic) and stochastic (aleatory) sources of uncertainty in a consistent manner.

The goal of the project is to develop approaches and data for addressing the effects of scenarios and phenomena on the risk of containment failure and characteristics of release in case of a severe accident. There are 4 work packages that provide tightly coupled with each other activities.

Activity leader: Pavel Kudinov, Royal Institute of Technology (KTH)
Funded organizations: KTH, LRC, VTT
Funding: 524 kDKK

Status: Final report expected in June 2018. A report (NKS-408) has been published containing material that was not íncluded in the SPARC final report for 2016 (NKS-395) from last year.

2.6.1 Final report NKS-408 (From SPARC 2016)

Report Title: *Phenomena Threatening Containment Integrity and Evaluating Source Term Characteristics*
Authors: Veikko Taivassalo, Eveliina Takasuo, Magnus Strandberg, Tero Tyrväinen, Ilkka Karanta, Anna Nieminen

Abstract: To assess phenomena threatening the BWR containment integrity more reliably, long-term debris bed coolability and possibility of hydrogen explosions to occur were analysed deterministically. When comparing VTT's MEWA results on the debris bed post-dryout temperature to KTH's DECOSIM results, a good agreement was achieved while the temperatures continued to increase, but the stabilized temperatures differed notably. Hydrogen explosions are possible in the containment only if the inertion is lost. This is most probable during the shutdown or start-up. In addition, factors affecting source term characteristics, i.e. release temperature, altitude and probability were considered for different accident scenarios to further develop the methods and tools for PRA. Source term release height is usually the height of the location where the reactor building leaks or the height of the chimney if release is controlled. The temperature of release from containment is in most cases close to 100 oC but the temperature of radionuclides can potentially change during their migration in the reactor building.

Keywords: Debris bed coolability, MEWA, hydrogen explosions, MELCOR, source term, PRA, FinPSA
Publication date: 08 Jun 2018
ISBN 978-87-7893-497-0

2.7 WRANC

Warm Pre-Stressing – Validation of the relevance of the main mechanisms behind Warm Pre-Stressing in assessment of nuclear components

Research Area: Plant Life Management and Extension

Summary
The embrittlement of the RPV due to extended operation can lead to difficulties in demonstrating safe operation beyond 40 years when using traditional assessment methods. Therefore, utilizing the beneficial WPS (Warm Pre-Stressing) effect in assessments is an important possibility for demonstrating continued safe operation beyond 40 years of the RPV.

The WPS effect is the increase of the apparent brittle fracture toughness for a ferritic component when pre-loaded at a temperature in the ductile upper shelf region and then cooled to the brittle lower shelf region of the material fracture toughness transition curve. The WPS effect can be attributed to four main mechanisms. These mechanisms have different impact, depending on the pre-load level and load path. All the mechanisms are related to plastic straining at pre-load.

Activity leader: Tobias Bolinder, Inspecta Technology AB
Funded organizations: Inspecta, KTH, SINTEF
Funding: 393 kDKK

Status: Delays – Final report expected in September/October 2018. Awaiting final measurements from SINTEF.

3 Summary and status of activities initiated in 2018

Six activities were approved funding in CfP 2018. Four of these are continuing activities and two are new (SITRON and SYNTAGMA). BREDA-RPV started in 2016 but did not apply for funding in CfP 2017. All contracts were signed before the end of March.

An overview of the 2018 NKS-R activities is presented below in Table 2.

A request for status updates of ongoing activities were sent to the Activity Leaders on May 7. The status of all activities are summarized in the sections below.

Table 2. NKS-R 2018 activities

Activity	Title	Leader	Partners	NKS number	Contract number	Total funding kDKK	Partner funding kDKK	Contract received
BREDA-RPV	Barsebäck RPV trepan studies	KTH	KTH	NKS_R_2016_118	AFT/NKS-R(18)118/1	500	150	2018-02-21
			VTT				250	
			CTH				100	
FIREBAN	Determination of fire barriers's reliability for fire risk assessment in NPP.	LU	LU	NKS_R_2016_119	AFT/NKS-R(18)119/2	450	104,9	2018-02-13
			VTT				104,9	
			AAU				104,9	
			DBI				104,9	
			RAB				30,4	
SITRON	SITe Risk Of Nuclear installations	Risk Pilot (Fi)	Risk Pilot	NKS_R_2018_125	AFT/NKS-R(18)125/3	600	100	2018-02-02
			LRC				100	
			VTT				100	
			IFE				300	
SPARC	Scenarios and Phenomena Affecting Risk of Containment Failure and Release Characteristics	KTH	KTH	NKS_R_2016_122	AFT/NKS-R(18)122/4	600	255	2018-03-28
			VTT				224	
			LRC				121	
SYNTAGMA	Synthetic ground motions to support the Fennoscandian GMPEs	VTT	VTT	NKS_R_2018_126	AFT/NKS-R(18)126/5	600	277	2018-02-14
			UU				46	
			GEUS				46	
			CTH				231	
NORDEC	Challenges and opportunities for improving Nordic nuclear decommissioning	IFE	IFE	NKS_R_2017_123	AFT/NKS-R(18)123/6	250	175	2018-02-19
			NRPA				6,25	
			SSM				6,25	
			STUK				6,25	
			SIS				6,25	
			VTT				12,5	
			Vattenfall				12,5	
			Fortum				12,5	
			ÅF				12,5	

3.1 BREDA-RPV

Barsebäck RPV trepan studies

Research Area: Plant Life Management and Extension

Summary

Irradiation induced ageing of the weld material of the reactor pressure vessel (RPV) is a limiting factor from a long-term operation perspective. The closed Barsebäck 2 reactor gives an opportunity to harvest samples from the RPV, which was manufactured and welded with the same technique and high amounts of nickel and manganese as most Nordic RPVs. A test program to analyze the as-aged material properties has been prepared within the NKS-R activity BREDA-RPV.

In 2016 base line testing was performed at VTT on un-irradiated material retrieved from the original testing of the reactor pressure vessel. In addition, a feasibility study on harvesting of material from the reactor pressure vessel at Barsebäck was presented in the end of 2016 as a collaboration between the present project group and Ringhals AB, who will act as contact point for

the trepan extraction. The microstructural features of un-irradiated material was mapped for several specimens laying the foundation for continued studies on irradiated materials.

The activity in 2018 starts by studies of the mechanical properties of an accelerated surveillance capsule as well as material from a standard surveillance capsule from the RPV of Barsebäck 2. The main deliverable is a literature review on the feasibility to utilize specimens with high degree of constrain, i.e. very small test specimen, to study the effects of irradiation on the mechanical properties. This is a preparation for testing of material from the reactor pressure vessel itself, which will be available in the end of 2018. It further contains an enhanced microstructural evolution of RPV weld materials containing high levels of nickel and manganese to study the build-up of agglomerates that are in part responsible for irradiation hardening of these alloys. This study includes Light Optical, Scanning Electron, Transmission Electron and Atom Probe Microscopy at CTH and VTT. The issue is also relevant to the Finnish new-build project in Hanhikivi since the base metal in that RPV has a similar composition.

Activity leader: Pål Efsing, Royal Institute of Technology
Funded organizations: KTH, VTT, CTH
Funding: 500 kDKK

Milestones

Tasks, milestones and deliverables until 2018-12-31	**Date**
Microstructural analysis of un-irradiated archive material using Transmission Electron Microscopy/TEM - VTT	2018-09-30
Literature review and coupled Finite Element Analysis on constraint effects on mechanical test samples and actual Reactor Pressure Vessels – VTT/KTH	2018-11-30
Microstructural study of low temperature heat treated material using Atom Probe Tomography/APT - CTH	2018-11-30
Summary report on mechanical testing on long term thermally aged material, fracture mechanical properties - KTH	2018-10-31

Status: Work progressing according to plan (May 30)

Material sampling from the reactor pressure vessel (RPV) of Barsebäck 2 has been conducted during the spring of 2018. Material was harvested from both the irradiated beltline region and from the RPV head, which has seen insignificant irradiation but relevant reactor temperature. Furthermore, a number of archive samples has been retrieved in order to allow for baseline testing. This tesing is going to be conducted as a separate work package by the Swedish Nuclear Power Plants as an in-kind contribution to the current NKS project. Surveillance specimens from the active program from Barsebäck 2 have been identified and will be transported to VTT for mechanical testing.

Since the material has not been avaible yet fror atom probe studies on active samples from Barsebäck, the work scope at Chalmers has been pushed into the fall for practical reasons.

Fracture mechanical testing of thermally aged surrogate material, similar weld material as used for the Barsebäck RPV harvested from a retired component from Ringhals, has shown that the effect of thermal ageing on the weld material used in the RPVs manufactured by Uddcomb, i.e. with high nickel and magnesium content, can be significant. At least for ageing temperatures at 345 °C, as is the case for the pressurizer of a pressurized water reactor (PWR) unit.

In this context, work has proceeded regarding the effect of constraint on mechanical properties. A draft version of the literature report is available for internal review and commenting, and plans are made to investigate the effect using Finite Element (FE) modelling tools.

The hardness test accompanied by post irradiation heat treatment, in order to isolate the effects that influence the irradiation induced hardening, has been postponed to the fall due to the commissioning of the new hot-cell laboratory at VTT in Finland.

The microstructure of unirradiated RPV material was characterized in 2017 using light optical microscopy and scanning electron microscopy (SEM). The characterization has been continued on irradiated weld metal in 2018 using field emission gun transmission electron microscopy (FEG-TEM) and SEM. The focus has been on secondary particles. Totally six slices were cut from the weld metal in one of the mechanical test specimens, and TEM-foils were prepared. The weld metal contains Al-Si-oxides with some Ca, Mn and Ti. The size is smaller than 1 μm. The weld metal contains even smaller Cr-Mo carbides. Both are typical for RPV weld metals. The average size of the round oxides was determined to be 240 nm, being between 40 and 992 nm, based on 60 particles using TEM. The size distribution was also determined using SEM. The average size was then 276 nm, being between 62 and 784 nm, based on 60 particles. The results can be explained through the higher resolution of TEM, resulting in a smaller average size, and larger area when using SEM. Further investigations are ongoing, and the results will be compiled in a report later in 2018. The results and gained insights will be used when characterizing the same material in irradiated condition in 2019.

3.2 FIREBAN

Determination of fire barriers' reliability for fire risk assessment in NPP.

Research Area: Risk Analysis & Probabilistic Methods

Summary
The scope of the project is to investigate and assess the reliability of fire barriers in NPP during realistic fire scenarios to support the plant-scale risk assessment.
The objective is to establish data and methods to determine the conditional probabilities for failure of fire barrier. The Methods used will be statistics, literature review, calculation and specific unique designed fire tests.

The scientific merit of the activitiy will be the establishment of a link between exisiting data on fire barriers and and probablistic fire design in NPP. The technical merit of the project is the possiblity to allow users to better determine the overall probablity of loss of compartmentation between redundant systems in case of different fire scenarios.
This is an important risk analysis for nuclear power plants, as it has been shown that the loss of compartmentation has severe consequences for a safe reactor shut down process.

Activity leader: Patrick van Hees, Lund University
Funded organizations: LU, VTT, AAU, DBI, RAB
Funding: 450 kDKK

Content of the project
The project major core of activity is the development of methods for barrier failure assessment, divided into the following work packages:

Work package 1: State-of-the-art for fire barrier reliability assessment
The first work package will collect the state of the art on methods and experiences to determine the reliability of fire barriers. The result of this work package will be an overview of the need for possible further development and the requirements for additional data both as input data for the PSA models.

Work package 2: Risk-based assessment of barrier performance
In this work package, we will determine the relationship between the standard-fire based fire resistance classification and the failure risk under real fire conditions and real protection objectives.

Work package 3: Reliability determination
This work will contain four major routes of determination:

Work package 4: Dissemination of results
Results from the project will be reported in scientific journals and at conferences. A small workshop for interested parties will be organised at the end of project.The co-operation with other national projects, such as the SAFIR2018 programme in Finland, will also take place in this work package.

Work package 5: Management
For the management of the project, we include activities such as communication with partners, meeting organisation, economical follow up and progress follow up.

Milestones

Tasks, milestones and deliverables until 2018-12-31	**Date**
Determination of reliability by different methods as input data for PSA (MS4) Uncertainty propagation analysis from model/parameter uncertainty to risk estimate (MS5)	2018-04-01
Workshop for PRA Integration (D3)	2018-11-01
Final report	2018-12-31

Status: Work progressing according to plan (June 15)

Update provided by Topi Sikanen, VTT:

- *Aalto continues the development of 3D heat transfer module in FDS with the aim of predicting the cold side temperature of Fire Barriers in large scale fire tests*
- *VTT works on modelling the behaviour of building products based on small scale tests.*

- *VTT disseminates results to utilities and authorities through the national SAFIR2018 programme.*
- *DBI, LTH and Ringhals are preparing fire resistance tests to validate the models developed at DBI, Aalto and LTH. One of the test set-up will also to contain a specific deficiency from a fire barrier in a nuclear power plant. Ringhals will provide this data.*
- *Test are scheduled after the summer.*
- *DBI and LTH continue cooperating in the development of models for predicting the fire resistance of fire barriers and publications were made.*

3.3 SITRON

SITe Risk Of Nuclear installations

Research Area: Risk Analysis & Probabilistic Methods

Summary
The importance of multi-unit Probabilistic Safety Assessment (PSA) has increased after the Fukushima Daiichi accident in March 2011. The major part of nuclear power sites house more than one nuclear power plant unit (NPP) and other nuclear facilities such as a spent fuel pool storage. Currently, multi-unit risks have not been accounted for adequately in risk assessments, but the multi-unit PSA is intensively discussed internationally.

The objective of the project is to search feasible approaches to assess the site level risk. This objective concerns with safety goals, risk criteria and PSA applications for a multi-unit site. Multi-unit risk assessment is not only limited to reactors but also other relevant sources for radioactive release such as spent fuel pools and storages. The second objective with the project is to develop methods to assess the risk for multi-unit scenarios. This objective concerns with analysis methods to consider the dependencies between the units. Pilot studies will be carried out to test and to demonstrate the proposed approach. The third objective is to develop applications for site risk analysis. In this respect, SITRON will study the role of Technical Support Centre (TSC) in multi-unit scenarios. The project will also follow the international development in this field.

Activity leader: Jan-Erik Holmberg, Risk Pilot Finland
Funded organizations: Risk Pilot (Fi), LRC, VTT, IFE
Funding: 600 kDKK

Milestones

Tasks, milestones and deliverables until 2018-12-31	**Date**
Kick-off meeting for 2018 activities	2018/02
2018 mid-term meeting	2018/06
Conference paper (ESREL)	2018/06
Conference paper (PSAM)	2018/09
Final seminar	2018/11
Working reports for each working package	2018/12
Final report	2019/01

Status: Work progressing according to plan (21 May)

SITRON project status

Task	Status
WP2: A work report on site level PSA methods	*Outline prepared*
WP3: A work report on guidelines for site level PSA model management	*Outline prepared*
WP4: Pilot studies are continued and finalized with emphasis on level 2 PSA scenarios	*Pilot studies initiated, outline of the pilot study report agreed*
WP5: Literature review on the assessment of the role of technical support centre	*Literature review initiated*
WP5: Questionnaire to utilities	*Questionnaire prepared and submitted to utilities*
WP6: Internal project meetings to coordinate WP activities	*Four Skype meetings organised*
WP6: Working meeting with stakeholders (Spring 2018)	*Organised April 12, 2018*
WP6: Progress reporting to the financiers	*Status reports (May 2018) submitted to SAFIR, Nordic PSA Group and NKS*
WP6: Presentation of the project achievements in international conferences	*Papers submitted to ESREL2018 (June 2018) and PSAM14 (September 2018). Abstract submitted to OECD/NEA WGRISK workshop (July 2018). All accepted.*
WP6: Organisation of a Nordic workshop on site level PSA	*Not initiated*
WP6: A summary report to be published in NKS report series	*Not initiated*

Overall progress 30%

3.4 SPARC

Scenarios and Phenomena Affecting Risk of Containment Failure and Release Characteristics

Research Area: Severe Accidents

Summary
A robust severe accident management strategy is paramount for minimizing the environmental impact in the case of a severe accident involving melting of a reactor core. Both physical phenomena (deterministic) and accident scenarios (stochastic) are sources of uncertainties in the assessment of effectiveness of the accident mitigation. Adequate approaches are necessary in order to address both deterministic (epistemic) and stochastic (aleatory) sources of uncertainty in a consistent manner.

KTH, VTT and LRC have been active in addressing phenomenological and scenario uncertainties in severe accidents in the framework of national programs such as APRI-MSWI, SAFIR, NPSAG, NKS-DECOSE and NKS-DPSA, European FP7 and Horizon2020 projects SARNET, SAFEST, CESAM, IVMR and in direct collaboration with nuclear power utilities and regulators.

The goal of the project is to develop approaches and data for addressing the effects of scenarios and phenomena on the risk of containment failure and characteristics of release in case of a severe accident. There are 4 work packages that provide tightly coupled with each other activities;
WP1: Development and application of risk oriented accident analysis framework (ROAAM+) for prediction of conditional containment failure probability for a Nordic type BWR (KTH).
WP2: Development of the methods for coupling of Integrated Deterministic Probabilistic Safety Analysis tools such as ROAAM+ developed by KTH with PSA in general and PSA-L2 in particular (LRC).
WP3: Deterministic modelling of core degradation, melt relocation, vessel failure, debris spreading, coolability and threats for the containment integrity (VTT).
WP4: Analysis of the factors that affect the energy (temperature), altitude and probability of the release in PSA-L2 (VTT). The input is from KTH, LRC and VTT analysis in WP1, WP2 and WP3.

Activity leader: Weimin Ma, Royal Institute of Technology
Funded organizations: KTH, VTT, LRC
Funding: 600 kDKK

Milestones

Tasks, milestones and deliverables until 2018-12-31	**Date**
1) WP1 Report on experiments and modeling development for analysis of severe accident phenomena in Nordic BWR (KTH)	31.01.2019
2) WP2 Report on development of demonstration case for integration of the data generated by integrated deterministic-probabilistic safety analysis into PSA (LRC)	31.01.2019
3) WP3 Report on analysis of debris bed coolability (VTT)	31.01.2019
4) WP4 Report on PSA-L2 analysis of important factors for severe accident phenomena and release characteristics (VTT)	31.01.2019
Final report	31.01.2019

Status: Work progressing according to plan (May 30)

The work plan of the SPARC activity has been fulfilled by around 50%, with involvement and contributions of many researchers at KTH, VTT and LRC, including young students and engineers. The research efforts will be enhanced and spreading to the entire activity space during next 6 months.

More details about the progress of the SPARC 2018 activity is found in Appendix A.

3.5 SYNTAGMA

Synthetic ground motions to support the Fennoscandian GMPEs

Research Area: Risk Analysis & Probabilistic Methods

Summary
In recent years earthquake source modelling methods have been developed, partly in NKS projects, to substantiate the expected earthquake ground motion in the ranges where empirical observations are not available in Fennoscandia. These ranges are, at the higher end of observed magnitudes and higher (Mw>4.0) and at distances closer than those available from instrumental recordings (0<d<40km). These ranges are very important contributor to the hazard, with de-aggregation showing well above 50% of the seismic hazard contribution from this interval.

The benchmark model results obtained in the NKS project AddGROUND highlighted shortcomings of the currently used Fennoscandian ground motion models (GMPEs) in probabilistic seismic hazard assessment (PSHA), and triggered the need to update these GMPEs. The update is proposed to be carried out in the Finnish Research Programme on Nuclear Power Plant Safety (SAFIR 2018).

As a complementary activity to the GMPE update in the SAFIR program, we propose that in the NKS framework we use the previously developed modelling method (Fülöp et al, 2017) to generate larger data set of synthetic ground motions. This is the logical extension of the earlier work, resulting in a practically usable synthetic data set. The two proposed studies reinforce each other – the analysis of measurement data in the SAFIR project is extended by the synthetic data generated in the NKS project, which in turn is validated by the measurements.

In addition to the technical outcome, this project also aims to establish and maintain a network of experts focused on diffuse seismicity areas of the Nordic Countries and further enhance the cooperation between VTT and Uppsala University in the area of earthquake source modelling. The project outcomes will support STUK and SSM, providing background information for the safety assessments of nuclear plants. The activity proposed here would be paired with the EVOGY project in SAFIR 2018 and be supervised from within that Ad-Hoc group, with participation from STUK, SSM, TVO, FORTUM and FENNOVOIMA.

Activity leader: Ludovic Fülöp, VTT Technical Research Centre of Finland
Funded organizations: VTT, UU, GEUS, CTH
Funding: 600 kDKK

Milestones

Tasks, milestones and deliverables until 2018-12-31	**Date**
M.1. Establishing of 20 fault rupture cases to be modelled (4.0<Mw<5.5)	02.2018
M.2. Fault modelling in 3DEC finished. Fault slips extracted	05.2018
M.3. Slip data transferred. COMPSYN models ready to run	06.2018
M.4. COMPSYN modelling finished. Ground motion extracted for points in the distance range 0<d<30km	10.2018
D.1. Data analysed. One paper drafted	11.2018
Final report	12.2018

Status: Work progressing according to plan (June 7)

From the start of the year 2018 Milestones 1 and 2 have been achieved in SYNTAGMA (bold underline in the table below). The preparation for creating the COMPSYN models is ongoing.

	Date
M.1. Establishing of 20 fault rupture cases to be modelled (4.0<Mw<5.5)	**02.2018**
M.2. Fault modelling in 3DEC finished. Fault slips extracted	**05.2018**
M.3. Slip data transferred. COMPSYN models ready to run	06.2018
M.4. COMPSYN modelling finished. Ground motion extracted for points in the distance range 0<d<30km	10.2018
D.1. Data analysed. One paper drafted	11.2018
Final report	12.2018

Based on considerations related to the prevailing fault typologies in Fennoscandia, it was decided that the earthquake scenarios in Table 1 will be considered. The range of magnitudes, hypocentre depths and stress drops were taken into account.

Table 1. *Targeted earthquake scenarios*

Depth (km)	Moment magnitude	Mechanism*	Stress drop (MPa)	Number of scenarios
2	4	RF, OB	10	3
10	4, 5, 5.5	RF, OB, SS	10	9
10	5.5	RF, OB, SS	50	3
20	5.5	RF, OB, SS	10, 50	6

* “RF” = Reverse Faulting, “OB” = Oblique Faulting, “SS” = Strike-Slip Faulting

Fault-ruptures for these scenarios were modelled in 3DEC. The 3DEC modelling is based on instantaneous rupture of the faults, once a pre-existing stress-state is postulated on the fault plane. Hence, the model result is only partly controlled and the model outcome will not completely conform to the targeted values.

As a major update to earlier work, the stress state promoting rupture in any random direction (rake and dip angle) can now be introduced in 3DEC. This allows modelling of more realistic ruptures, adjusted to the observed fault plane solutions In Fennoscandia.
The outcomes of the fault rupture models from 3DEC are given in the Table 2.

The slip patterns on the entire rupture area were archived and are now being transferred to COMSYN for reaching Milestone 3. Hence, the project is on schedule.

Table 2. *Fault rupture parameters based on 3DEC outcome*

Mechanism*	Moment magnitude (M_w)	Seismic moment	Average Stress drop (MPa)	Average slip (m)	Peal slip velocity (m/s)	Rupture area (km^2)	Dip	Rake
RF	4.3	$3.9 \cdot 10^{15}$	9.7	0.11	1.7	1	30	80
SS	4.3	$4.0 \cdot 10^{15}$	9.9	0.11	1.7	1	80	9.9
OB	4.3	$3.8 \cdot 10^{15}$	9.5	0.11	1.7	1	45	46
RF	5.0	$3.5 \cdot 10^{16}$	10	0.24	2.7	4.0	30	80
SS	5.0	$3.4 \cdot 10^{16}$	10	0.23	2.6	4.0	80	9.8
OB	5.0	$3.4 \cdot 10^{16}$	10	0.23	2.7	4.0	45	45
RF	5.5	$2.0 \cdot 10^{17}$	12	0.45	3.8	12.3	30	80
SS	5.4	$1.8 \cdot 10^{17}$	11	0.41	3.5	12.3	80	9.8
OB	5.4	$1.8 \cdot 10^{17}$	11	0.41	3.7	12.3	45	46
RF	5.6	$3.0 \cdot 10^{17}$	50	1.3	14	6.3	30	80
SS	5.6	$3.0 \cdot 10^{17}$	48	1.3	13	6.3	80	9.9
OB	5.6	$2.9 \cdot 10^{17}$	50	1.3	14	6.3	45	46

* “RF” = Reverse Faulting, “OB” = Oblique Faulting, “SS” = Strike-Slip Faulting

3.6 NORDEC

Challenges and opportunities for improving Nordic nuclear decommissioning

Research Area: Decommissioning incl. decommissioning waste

Summary

Approaching large-scale nuclear decommissioning projects in the Nordic countries makes it important for both regulators and operators to build new capabilities for handling up-coming challenges. Sweden has the most urgent need for building up large-scale national capability for Nuclear Power Plant (NPP) decommissioning in order to respond to national decisions resulting in shutdown plans for seven units in the country. Finland is preparing detailed plans for removing the active containment of the Otaniemi research reactor. Experience from decommissioning of research reactors lies primarily with Denmark, but there is also some experience in Sweden and Norway. All countries can benefit from a more mature and integrated approach to decommissioning that utilizes more thorough planning to identify the future needs of the organisation and makes it possible to plan for the resources needed to handle upcoming challenges.

The results of the survey in the previous phase of the project clearly identified a general need for informal platforms where Nordic countries can exchange more practical experience and work more closely together. Due to closer physical and cultural proximity and some similarities in national framework among these countries, such a forum would further facilitate development of national capabilities for nuclear decommissioning in these countries. It would be very advantageous to be able to continue Nordic exchange and communication also after the project is finalised.

The key Nordic general decommissioning challenge areas that the project has found to be the most important are the following:

- Developing and maintaining competence and motivation
- Regulatory decision-making and oversight
- Safe and effective waste characterization and clearance
- Planning and management of site modification and dismantling
- Collaboration and information sharing between stakeholders
- Establishing common legislation and guidance

In 2018 work meetings and workshops will be held to discuss the Nordic decommissioning challenges. Opportunities and models for establishing a platform enhancing Nordic collaboration will be discussed and new concepts related to the challenges will be presented. An open workshop is planned in Lillehammer in December 2018.

Activity leader: István Szőke, Institute for Energy Technology
Funded organizations: IFE, NRPA, SSM, STUK, SIS, VTT, Vattenfall AB, Fortum, ÅF
Funding: 250 kDKK

Milestones
Tasks, milestones and deliverables until 2018-12-31

T1: Work meetings (discussions)
- Video/phone discussions will be held with the project partners around the main Nordic decommissioning challenge areas identified in 2017.
- Opportunities and models for establishing a platform enhancing Nordic collaboration within the main Nordic decommissioning challenge areas will also be discussed.

T2: Workshop preparation
- Presentations will be prepared by the project partners with focus on opportunities for enhancing collaboration within main Nordic decommissioning challenge areas.
- Demonstrations will be prepared by the project partners presenting new concepts related to the main Nordic decommissioning challenge areas and collaboration of Nordic countries.
- Administrative and technical preparatory work for the workshop will also be done within this task.

T3: Workshop
- An open workshop will be held with the project partners and invitees. The workshop is planned to be held as a mini-workshop immediately following a larger international workshop organised by the project coordinator (Lillehammer, December 6-7).

T4: Reporting
- A final report, mainly consisting of presented material and summaries from the workshop, will be prepared.

Status: Work progressing according to plan (June 4)

Based on the current work progress there are no foreseen issues that might cause major deviations from the deliverables promised in the work plan.

Current progress

The proposal for this project has been accepted with a funding from NKS limited to 250 kDKK. As a result, the original work plan has been limited. In line with the specific message from the NKS board, the new work plan is primarily focusing on the workshop mentioned in the proposal for the NORDEC activity in 2018.

According to the new work plan we focused on preparations for an NKS workshop addressing the key topics related to high priority needs for improving decommissioning in the Nordic countries. In order to achieve a good coordination between the NKS workshop and other workshops planned for 2018 by the project coordinator with strongly related focus areas, we decided to co-host the NKS workshop with two other events. This will ensure a good participation of international experts, facilitating application of international experience to Nordic challenges.

Next steps

- *Work meeting(s) (via video/phone/e-mail) will be held with the participants of the project in order to plan/coordinate presentations on the key Nordic aspects identified in the 2017 phase of the project.*
- *An NKS Workshop will be held in Lillehammer, December 6-7, 2018 co-hosted with an OECD Halden Reactor Project, and an international workshop on "Application of advanced plant information systems for nuclear decommissioning and life-cycle management". See below for more information.*
- *A final report will be produced summarising the outcomes of the Workshop in December.*

Invitation

OECD-HRP/NKS workshop on Challenges and opportunities for improving nuclear decommissioning in HRP member and Nordic countries

December 6-7, 2018

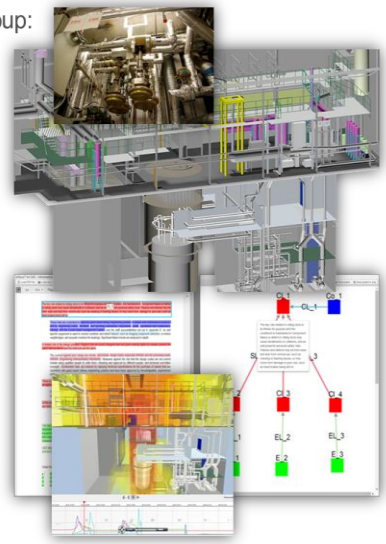
Hotel Scandic

Lillehammer, Norway

This workshop is organised within the OECD **H**alden **R**eactor **P**roject (www.ife.no/en/ife/halden/hrp/the-halden-reactor-project) and the Nordic Nuclear Safety Research Forum (www.nks.org/en/nksr/current_activities/nordec.htm). The workshop aims at bringing together a multidisciplinary group representing the professional community working on implementation and oversight of decommissioning for discussing opportunities and challenges for improving nuclear decommissioning in HRP member and Nordic countries. Special focus will be on bringing stakeholder organisations closer together through digitally enhanced innovative concepts. This workshop will also host the first meeting of a nuclear decommissioning advisory group to be launched by the OECD-HRP programme.

Examples for specific subjects to be addressed by the group:

- Collaborative development of guidance for practical application of regulation.
- Application of advanced information systems for demonstrating regulatory compliance.
- Joint development of case studies with digital support concepts.
- Establishing and testing digital experience based training methods.
- Joint development of e-Learning material for nuclear decommissioning.
- Interfacing big contractors with the regulators through digital safety demonstration methods.
- Collaborative testing of new decommissioning technologies using digital twins.



3-5 December: Within our series on "Digitalisation for nuclear decommissioning" an international workshop on **Application of advanced plant information systems for nuclear decommissioning and life-cycle management** will be held (www.ife.no/digidecom2018) at the same venue, providing the opportunity for interested participants to attend both events. (see also: www.ife.no/digidecom2019)

Organising committee: **digidecom@ife.no**

Chairman: I Szőke, Institute for Energy Technology, Norway

4 Overview of all NKS-R activities in 2010-2017

All activities started in 2016 and earlier have been finalised, see table below.

An activity is considered to be started at the time of the January board meeting, and ended when the final report has been delivered.

Activity	NKS number	Started	Ended
Decom-sem	NKS_R_2010_83	01/2010	12/2010
DIGREL	NKS_R_2010_86	01/2010	12/2010
IACIP	NKS_R_2008_61	01/2010	12/2010
INCOSE	NKS_R_2009_75	01/2010	05/2011
MOSACA10	NKS_R_2008_69	01/2010	01/2011
NROI	NKS_R_2008_70	01/2010	04/2011
POOL VTT	NKS_R_2007_58	01/2010	05/2011
POOL KTH	NKS_R_2007_58	01/2010	06/2011
POOL LUT	NKS_R_2007_58	01/2010	03/2011
AIAS	NKS_R_2011_98	01/2011	12/2012
DIGREL	NKS_R_2010_86	01/2011	01/2012
ENPOOL	NKS_R_2011_90	01/2011	03/2012
ENPOOL	NKS_R_2011_90	01/2011	05/2012
ENPOOL	NKS_R_2011_90	01/2011	05/2012
MoReMO	NKS_R_2011_95	01/2011	02/2012
NOMAGE4	NKS_R_2008_63	01/2011	11/2011
POOLFIRE	NKS_R_2011_96	01/2011	02/2012
SADE	NKS_R_2011_97	01/2011	03/2012
RASTEP	NKS_R_2010_87	06/2011	09/2012
AIAS	NKS_R_2011_98	01/2012	06/2013
DECOSE	NKS_R_2012_100	01/2012	07/2013
DIGREL	NKS_R_2010_86	01/2012	02/2013
ENPOOL VTT	NKS_R_2011_90	01/2012	04/2013
ENPOOL LUT	NKS_R_2011_90	01/2012	03/2013
ENPOOL KTH	NKS_R_2011_90	01/2012	05/2013
MoReMO	NKS_R_2011_95	01/2012	03/2013
Nordic-Gen4	NKS_R_2012_103	01/2012	11/2012
POOLFIRE	NKS_R_2011_96	01/2012	02/2013
RASTEP	NKS_R_2010_87	01/2012	10/2013
SADE	NKS_R_2011_97	01/2012	03/2013
Decom-sem	NKS_R_2013_106	01/2013	02/2014

Activity	NKS number	Started	Ended
DECOSE	NKS_R_2012_100	01/2013	10/2014
DIGREL	NKS_R_2010_86	01/2013	03/2014
DPSA	NKS_R_2013_107	01/2013	07/2014
ENPOOL	NKS_R_2011_90	01/2013	10/2014
Exam HRA	NKS_R_2013_110	01/2013	03/2014
HUMAX	NKS_R_2013_108	01/2013	02/2014
L3PSA	NKS_R_2013_109	01/2013	03/2014
POOLFIRE	NKS_R_2011_96	01/2013	12/2014
SADE	NKS_R_2011_97	01/2013	02/2014
ATR	NKS_R_2014_111	01/2014	06/2015
DECOSE	NKS_R_2012_100	01/2014	07/2015
DIGREL	NKS_R_2010_86	01/2014	02/2015
DPSA	NKS_R_2013_107	01/2014	08/2015
ENPOOL	NKS_R_2011_90	01/2014	07/2015
HUMAX	NKS_R_2013_108	01/2014	01/2015
L3PSA	NKS_R_2013_109	01/2014	04/2015
Nordic-Gen4	NKS_R_2012_103	01/2014	02/2015
ProCom	NKS_R_2014_112	01/2014	03/2015
ADdGROUND	NKS_R_2015_113	01/2015	04/2016
ATR-2015	NKS_R_2014_111	01/2015	06/2016
COPSAR	NKS_R_2015_114	01/2015	08/2016
DECOSE	NKS_R_2012_100	01/2015	10/2016
L3PSA	NKS_R_2013_109	01/2015	11/2016
LESUN	NKS_R_2015_115	01/2015	12/2015
MODIG	NKS_R_2015_116	01/2015	03/2016
PLANS	NKS_R_2015_117	01/2015	01/2016
ADdGROUND	NKS_R_2015_113	01/2016	08/2017
BREDA-RPV	NKS_R_2016_118	01/2016	03/2017
COPSAR	NKS_R_2015_114	01/2016	08/2017
FIREBAN	NKS_R_2016_119	01/2016	10/2017
HYBRID	NKS_R_2016_120	01/2016	04/2017
L3PSA	NKS_R_2013_109	01/2016	03/2017
SC_AIM	NKS_R_2016_121	01/2016	01/2017
SPARC	NKS_R_2016_122	01/2016	08/2017
COPSAR	NKS_R_2015_114	01/2017	ongoing
FIREBAN	NKS_R_2016_119	01/2017	ongoing
HYBRID	NKS_R_2016_120	01/2017	ongoing

Activity	NKS number	Started	Ended
NORDEC	NKS_R_2017_123	01/2017	02/2018
SC_AIM	NKS_R_2016_121	01/2017	02/2018
SPARC	NKS_R_2016_122	01/2017	ongoing
WRANC	NKS_R_2017_124	01/2017	ongoing
BREDA-RPV	NKS_R_2016_118	01/2018	ongoing
FIREBAN	NKS_R_2016_119	01/2018	ongoing
SPARC	NKS_R_2016_122	01/2018	ongoing
NORDEC	NKS_R_2017_123	01/2018	ongoing
SITRON	NKS_R_2018_125	01/2018	ongoing
SYNTAGMA	NKS_R_2018_126	01/2018	ongoing

Abbreviated organisations

AAU	Aalto University	Fi
CT	Clay Technology AB	Sw
CTH	Chalmers University of Technology	Sw
DBI	Danish Institute of Fire and Security Technology	Dk
DTU	Technical University of Denmark, Risö	Dk
FCR	Firma Carl Rollenhagen	Sw
FKA	Forsmarks Kraftgrupp AB	Sw
GEUS	Geological Survey of Denmark and Greenland	Dk
IFE	Institutt for Energiteknikk, OECD Halden	No
LC	Lilikoi Consulting (Teemu Reiman)	Fi
LRC	Lloyds Register Consulting	Sw
LU	Lund University	Sw
LUT	Lappeenranta University of Technology	Fi
NRPA	Norwegian Radiation Protection Authority (Statens strålevern)	No
NTNU	Norwegian University of Science and Technology	No
PWC	PricewaterhouseCoopers	No/Sw
RAB	Ringhals AB	Sw
SAFIR	The Finnish Research Programme on Nuclear Power Plant Safety	Fi
SEI	University of Helsinki, Institute of Seismology	Fi
SINTEF	Stiftelsen for industriell og teknisk forskning	No
SIS	Danish Health Authority, Denmark	Dk
SSM	Swedish Radiation Safety Authority	Sw
STUK	Finnish Radiation and Nuclear Safety Authority	Fi
UIO	University of Oslo	No
UU	Uppsala University	Sw
VTT	VTT Technical Research Center of Finland	Fi
VYR	State Nuclear Waste Management Fund	Fi
ÅFC	ÅF-Consult	Sw

Appendix A

Contract AFT/NKS-R(18)122/4

Status Report

Scenarios and Phenomena Affecting Risk of Containment Failure and Release Characteristics

Weimin Ma, Anna Nieminen, Anders Riber Marklund

KTH - Royal Institute of Technology
VTT Technical Research Centre of Finland Ltd
LRC - Lloyd´s Register Consulting Energy AB

May 2018

1. Introduction

The goal of this project is to produce new data, and to develop models and methodologies for addressing severe accident scenarios and phenomena which are important to assess the risk of containment failure and radioactivity release in a postulated severe accident of Nordic nuclear power plants. The experimental studies and deterministic modelling at KTH and VTT provide necessary insights and data for scenarios definition and tools development which are important to PSA studies at LRC. Therefore, this joint research project enables the three Nordic partners to leverage their ongoing projects, so as to maximize the research outcomes and spread the excellences to each other. The collaborative project also helps establish/enhance the informal Nordic networks for information exchange on severe accident research.

The project has the following four work packages proposed in the activity plan:

.

WP1: Experimental study of severe accident phenomena and modeling development for assessment of core melt risk and corium stabilization in a Nordic BWR.

- 1.1 In-vessel debris/molten pool behavior and RPV failure, in order to gain insights into complex in-vessel phenomena, including remelting of a debris bed to a molten pool, heat and mass transfer to the vessel wall and penetrations, failure of RPV penetrations (e.g., CRGTs, IGTs), and melt release scenarios including breach ablation/clogging issues.
- 1.2 Ex-vessel debris bed coolability, in order to produce new data to address the following critical issues: post dry-out heat and mass transfer of a debris bed, and corium oxidation and debris remelting.
- 1.3 FCI and steam explosion, involving large and small scale experiments to study molten fuel coolant interactions (FCI), using various oxides mixture and metal compositions to address material effects on melt fragmentation and its improvement, Zircaloy and steel oxidation and hydrogen generation, and triggered and spontaneous steam explosion and its suppression.
- 1.4 Modelling development for deterministic analysis .
- 1.5 Further development and application of ROAAM+ framework

WP2: Development of methods for coupling of Integrated Deterministic Probabilistic Safety Analysis tools such as ROAAM+ developed by KTH with PSA in general and PSA-L2 in particular.

- 2.1 Development of IDPSA generated data processing techniques for informing PSA about importance of (i) timing of events and (ii) epistemic uncertainty.
- 2.2 Different approaches will be considered in collaboration with KTH and VTT to addressing of dynamic events and physical phenomena in (i) cut sets; (ii) success and failure paths; (iii) connections to PSA-L3.

WP3: Deterministic modelling of debris bed coolability and threats for the containment integrity including steam and hydrogen explosions.

- 3.1 Establishing a temperature-based coolability criteria for debris beds to evaluate the coolability of a multi-dimensionally flooded conical debris bed less conservatively. Assessing more thoroughly the effect of heat transfer models to the evolution of temperature in time. Modelling a truncated cone case with MEWA. Comparing results with the DECOSIM analyses done by KTH. This

task is performed in close collaboration with task 1.2 to find out the origin of the differences in the debris bed post-dryout temperature behavior noticed in previous analyses by VTT and KTH.

3.2 MELCOR analyses on hydrogen explosions. Examining accident scenarios that may lead to hydrogen explosions in the Nordic BWR containment and reactor hall.

3.3 MC3D analysis on the effect of vessel breaking mode to dynamic pressure loads on cavity wall induced by steam explosion. Assessing steam explosion loads in Nordic BWR geometry and examining the sensitivity of the results to key input parameters. Also assessing the effect of break location.

WP4: Level 2 PSA modelling of phenomena and factors affecting containment failure probability and release characteristics.

4.1 PSA-L2 analysis with the focus on the factors affecting source term characteristics. The factors to be considered are: (i) plant damage states (from PSA level 1), (ii) plant design and (iii) accident progression phenomena. Generic BWR model utilizing dynamic containment event trees is developed further, with special consideration of uncertainties.

4.2 Consideration of the factors affecting the probability and magnitude of relevant phenomena such as (i) steam explosions and (ii) non-coolable debris bed formation and core-concrete interaction. The results of KTH and LR, especially those represented in report NKS-395, will be utilized.

2. Progress and status

WP1: Experimental study of severe accident phenomena and modeling development for assessment of core melt risk and corium stabilization in a Nordic BWR

The REMCOD facility is developed with the aim of filling the knowledge gap in remelting phenomena of the debris beds. Based on the obtained results from previous tests (21 tests in total), the road map of the future research has been drawn by improvement of the follows:

- improved parametric study;
- facility design;
- experimental procedure; and
- measurement techniques.

So far, three types of experiments have been conducted:

- Melt penetration into cold debris (E1-E8)
- Melt infiltration through hot debris (E9 & E11)
- Remelting of initially solidified melt (E10)

A test matrix has been designed to resolve remaining issues associated with the remelting phenomena in the existing facility which includes test series E12, E13 and E14 (each test is composed of 4 subtests).

Post-processing of the experimental results has revealed interesting observations (see Fig. 1). Two flow regimes are identified in the melt infiltration process which is dominated at the beginning by capillary forces and Later it is governed by gravity

forces. At the current state, scaling rules of the problem are identified for correlating length scales and time scales of infiltration process. Further simulation activities are in process for better understanding of competition mechanism between hydrodynamics and solidification.

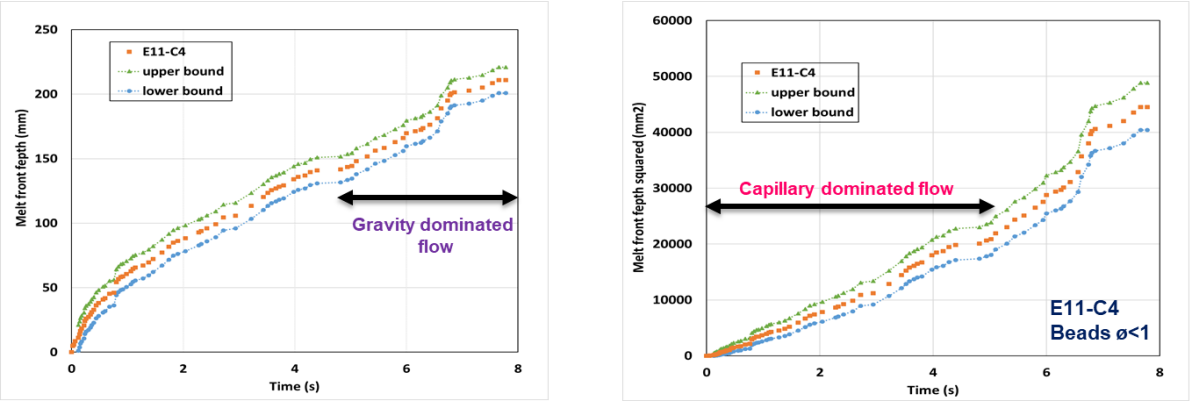


Fig. 1: Infiltration process of test E11.

Debris bed coolability is important to terminate and stabilize a hypothetical nuclear severe accident. Previously the POMECO-HT facility was developed at KTH to study long-term coolability of debris bed of various prototypical characteristics, with focus on measurement of dryout heat flux.

However, prior to the long-term collability (steady-state), a debris bed formed during fuel coolant interactions (FCI) must experience a quenching process (transient) which brings post-dryout debris bed to coolable state. In order to invetigate such quenching process, a new test facility called POMECO-Q is being considered at KTH, which is intended to address the quenching and post-dryout heat transfer of debris bed. The test section will be (2D) sliced geometry of rectangular cross-section, to simulate the ex-vessel conditions in two dimensions on an intermediate scale. The preliminary specifications of the experimental setup are as follows:

- power capacity: 84 kW;
- test section dimensions: ~600×12×500 mm^3;
- temperature up to: 800°C;
- water supply: top and bottom.

Currently, the experimental facility POMECO-Q is in its early design phase, and the progress will be done in various stages as follows:

- complete facility design and manufacture;
- conduct dryout experiments;
- go to higher temperatures and create post-dryout conditions;
- conduct the quenching tests;
- analytical development to represent the quenching and post-dryout heat transfer mechanisms.

MISTEE-HT facility at KTH is developed to conduct FCI experiments at high melt temperatures (T_{melt}>2000°C) with or without steam explosion triggering. The upgraded facility offers unique advantage to investigate the longstanding issues of so-called “material effect” in steam explosion and oxidation of metal melts during FCI. Recently the MISTEE-HT facility was successfully adapted to study thermal fragmentation characteristics of single droplets of Al_2O_3 (T_{melt}: 2054°C). Oxidation is the most uncertain part of understanding and modelling of fuel-coolant interaction

studies. Experimental data on oxidation behavior during FCI is rather scarce and inconclusive. Hence, the focus of MISTEE-HT experiments is currently placed on the investigation of the chemical augmentation of Zr melt or a mixture of Zr and Fe melt under FCI conditions. The aim of the current work is to advance our current state of understanding on zirconium melt oxidation behavior as well as to provide conservative estimates on O/Zr ratio during the pre-mixing phase of FCI. In the experiments, interaction between the melt and water are recorded visually at high speed. Scanning Electron Microscopy (SEM) combined with Energy-Dispersive X-Ray Spectroscopy (EDS) were used to study distribution of phases and their composition. The investigation reveals complex radial stratification of oxygen content in the samples from the surface to the bulk of the droplet. Further, it is also found that the oxygen content increases at a decreased degree of water subcooling (cf. Fig. 2). Considering the scarcity of experimental data, the conservative estimates at varied experimental conditions are vital for model development. Experiments with a mixture of Zr and Fe melt are underway with adequate modification of materials used in the furnace.

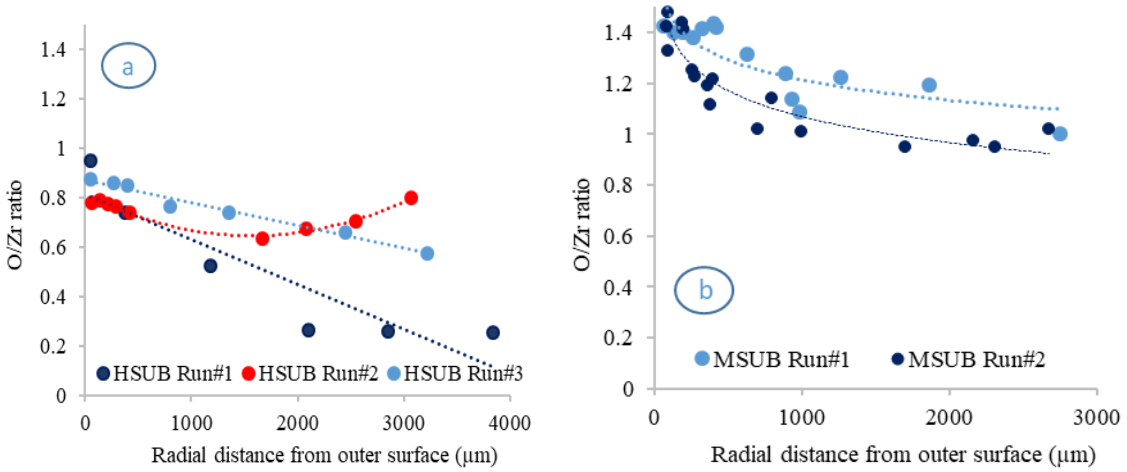


Fig. 2: Measured O/Zr ratio in the quenched samples under (a) high subcooling (ΔT_{sub}: 85K; HSUB series), *and (b) medium subcooling (*ΔT_{sub}: 45K; MSUB series).

SIMECO-2 facility is being developed to investigate heat transfer in 2- and 3-layered stratified molten pool formed by oxide and metal simulants with different densities covering the following key phenomena:

(i) redistribution (inversion) of oxide and metal simulants layers due to change of material densities
(ii) effect of the crust formation on the top/bottom layer interface
(iii) influence of top metallic layer thickness on the focusing effect
(iv) multidimensional heat transfer in, and between, the melt pool, the top metallic layer and the vessel.

The SIMECO-2 test section is developing as a slice-type vessel, which includes a semi-circular section, representing the lower head of the reactor vessel. Fig. 1 presents the general view of the SIMECO-2 test section. The diameter, height, and width of the working volume of pool are 1000×500×120 mm, respectively. One of the main feature of SIMECO-2 facility is optically transparent front and back walls made of quartz, that allows to have visual observation of pool behavior, such as crust growing and to measure velocities of local and global heat flows.

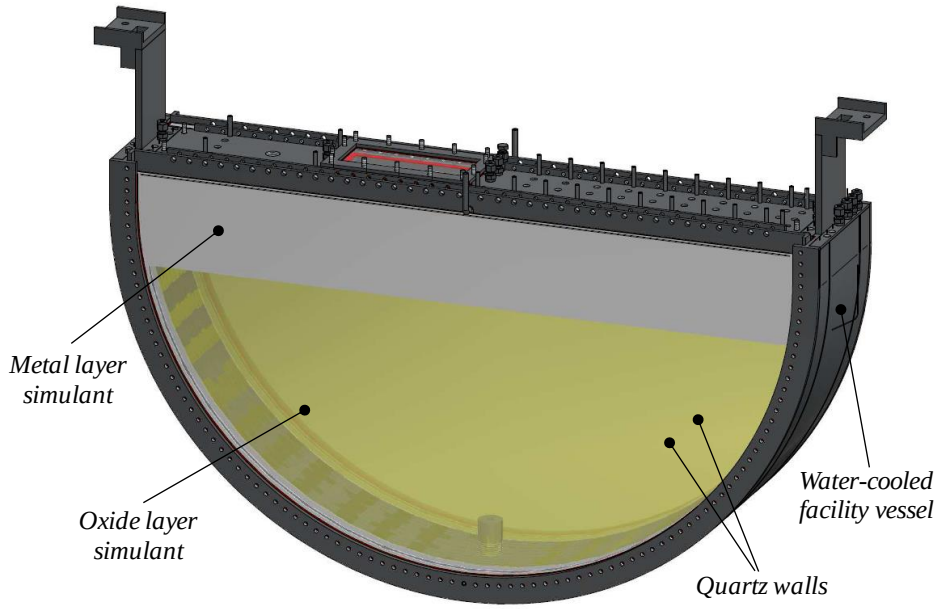


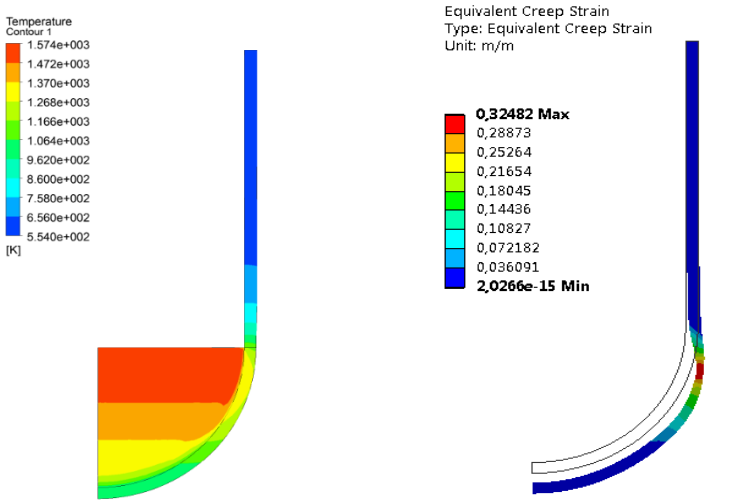
Fig. 3: The general view of the SIMECO-2 test section.

The planning experiments with high temperature molten salt (as oxide simulant) will be covered a temperature range up to 900 °C and internal Rayleigh numbers about $4 \cdot 10^{14}$. Variation of top metal layer thickness from 2 to 10 cm allows to investigate the focusing effect in the range of the concentration factor (ratio of heat flux to the wall and heat flux from the oxide layer) from 3 to 7 and covering external Rayleigh numbers about 6×10^{6}.

Current activity of SIMECO-2 development focuses on the test section construction and preparation of infrastructures including cooling system, melt preparation system, etc.

In the severe accident mitigation strategy for Nordic BWRs, vessel failure mode (including characteristic time of melt release, rupture size and location, and amount and superheat of melt available for release) and location would essentially affect melt-coolant interaction and debris bed coolability in the reactor cavity. The latest progress of computational power could allow more detailed modelling of reactor vessel failure, which could help understanding the relevant phenomena and predicting the accident progression more accurately. To explore such advanced computational capability, KTH is investigating the interaction between the corium and vessel by simulating the FOREVER experiment with a two-way coupling thermo-mechanical approach.

Currently the FOREVER-EC2 test is chosen to be simulated. A literature review was done on this test, the advances of reactor vessel failure simulations and general Fluid-Structure Interaction approaches. Inputs of all materials for both fluid solver and structure solver have been established. A one-way simulation was done for a case checking and to eliminate possible setting errors. Satisfactory results were obtained (2000 s discrepancy in predicting vessel failure time). Fig. 4 shows a temperature contour (left) when the temperature was stable and a creep strain contour (right) when the vessel failed. Two-way coupling would be explored soon after this simulation.



(a) Temperature (b) Creep Strain

Fig. 4: Snapshots from the one-way coupling.

WP2: Development of methods for coupling of Integrated Deterministic Probabilistic Safety Analysis tools such as ROAAM+ developed by KTH with PSA in general and PSA-L2 in particular

The goal of WP2 is development of IDPSA generated data processing techniques for informing PSA about importance of (i) timing of events and (ii) epistemic uncertainty. The uncertainty analysis performed in last year´s report was a simplified approach. A more correct approach would be to study the uncertainties where they arise. It is in principle possible to, using the data used in the ROAAM+ approach, gather such information. It has however been found that the sampling of cases used in the ROAAM+ approach does not translate directly into uncertainty propagation through the modified containment event tree in Monte Carlo-analysis. LRC will therefore clarify in the report how the sampling is performed in RiskSpectrum PSA and how the unacceptable release frequency is calculated.

In particular, the correlation effect of different input parameters where there are "competing" phenomena for containment failure (e.g. steam explosion and debris coolability) will be discussed. It has been concluded that this issue cannot be directly solved in the current framework of ROAAM+ and standard PSA level 2 modeling. To solve this; KTH will on their side look into methods of addressing these correlations within the ROAAM+ framework and LRC will extend their current scope of studies for melt release diameter with a bounding pessimistic case, a sensitivity study and a bounding optimistic case.

Also, LRC will clarify the reasons for the large difference between IM isolation and loss of feedwater cases as well as implement a new grouping of sequences where the consequence "Basemat meltthrough" is grouped together with the previous unacceptable releases into a general category of non-contained release.

The pilot study will be updated with these refined data and extended calculations, to be able to evaluate their impact on the overall results of the PSA

WP3: Deterministic modelling of debris bed coolability and threats for the containment integrity including steam and hydrogen explosions

VTT is analyzing the evolution of debris bed temperature behaviour in post-dryout conditions is continued assessing the effect of heat transfer models to simulation results more thoroughly. MEWA and Fluent simulations have been performed for truncated-cone debris beds to exclude the complex physics in the cone tip. The shape of the beds and spatial discretization are the same as in the DECOSIM computations of KTH. The same three different particle sizes (1, 2 and 3 mm) were also used with various heating powers.

At VTT the Fluent implementation was verified further by applying the Tung & Dhir friction model and comparing simulation results to the MEWA results for the same friction model. The Fluent simulations were repeated with the Schmidt (2007) version of the modified Tung & Dhir model. In case of truncated-cone debris beds, the differences between Fluent and DECOSIM results show the same characteristics as obtained previously in the conical bed cases.

WP4: Level 2 PSA modelling of phenomena and factors affecting containment failure probability and release characteristics

The first draft of a report focusing on modelling of timings and uncertainty analysis in dynamic containment event trees has been written by VTT. A simple emergency core cooling system recovery case has been used to demonstrate different options to model the recovery time and the effects of different timings. Epistemic and aleatory uncertainties have been separated in the case study, and two-phase uncertainty analysis has been performed. A high pressure melting containment event tree from the previous year has also been developed further, e.g. by modelling timings explicitly.

3. Concluding remarks

This brief report provides the progress and status the project “Scenarios and Phenomena Affecting Risk of Containment Failure and Release Characteristics” (SPARC) being carried out by KTH, VTT and LRC. The focus of this project is to produce new data and to develop models and methodologies for addressing severe accident scenarios and phenomena which are important to assess the risk of containment failure and radioactivity release in postulated severe accidents of Nordic nuclear power plants. The main achievements obtained so far are as follows.

In general, the work plan of the research activity has been fulfilled by around 50%, with involvement and contributions of many researchers at KTH, VTT and LRC, including young students and engineers. The research efforts will be enhanced and spreading to the entire activity space during next 6 months.

Nordisk kernesikkerhedsforskning
Norrœnar kjarnöryggisrannsóknir
Pohjoismainen ydinturvallisuustutkimus
Nordisk kjernesikkerhetsforskning
Nordisk kärnsäkerhetsforskning
Nordic nuclear safety research

NKS-B Status Report

Kasper G. Andersson
NKS-B Programme Manager
June 2018
Technical University of Denmark

Status summary

Overall the work in NKS-B is progressing well. Since the last NKS-B status report was made to the NKS-Board in January 2017, 4 new final reports from completed NKS-B activities have been published on the NKS website. All NKS-B activities that commenced prior to 2018 are completed. Of the 9 NKS-B activities that started in 2018, contracts have been agreed and signed with all. Activities that started in 2018 are all currently on schedule.

NKS-B reports

The following NKS-B reports have been published on the NKS website since the last NKS-Board meeting.

AVESOME
J. Havskov Sørensen et al.
Added Value of uncertainty Estimates of SOurce term and Meteorology (AVESOME)

NORDIC-ICP 2016
J. Qiao et al.
An inter-comparison exercise on the application of ICP-MS techniques for measurement of long-lived radionuclides

NORDIC-ICP 2017
J. Qiao et al.
NKS ICP User 2017 Seminar Proceedings

NEXUS
M. Gårdestig et al.
Nordic Exercise for Unmanned Systems

NKS-B activities from 2018 (January)

AUTOMORC
Improvement of automatic methods for identification of radioactive material out of regulatory control (MORC) by mobile gamma spectrometric search
Activity leader: Christopher Rääf (Lund U.)

NKS-B funding: **454 kDKK**

Milestones defined in contract:
1. June 30, 2018: Description of the field experiment to be conducted in a detached area in southern Sweden during three days in the period June – August 2018. Mandatory participation of all collaborating organisations.
2. September 30, 2018: Preliminary results from the field experiment with comparison between model calculations of maximum detection distances and experimentally determined distances, and comparison between real values and calculated source distances and activities using the Bayesian statistical method, where calculations are made on a stand-alone computer. Collaborating organizations provide with the requested data.
3. December 30, 2018: Final report - results from the outcome of the 2018 field experiment. Description of the Bayesian statistical method to determine distance and activity to single

point sources in mobile detection. A stand-alone prototype computer program for the Bayesian statistical method.

Status
Contract signed. Progress report with details on planning of the field experiment received. Progress is on schedule.

OPTIMETHOD
Optimization of analytical methods for simultaneous determination of important alpha emitting radionuclides in nuclear and environmental samples
Activity leader: Xiaolin Hou (DTU)

NKS-B funding: **450 kDKK**

Milestones defined in contract:
1. Project meeting, Feb 2018
2. Sampling. Sample preparation and shipment for intercomparison, Feb-Mar. 2018
3. Analysis of intercomparison samples by partner labs, April-Oct. 2018
4. Validation and optimization of analytical methods, July-Oct. 2018
5. Data analysis and evaluation of intercomparison results, Oct.-Nov. 2018
6. Final report, 31st Dec. 2018

Status
Contract signed. Milestones 1 and 2 are done. Analysis is ongoing. Progress is overall on schedule.

RADWORKSHOP
Workshop on radioanalytical chemistry for nuclear decommissioning and waste management
Activity leader: Jixin Qiao (DTU)

NKS-B funding: **370 kDKK**

Milestones defined in contract:
1. Preparation of theworkshop
2. Organisation of the workshop
3. Summary and evaluation of the workshop
4. Final report

Status
Contract signed. Workshop flyer made. Draft program announced. Seminar announced on NKS webpage, in NewsFlash and through individual invitations. Progress on schedule.

GAMMARAY
Seminar/workshop for users of gamma-ray spectrometry
Activity leader: Henrik Ramebäck (FOI)

NKS-B funding: **362 kDKK**

Milestones defined in contract:

1. Planning meeting (Spring 2018)
2. Announcement of seminar and intercomparison (Spring 2018)
3. Seminar/workshop (Autumn 2018)
4. Final report (15 December 2018)

Status
Contract signed. Preliminary announcement of seminar/workshop made on NKS website and in NewsFlash. Progress on schedule.

NORCO II
Nordic Cosms - part II
Activity leader: Tanya Helena Hevrøy (NRPA)

NKS-B funding: **460 kDKK**

Milestones defined in contract:
Meeting with all partners 10/2-2018
NRPA & SU evaluate restrictions and regulations at institutes for experimental cosms 5/2-18
Report from survey UEF 31/9-18
Microcosm study 30/8-18
Data analyses 30/10-18
Draft scientific papers 31/12-18
Final report 16/12-18

Status
Contract signed. Planning meeting held, restrictions and regulations evaluated. Progress on schedule.

AVESOME
Added value of uncertainty estimates of source term and meteorology
Activity leader: Jens Havskov Sørensen (DMI)

NKS-B funding: **436 kDKK**

Milestones defined in contract:
1. Severe accident scenarios will be selected and corresponding realistic source-term ensembles prepared for atmospheric dispersion model calculation. If available, probabilities (weighting factors) associated with the source term will be assigned.
2. A protocol for automatic communication between the DSS and the high-performance computing (HPC) facility will be developed.
3. Efficient parallelized calculation at the HPC facility will be established.
4. The graphical user interface of the DSS employed in AVESOME will be improved in order to adhere to recommendations of the "NKS Workshop on the Use of Meteorological Uncertainty Estimates for Decision Making during a Nuclear Emergency", 2015.
5. The methodology will be applied to selected meteorological situations and corresponding source-term ensembles by employing the DERMA atmospheric dispersion model and using numerical weather prediction model data of the DMI ensemble prediction system.
6. A seminar will be organized at DMI in Copenhagen on the future use of source-term ensembles describing the inherent uncertainty. The Nordic radiation protection authorities as well as members of CONFIDENCE and FASTNET will be invited.
7. The final numerical results will be made available in a format facilitating import into the

ARGOS DSS, which will thereby host a demonstration of the AVESOME results.
8. The methodology developed and the results obtained will be reported in an NKS report.

Status
Contract signed. First 3 points done. Seminar entitled "Uncertainties in Decision Support – on the use of meteorological and source-term data in nuclear emergency management" planned for September. Progress on schedule.

RADSHIELD 2
Activity estimation of shielded or hidden radionuclides in emergency conditions
Activity leader: Henrik Ramebäck (NRPA)

NKS-B funding: **427 kDKK**

Milestones defined in contract:
1. Planning meeting (March 2018)
2. Field trial (August 2018)
3. Draft report (October 2018)
4. Final report (December 2018)

Status
Contract signed. Planning meeting done. Progress on schedule.

NANOD
Natural radioactivity in the Nordic diet
Activity leader: Mari Komperød (NRPA)

NKS-B funding: **291 kDKK**

Milestones defined in contract:
1. Finalise sampling plan
2. Sampling completed and all analyses completed
3. Final report summarising Nordic seafood consumption, existing data, sample overview and results of samples analysed.

Status
Contract signed. Sampling plan done. Progress on schedule.

Short note on status of the website, NewsLetters etc.

The Secretariat

Finn Physant

NKS Board Meeting, Copenhagen
28 June 2018

Information activities:

- **2019 R and B seminar**
- **R and B articles**
- **Website**
- **Newsletters**
- **LinkedIn**
- **Pamphlet**

Website

- The present version of the website was opened in 2012 and still a state-of-the-art day-to-day working tool.
- We will keep an eye with this and – if needed – come back to you with possible update/upgrade proposals.
- For the present sites we started obtaining statistics from a Google site late 2012. Here you have some main monthly figures for the first 5 years:

Data 2013

nks.org user statistics

Year: 2013	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Visitors	2110	841	727	1030	815	623	577	643	1249	967	742	578
Unique visitors	1342	642	550	718	562	459	415	481	803	628	546	459
New visitors	1226	539	474	584	448	374	348	406	648	511	461	397
Return visitors	884	302	253	446	367	249	229	237	601	456	281	181
Av. session time	156	145	152	160	200	170	152	146	213	200	169	215

Data 2014

nks.org user statistics

Year: 2014	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Visitors	878	1011	969	722	659	717	823	762	904	865	712	736
Unique visitors	672	763	771	581	471	499	696	620	680	625	536	578
New visitors	380	370	296	203	243	298	178	207	332	356	231	221
Return visitors	498	641	673	519	416	419	645	555	572	509	481	515
Av. session time	156	129	131	151	267	197	155	148	178	220	241	198

Data 2015

nks.org user statistics

Year: 2015	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Visitors	1067	723	1046	848	864	877	673	869	1207	1037	923	822
Unique visitors	751	547	857	648	670	642	524	627	818	665	568	571
New visitors	431	244	249	272	279	551	481	553	680	524	459	440
Return visitors	636	479	797	576	585	326	192	316	527	513	464	382
Av. session time	220	185	137	175	166	150	149	140	180	183	166	165

Data 2016

nks.org user statistics

Year: 2016	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Visitors	1523	730	724	792	845	854	584	664	890	1042	915	594
Unique visitors	903	522	536	579	670	589	459	513	621	705	555	420
New visitors	684	403	448	511	583	332	166	460	542	591	478	374
Return visitors	839	327	276	281	262	522	418	204	348	451	437	220
Av. session time	163	184	144	211	137	166	143	161	235	213	227	170

Data 2017

nks.org user statistics

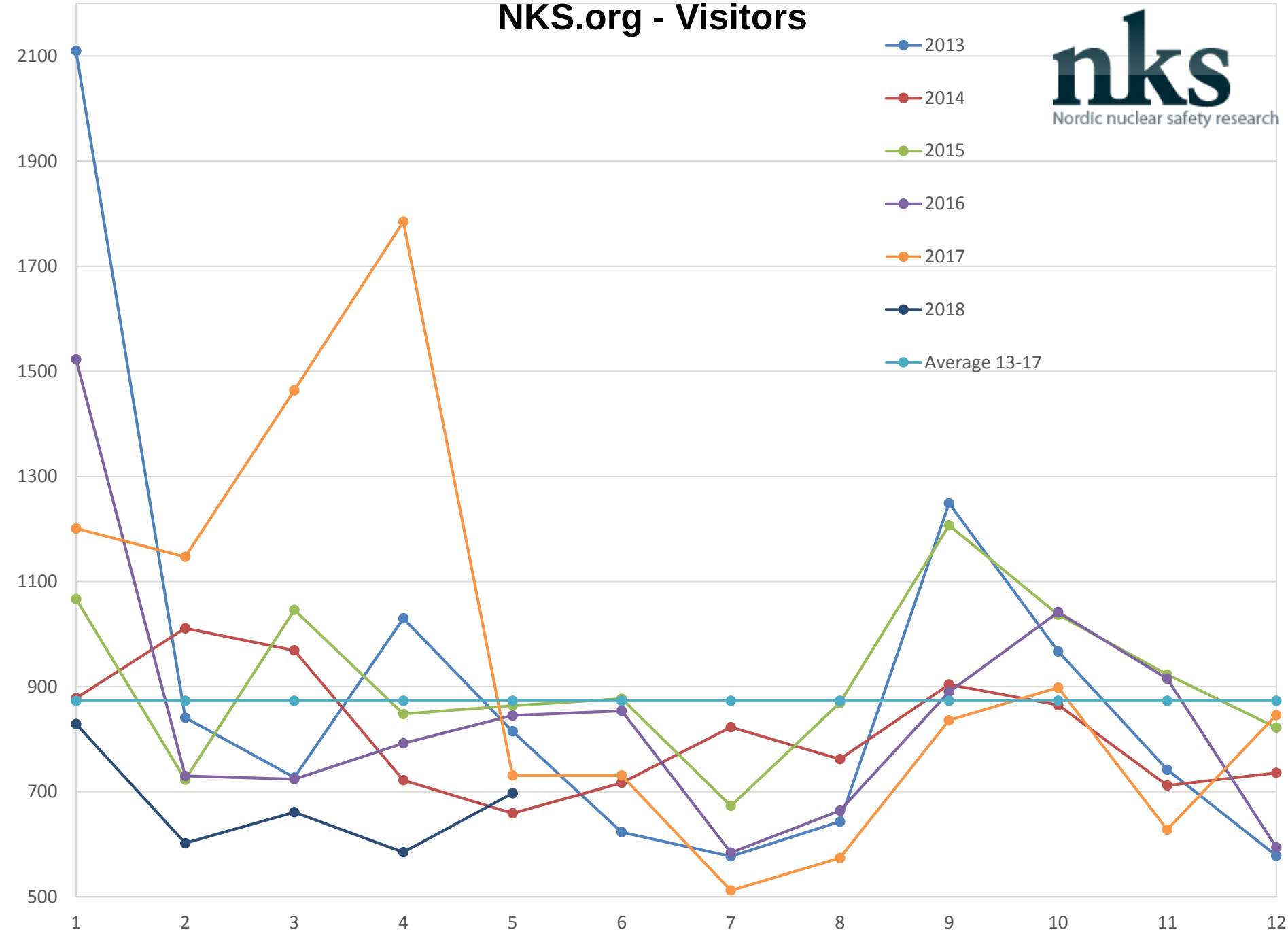
Year: 2017	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Visitors	1201	1147	1464	1785	731	731	512	574	836	898	628	846
Unique visitors	703	685	932	931	507	537	408	429	599	598	424	713
New visitors	613	582	799	719	482	456	359	369	531	480	358	654
Return visitors	588	565	665	1066	299	275	153	205	305	418	270	192
Av. session time	170	86	69	67	151	113	131	165	149	167	128	60

Data 2018

nks.org user statistics

Year: 2018	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Visitors	829	602	661	585	697							
Unique visitors	484	431	465	442	545							
New visitors	390	354	394	389	487							
Return visitors	439	248	267	206	210							
Av. session time	167	111	155	138	137							

NKS.org - Visitors



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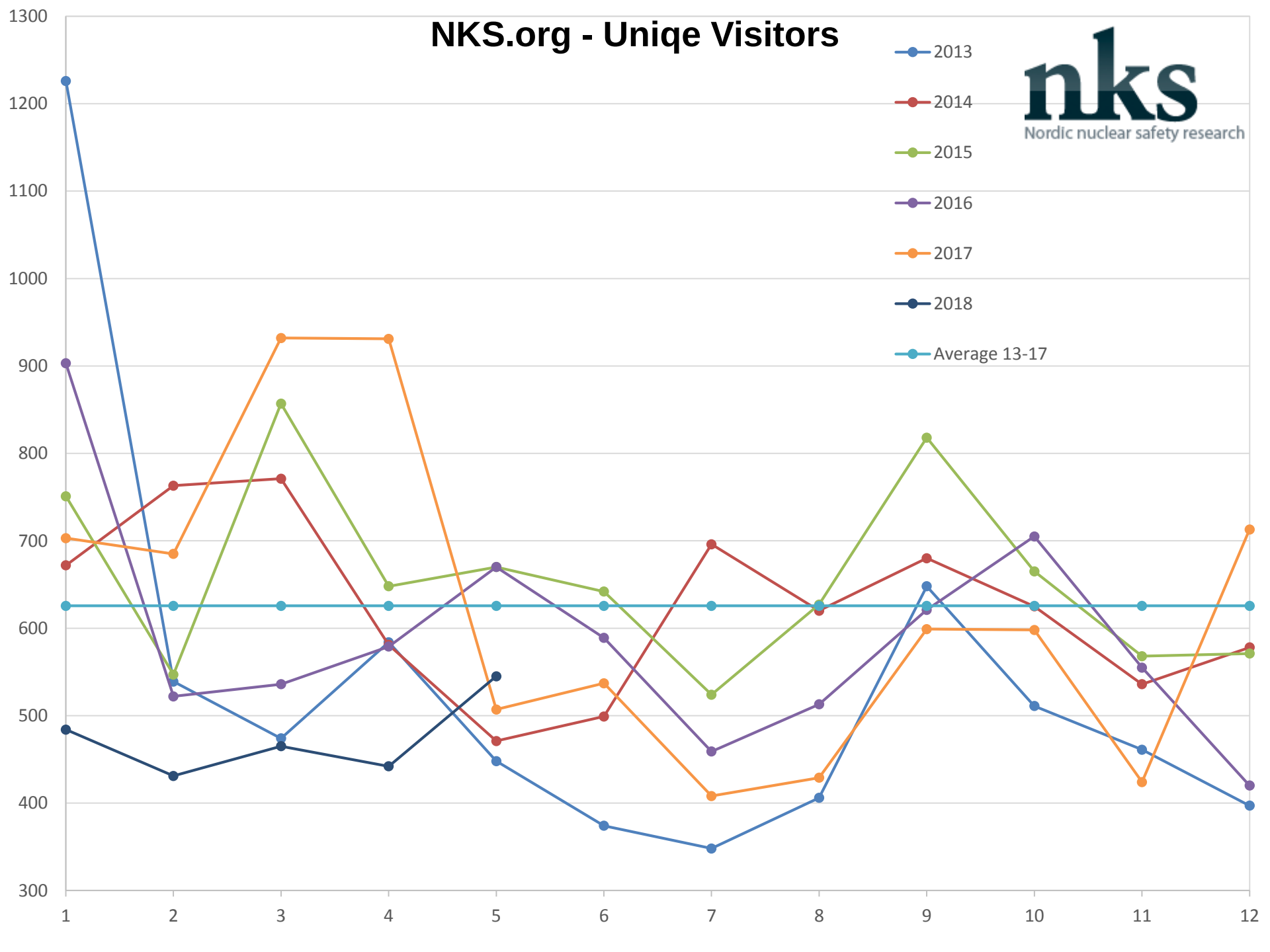
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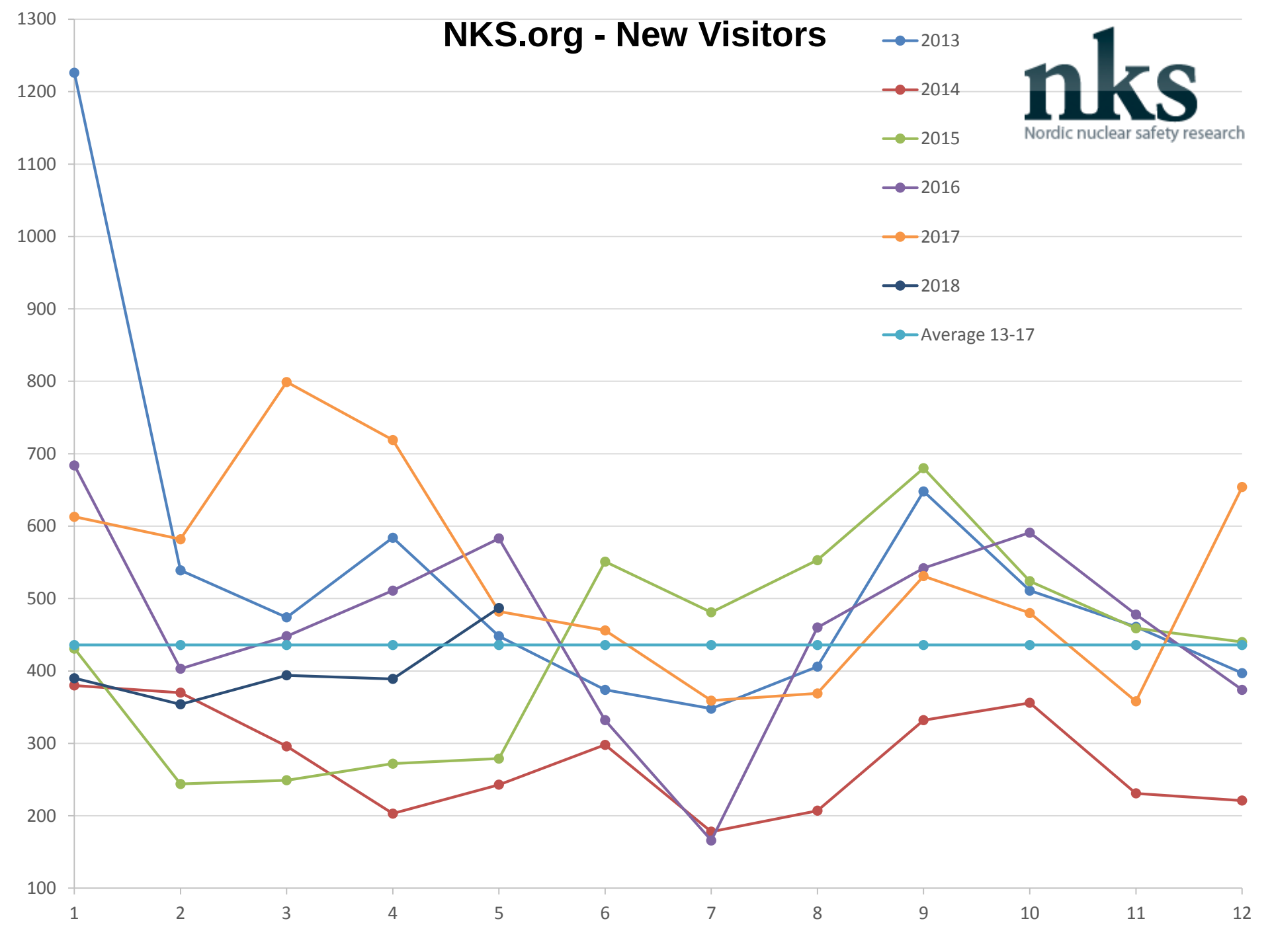
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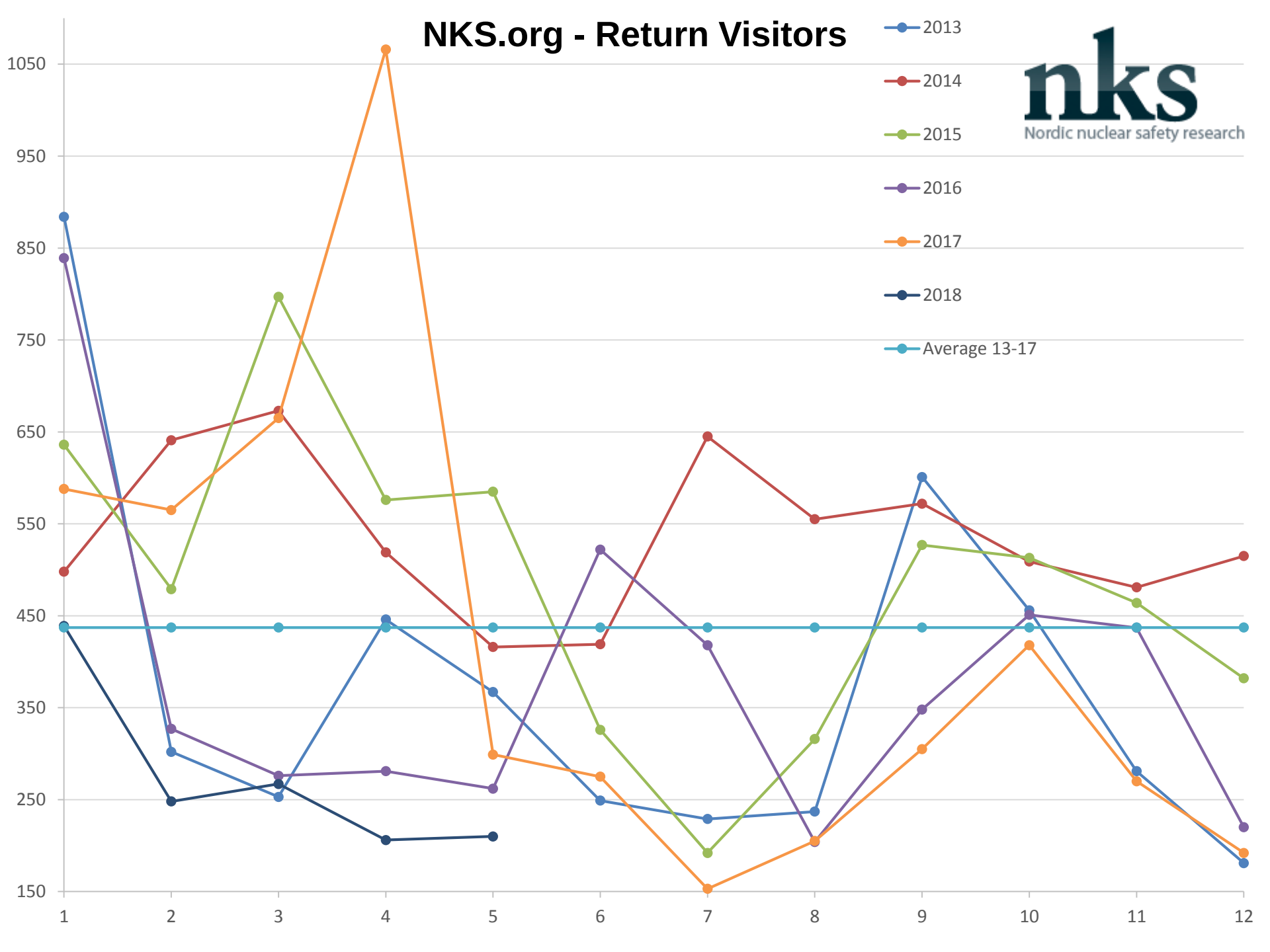
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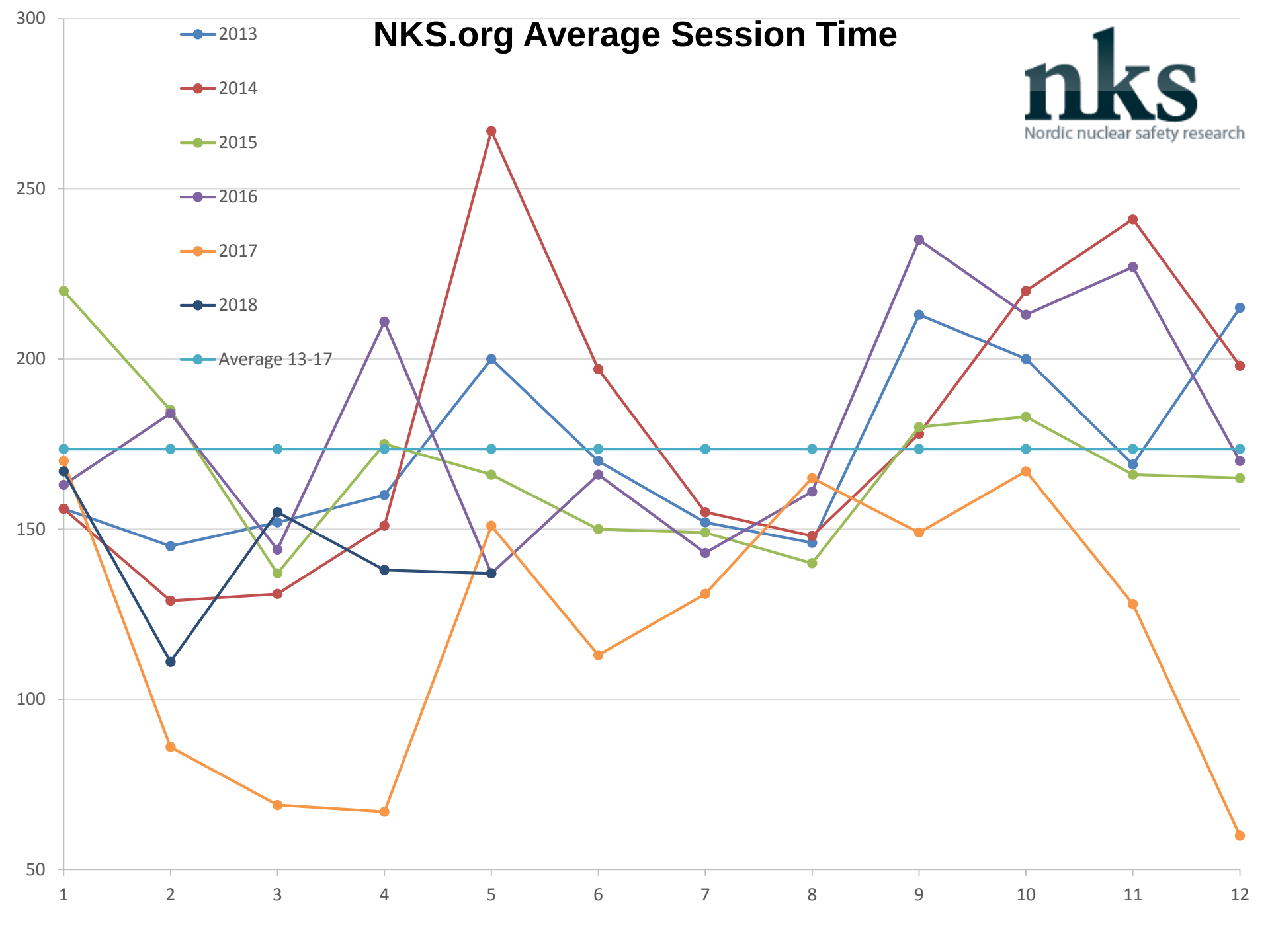
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NewsLetters and NewsFlashes

- Since the last board meeting two NewsFlashes have been distributed.
- January 25: summary report from the January board meeting.
- May 3: upcoming seminars, new publications, young scientist travel assistance and NKS on LinkedIn.
- A NewsLetter was distributed a week before this meeting.
- A NewsFlash will be prepared for distribution within a week after this meeting including a summary report from today's meeting.
- There is a list of more than 500 e-mail addresses, to which our electronic letters are forwarded.

Other kinds of info material –new pamphlet

- A new and updated version of the pamphlet "Nordic Nuclear Safety Research" was published in 2017 and a new and updated version will be published in 2018 shortly before the 2019 seminar.