Nordic nuclear safety research

NKS-R STATUS REPORT

Karin Andgren
NKS-R Programme Manager
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Status summary

This report provides a short overview of the current status of the NKS-R programme. Since the last NKS Board meeting in January, final reports for six of the NKS-R activities started in 2014 have been published on the NKS website. Contracts have been agreed and signed for seven out of eight activities started in 2015. All activities initiated earlier than 2014 have been finally reported.

1.1 Seminars

Five NKS-R activities will have seminars or workshops: MODIG seminar with stake holders (October), ADdGROUND workshops (May and November), L3PSA final seminar (January), LESUN dissemination seminar with stakeholders (October) and two workshops within the PLANS activity (May and November).

1.2 Young scientist travel support

No requests have been received.

1.3 Published reports

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

NKS-328	February 2015	Human performance tools in nuclear power plant maintenance activities - Final report of HUMAX project	HUMAX
NKS-329	February 2015	Nordic Nuclear Forum for Generation IV Reactors 2014	Nordic-Gen4
NKS-330	February 2015	Guidelines for reliability analysis of digital systems in PSA context — Final report	DIGREL
NKS-332	March 2015	Measuring Procedure Competence. Final Report from the NKS-R(14)112/13	ProCom
NKS-333	April 2015	PIV Measurements of DCC-06 and DCC-07 PPOOLEX Experiments	ENPOOL
NKS-334	April 2015	PPOOLEX Experiments with a Sparger	ENPOOL
NKS-337	April 2015	Addressing off-site consequence criteria using Level 3 PSA	L3PSA
NKS-338	May 2015	CFD and FEM modeling of blowdown of gas into pressure suppression pool	ENPOOL

The reports listed above are all final reports for work done in 2014 within the respective activities. Most of the activities result in one joint final report. However, participants in some of the activities prefer to submit separate final reports. In addition, some of the activities are divided into sub-activities which provide separate reports.

2 Activities initiated in 2014

Nine activities were initiated in 2014. Seven of the activities were continuing activities and two were new. Four final reports are still missing. An overview of the status of 2014 NKS-R activities is presented in table 1.

Table 1. NKS-R 2014 activities

Activity	Description	First invoice	Report	Second invoice	Report number
ATR	Impact of Aerosols on the Transport of Ruthenium in the primary circuit of nuclear power plant.	x	-	-	
DECOSE	Debris coolability and steam explosion	x	-	-	
DIGREL	Guidelines for reliability analysis of digital systems in PSA context	x	1/2	-	NKS-330
DPSA	Deterministic-probabilistic safety analysis methodology	x	-	-	
ENPOOL	Experimental and numerical studies on suppression pool issues	x	3/4	-	NKS-333 NKS-334 NKS-338
HUMAX	Maximizing human performance in maintenance	x	x	2/3	NKS-328
L3PSA	Addressing off-site consequence criteria using Level 3 PSA	x	x	1/4	NKS-337
Nordic-Gen4	Nordic nuclear forum for generation IV reactors	x	x	x	NKS-329
ProCom	Measuring procedure competence	x	x	x	NKS-332

3 Activities initiated in 2015

Eight activities were started in 2014. Three of these are continuing activities and five are new. Contracts have been signed for seven of the activities. The contracts from KTH for DECOSE and their part of the work within COPSAR are still missing. The reason being mainly because of the delay with signing the main APRI-9 project contract. Hopefully, both contracts will be signed in the beginning of June. In this chapter short descriptions are given for the activities. For more detailed status reports see attachments.

3.1 ADdGROUND

Modelling as a tool to augment ground motion data in regions of diffuse seismicity

After the Fukushima accident, seismic safety of nuclear power plants and other nuclear installations has become an increasingly important topic also in regions with low seismic activity, including the Nordic nuclear sites. The technical aim of the ADdGROUND activity is to refresh existing and to build new capabilities in earthquake source modelling for ground motion simulations in the context of stable continental regions, specifically the Fennoscandian shield. The scarcity of empirical observations of near-field ground motions from large

magnitude earthquakes in Fennoscandia has been an impediment for deeper understanding of the possible earthquake loading scenarios on nuclear installations, even if the empirical data has been exhaustively analyzed. With recent advances in computational methods, the opportunity exists for numerical models to give realistic estimates of earthquake loads. 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.

Activity leader: Ludovic Fülöp, VTT

NKS-R funding: 500 kDKK

Milestones:
1) Potential calibration cases for modelling identified. Data collected by end of July
2) Input variable ranges for selected modelling cases ready by December
3) Final report expected by year end

Status
The main progress item in the project is the realization of an initial workshop which contributed towards Milestone #1. The workshop “Potential of numerical methods to supplement empirical earthquake observations” was organized on 8th of May 2015 with six presentations focusing on the topic at hand. The consortium agreed on which data should be collected for calibration. Planning of the data collection is ongoing, and the project is on schedule.

3.2 ATR

Impact of Aerosols on the Transport of Ruthenium in the primary circuit of nuclear power plant
Previous experiments have shown that the fraction of gaseous ruthenium transported through the primary circuit of an experimental setup at VTT was higher than what would be expected in thermodynamic equilibrium calculations. Focus of the ATR project is to study the impact of aerosols on the transport of ruthenium in the containment air of a BWR. Some of the most radiotoxic elements that may be released from the fuel into the containment’s atmosphere during a severe accident are iodine and ruthenium. The proposed work for 2015 is a continuation of previous experiments (ATR project in 2014) on the release and transport of ruthenium in the model of primary circuit. This work will create a clear added value by combining the national efforts and specialisations at VTT and at Chalmers. In this study, details of the impact of nitrogen oxide compound NO_2 with various concentrations on the transport of ruthenium in primary circuit conditions will be examined. Another aim is to examine the CsI-Ru system and to find out the reason for the observed extremely high transport of gaseous Ru. In addition to the analysis of gaseous and aerosol ruthenium mass fractions, the speciation of the reaction products will also be determined with several analysis techniques.

Activity leader: Ari Auvinen, VTT

NKS-R funding: 300 kDKK

Milestones:
1) Experiments/tests done at VTT during the summer
2) Analysis of samples during summer/autumn
3) Experiments/tests done at Chalmers during the autumn
4) Finalization of data by the year end

Status
Publication is under preparation based on the results from last year experiments. Submission for review is expected in June and the NKS report for 2014 is expected by end of May.

3.3 COPSAR

Containment Pressure Suppression Systems Analysis for Boiling Water Reactors
BWR containment is a complex system that includes many elements which affect each other's operation. There is a number of safety important scenarios, where containment pressure suppression function operation can be affected by (i) stratification and mixing phenomena, (ii) interactions with emergency core cooling system (ECCS), spray, residual heat removal (RHR) system, filtered containment venting system (FCVS), and (iii) overall water distribution between containment compartments. Year 2015 is the first year of the proposed four year project. The main aim is to design a spray test facility, start development work of spray calculation models and run pre-test simulations. In addition, behaviour of safety relief valve spargers and RHR nozzles will be studied both experimentally in the PPOOLEX facility and computationally with the help of GOTHIC code.

Activity leader: Markku Puustinen, LUT

NKS-R funding: 500 kDKK

Deliverables of VTT:
1) Improved condensation model for vapour on spray droplets
2) CFD calculation of the single spray nozzle experiment performed at LUT
3) CFD model for the PPOOLEX facility with spray systems and pre-calculation of experiments
4) Reports on the single spray nozzle calculations and PPOOLEX pre-test calculations

Deliverables of KTH:
1) Contribution to selection of the design of the spray injection systems for the drywell and wetwell of the PPOOLEX facility
2) Pre-test analysis for selection of operational regimes and test procedures
3) Post-test analysis and validation with GOTHIC code on spray
4) Post-test analysis and validation of EHS/EMS on spargers and RHR nozzles

Deliverables of LUT:
1) Experiments with a SRV sparger and RHR nozzles
2) Designing spray injection systems for the PPOOLEX facility
3) Designing spray injection systems for the PPOOLEX facility
4) Delivery of relevant experiment data to the simulation partners

Status
There activity is progressing according to plan.

3.4 DECOSE

Debris coolability and steam explosion
Uncertainties in assessment of (i) debris bed properties and coolability, (ii) steam explosion impact in BWRs will be reduced by experimental and analytical studies. The experimental part of the project will investigate key physical phenomena of the debris bed formation and coolability. Experimental data will be validated using simulation tools, leading to more reliable predictions of the debris bed coolability in case of an accident with a severe core damage. An analytical approach will be utilized to improve the prediction of coolability and to assess the uncertainties in modelling of steam explosion impact.

Activity leader: Pavel Kudinov, Kungliga Tekniska Högskolan

NKS-R funding: 460 kDKK

Deliverables:
1) Experimental data on debris bed properties and coolability from experimental facilities at KTH and at VTT
2) Developed and validated codes (DECOSIM, MEWA, CFD code) for analysis of the debris bed coolability in severe accident.
3) Analysis of steam explosion and debris bed coolability scenarios in Nordic BWRs.

Status
There are no major deviations between plans and results except for:
- Additional experiments with the COOLOCE facility at VTT will not be performed due to the reduction of funding in SAFIR2018. Instead the focus will be on analytical activities and application of the validated codes to prototypic plant conditions.

3.5 L3PSA

Addressing off-site consequence criteria using level 3 PSA
The aim is to deepen the Nordic understanding about the merits and limitations of probabilistic off-site consequence analysis for nuclear facilities. The project began in 2013, and is in its last year of a planned three years. Through this study the group is furthering Nordic understanding of the potential for Level 3 PSA to determine the influences and impacts of off-site consequences, the effectiveness of off-site emergency response, and the potential contributions of improved upstream Level 1 and Level 2 PSAs. Level 3 PSA provides a tool to assess the risks to society posed by a nuclear plant, and could be integral in making decisions related to the off-site risks of nuclear facilities.

Activity leader: Andrew Wallin-Caldwell, LRT

NKS-R funding: 300 kDKK

Tasks and milestones:
1) Industry and Literature Survey (Status: Completed)
2) Appropriate Risk Metrics (Status: Completed)

3) Regulation, guides and standards (Status: Continuation of IAEA & ANS/ASME work.)
4) Development of a Guidance document (Status: Activity started in 2014 and to be completed in 2015)
5) Pilot Application including tools for dispersion and consequence analysis (Status: Activity started in 2014 and to be completed in 2015)
6) Final report of appropriate risk metrics and regulation, guides and standards

Status
Last year's progress on the Pilot projects was modest as compared with the project plan developed in 2013. This slight deviation in the progress of the pilot project is only slight and will not compromise the overall project plan. The working group has better distributed project responsibilities in order to complete the project according to the proposed schedule.

3.6 LESUN

Learning from Successes in Nuclear Power Plant Operation to Enhance Organisational Resilience
The purpose of the LESUN project is to improve nuclear safety by enhancing organisational learning from successful actions and decisions. The specific goal is to develop an Operating Experience method for capturing, analysing and communicating lessons learned based on successes.

Activity leader: Ann-Britt Skjerve, IFE

NKS-R funding: 600 kDKK

Tasks

No.	Activities	Duration (planned)	Status
1	Literature review	January-August 2015	On-going, almost completed.
2	Data collection: Empirical studies in two Nordic NPPs	March-October 2014	Preparations on-going.
3	Data analysis (dep. on data collection period)	March-November 2014	
4	Dissemination seminar	December 2015	
5	Intermediate report	December 2015	

Status
The project progresses according to plan. Pia Oedewald will resign from her position at VTT before the summer vacation, Marja Liinasuo and Hanna Koskinen, will instead join the project team.

3.7 MODIG

Modelling of Digital I&C
MODIG is an international collaboration project focussing on risk analysis methods and application for modern nuclear power plants with digital automation systems. The objective is to get a consensus approach for a reliability analysis of a plant design with digital I&C, improved integration of probabilistic and deterministic approaches in the licensing of digital

I&C, improved failure data collection including software failure probability quantification, and practical application of probabilistic risk analysis (PRA) to compare design alternatives.

Activity leader: Jan-Erik Holmberg, RiskPilot

NKS-R funding: 300 kDKK

Tasks

1) Development of a method for the analysis of spurious actuations for PSA
2) Clarification of the role of PSA when assessing defence-in-depth, diversity and complexity in design
3) Software reliability: Further explore additional field data (AREVA, Siemens), test of the developed method on real implementation, assessment of the software complexity, improvement of the CCF treatment.
4) Initiation of WGRISK task on failure data collection
5) Seminar together with the SAFIR project SAUNA on September 30 in Espoo
6) Final report is expected to be submitted by year end

Status

3.8 PLANS

Planning Safety Demonstration
Better understanding of selected relevant challenges associated with DI&C safety demonstration and how they can be effectively addressed in the early stages of development projects which benefits all concerned stakeholders on a general level. Refined guidance for DI&C safety demonstration planning on selected topics offering better work routine, harmonized practises and cost savings for stakeholders and thus an expected competitive edge for Nordic end user organizations. An established network of Nordic nuclear safety experts working on DI&C safety demonstration offering a forum of competence and knowledge exchange and strengthening the position of Nordic countries in the world's nuclear community..

Activity leader: Vikash Katta, IFE

NKS-R funding: 400 kDKK

Tasks

1) Extending the approach described in the safety demonstration plan guide (described in Elforsk report 13:86) by investigating further the following areas and devise detailed guidance on them:
    a. Explore reasoning models in order to support an explicit and clear reasoning structure for safety argumentation.
    b. Refine guidance on the first three SSAs, namely Project Scope, Safety Classification and Categorisation, and Requirements.
    c. Develop illustrative examples for the framework based on case studies when possible.
2) Establishing a Nordic technical group of experts on nuclear DI&C safety demonstration. The project group will be extended with experts representing regulators,

utilities, suppliers, consultancy firms and research organisations related to nuclear safety in Nordic countries.

Status
An industrial expert workshop was held on May 12th. There are no major deviation to the original plan.

4 Overview of all NKS-R activities 2010-2014

It is seen from the table below that all activities started in 2013 and earlier have been finalised. An activity is considered to be started at 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
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	unfinished
DECOSE	NKS_R_2012_100	01/2014	unfinished
DIGREL	NKS_R_2010_86	01/2014	02/2015
DPSA	NKS_R_2013_107	01/2014	unfinished
ENPOOL	NKS_R_2011_90	01/2014	unfinished
HUMAX	NKS_R_2013_108	01/2014	02/2015
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

Attachments

A1. Status report ADdGROUND

Progress to NKS of the project

Modelling as a tool to augment ground motion data in regions of diffuse seismicity (ADdGROUND)

Activity leader: Ludovic Fülöp (VTT), May 20th, 2015

Introduction/Scope

After the Fukushima accident, seismic safety of nuclear power plants and other nuclear installations has become an increasingly important topic also in regions with low seismic activity, including the Nordic nuclear sites.

The technical aim of the proposed project is to refresh existing and to build new capabilities in earthquake source modelling for ground motion simulations in the context of stable continental regions, specifically the Fennoscandian shield. The scarcity of empirical observations of near-field ground motions from large magnitude earthquakes in Fenniscandia has been an impediment for deeper understanding of the possible earthquake loading scenarios on nuclear installations, even if the empirical data has been exhaustively analyzed. With recent advances in computational methods, the opportunity exists for numerical models to give realistic estimates of earthquake loads. 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. A longer term aim would be to extend the cooperation to the Baltic countries. The project outcomes will support STUK and SSM, providing background information for the safety assessments of nuclear plants, but are also significant for nuclear repositories.

Foreseen milestones and deliverables

	Date
D.1. Workshop – Potential of numerical methods to supplement empirical earthquake observations (min 3 speakers)	03.2015
M.1. Potential calibration cases for modelling identified. Data collected.	07.2015
D.2. Workshop – Sensitivity of modelling effects of earthquakes in areas of diffuse seismicity (min 3 speakers)	11.2015
M.2. Input variable ranges for selected modelling cases.	12.2015
D.4. Journal paper submitted	07.2016
Final report	12.2015

Some presentation material is public, and some is becoming public once the underlying publications are accepted. We are in the process of clarifying the status of presentations. The workshop had 15 participants:

The consortium agreed to collect data for three levels of earthquake as calibration cases for the future modelling tasks:

- Data from one recent Canadian event (M_w>5) which was well measured for strong earthquakes (VTT and Uppsala University)
- Data from a low magnitude Swedish earthquake measured as close (<20km) to epicentre (Uppsala University)
- Continue with the Kouvola data analysis (M_L 2.6)
- Use some micro earthquake data measured in POSIVA's array (ÅF-Consult)

Planning of the data collection is ongoing, and the project is on schedule.

Publicity for AdDGROUND

Intensive PR activity was also carried out to publicise the events. The press releases of the Workshop in Finnish and English were republished by several media outlets, contributing to the visibility of the activity and of the research project/program:

Ei Fukushimaa Fennoskandiaan" -projekti käyntiin, suomalaiset mukana (07/05-15 14:43);

http://www.talouselama.fi/uutiset/ei+fukushimaa+fennoskandiaan+projekti+kayntiin+suomalaiset+mukana/a2305150

Seismic Safety of Nuclear Power Plants Will Improve (07/05-15 16:16);

https://informedinfrastructure.com/14640/seismic-safety-of-nuclear-power-plants-will-improve/

Nordic earthquake experts convene in Espoo (08/05-15 13:01)

http://www.paneuropeannetworks.com/environment/nordic-earthquake-experts-convene-in-espoo/

Seismic safety of nuclear power plants will improve (10 May 2015)

http://www.cnegypt.com/2015/05/seismic-safety-of-nuclear-power-plants.html

Vakaiden manneralueiden maaniäristyksiä mallinnetaan (10.5.2015) Kaleva + liitteet (E-edition, PDF)

A2. Status report ATR

PROJECT STATUS REPORT 1 (2)

Project name: **Impact of Aerosols on the Transport of Ruthenium in the primary circuit of nucear power plant**

Project short name: ATR-2015 Project number: 237799

Author / logger: Ari Auvinen Date: 29.5.2015

1 Project assignment realisation

Description of the work done during the work period (1.1.2015 – 31.5.2015):

Six out of nine experiments planned for year 2015 on the transport of Ru have been conducted at VTT (table 1.). The carrier gas in the experiments is air. Reference experiments on the chemistry of pure RuO_2 and CsI were conducted at first. In the second phase, the effect of nitrogen oxides (N_2O, NO_2) and nitric acid (HNO_3) on the ruthenium transport was studied by varying their gas phase concentrations and residence time together with Ru oxides in the RCS model. Thus their impact on the equilibrium of Ru species transported to the outlet of the RCS model can be found out.

Table 1. Experimental matrix for transport of Ruthenium in air-ingress scenario.

Exp.	T (K)	precursor	additive precursor conc.	comments	humidity
1	1300	RuO_2	atomizer without particles	Reference exp.; use of inner tube	humid
2	1500	RuO_2	atomizer without particles	Reference exp.; use of inner tube	humid
3	1700	RuO_2	atomizer without particles	Reference exp.; use of inner tube	humid
4	1300	RuO_2+ $NO_2/N_2O/HNO_3$	HNO_3 through atomizer	Use of inner tube	humid
5	1500	RuO_2+ $NO_2/N_2O/HNO_3$	HNO_3 through atomizer	Use of inner tube	humid
6	1700	RuO_2+ $NO_2/N_2O/HNO_3$	HNO_3 through atomizer	Use of inner tube	humid
7	1300	RuO_2+CsI	4 wt.% of CsI solution		humid
8	1500	RuO_2+CsI	4 wt.% of CsI solution		humid
9	1700	RuO_2+CsI	4 wt.% of CsI solution		humid

Deviations from set objectives:

There is no deviations to the project plan.

2 Results produced during the performance period

The results of year 2014 activities were presented in ERMSAR 2015 conference on Severe Accident Research 24th-26th April, International OECD/NEA-NUGENIA/SARNET Workshop on the "Progress in Iodine Behaviour for NPP Accident Analysis and Management" 30th March – 1st April and OECD-NUGENIA/SARNET Source Term workshop 1st – 2nd April.

The results have attracted considerable interest and IRSN have announced their plan to duplicate tests carried out with NO_2 gas in their OECD STEM2 programme. Therefore, writing a publication of the test results as soon as possible is considered to be of high priority.

3 Scheduling situation

The third phase of experiments will start on Wednesday the 3rd of June. In the third phase, the chemistry of CsI-Ru system will be investigated. In the experiments caesium iodide, caesium and

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iodine will be fed separately to the flow of Ru oxides. As an outcome the reason for increased transport of gaseous ruthenium will be explained and the related chemical reactions will be proposed.

These experiments and the following analyses of samples will give a more detailed view on the processes leading to the transport of ruthenium through the reactor coolant system and a better understanding on the chemical composition of containment atmosphere during a severe accident. The last phase of experiments will be completed by June 25th and the activity will be reported on schedule.

The report for year 2014 activities will be delivered on week 23 to NKS and a publication manuscript describing the results will be send for a review.

A3. Status report COPSAR

STATUS of COPSAR-NKS ACTIVITIES, May 20th, 2015

Work at LUT, Markku Puustinen, Jani Laine, Antti Räsänen, Lauri Pyy and Joonas Telkkä

Deliverable 1: Experiments with a SRV sparger and RHR nozzles
Specifications for the SPA-T1 test were agreed with KTH on the basis of earlier tests and GOTHIC simulations and the test was carried out on 12th of May. Test matrix for single phase liquid tests, where the PIV system could be utilized for the definition of flow fields around the sparger head, is being developed with KTH. Design of a RHR nozzle to be installed for mixing efficiency tests is under development. Expected submit date of the report is October 15th, 2015.

Deliverable 2: Designing spray injection systems for the PPOOLEX facility
Information on different spray systems in power plants is being gathered.

Deliverable 3: Single spray nozzle experiments in a separate test facility
Droplet size measurements of a single spray nozzle with the help of the shadowgraphy application of the PIV system are being done. The aim is to develop a measurement environment for defining kye characteristics of a spray nozzle design which will be later installed to the PPOOLEX facility. Expected submit date of the report is November 30th, 2015.

Deliverable 4: Delivery of relevant experiment data to the simulation partners.
Measurement data and video clips of SPA-T1 were delivered to KTH.

Work at VTT, Timo Pättikangas and Risto Huhtanen

Deliverable 1: Improved condensation model for vapour on spray droplets
The submodel developed earlier for the evaporation and condensation model for spray droplets is transferred to new version of ANSYS Fluent. Implementation of the modifications needed for using the submodel with the Euler-Euler two-phase solver have been started. The possibilities to use the model with the Euler-Euler two-phase solver will be tested.

Deliverable 2: CFD calculation of the single spray nozzle experiment performed at LUT
Modelling of single spray nozzle experiments has been started. First CFD model for the experimental configuration has been constructed. The first experiments do not include condensation or evaporation. Test calculations for the spray nozzle have been performed by using available information on the properties of the nozzle.

Deliverable 3: CFD model for the PPOOLEX facility with spray systems and pre-calculation of experiments
Modelling of the PPOOLEX facility will be started in August.

Deliverable 4: Reports on the single spray nozzle calculations and PPOOLEX pre-test calculations

Reporting will be started in November.

Work at Royal Institute of Technology (KTH), Ignacio Gallego-Marcos, Lukasz Filich, Walter Villanueva and Pavel Kudinov

Deliverable 1: Contribution to selection of the design of the spray injection systems for the drywell and wetwell of the PPOOLEX facility
Information on spray nozzle models, nozzle diameters, droplet diameters, droplet distributions, mass flow rates, and jet expansion angles that have been obtained from literature. Discussion on the selection of the design will be carried with LUT.

Deliverable 2: Pre-test analysis for selection of operational regimes and test procedures
No progress.

Deliverable 3: Post-test analysis and validation with GOTHIC code on spray
No progress.

Deliverable 4: Post-test analysis and validation of EHS/EMS on spargers and RHR nozzles
Post-test analysis and preliminary validation of EHS/EMS on spargers against the recent PPOOLEX SPA-T3 and SPA-T4 tests have been carried out. Further development of the EMS model for spargers is ongoing as well as the validation of the EHS/EMS models against the remaining SPA tests. Expected submission date of the report is June 30, 2015.

A4. Status report DECOSE

STATUS REPORT OF DECOSE-NKS PROJECT IN 2014
May 20, 2015

Work at Royal Institute of Technology (KTH), Division of Nuclear Power Safety
DECOSE-NKS and APRI-9

Pavel Kudinov, Sergey Yakush, Simone Basso, Dmitry Grishchenko, Alexander Konovalenko, Sachin Thakre, Weimin Ma, Aram Karbojian.

1. Joint analytical activity on debris bed coolability which will include: code–to–code comparison, development of recommendations and best practice guidelines for simulations, defining reference cases for coolability analysis in plant accident conditions, post-test analysis and code validation against COOLOCE data and pre-test analysis to determine conditions for the future COOLOCE experiments (Tasks 7).

A workshop has been organized at KTH in January to discuss and plan project activities. Validation of the DECOSIM code against existing COOLOCE data with different configurations of debris bed is ongoing. Code performance (convergence, time step limitations) has been improved significantly. DECOSIM simulations of debris bed coolability were carried out for the experimental conditions of COOLOCE-10, 11, and 12 test series performed by VTT. It was known that simulations give lower dryout power than that for top flooding, while in COOLOCE-11 experiments the dryout power was higher (better coolability). Therefore, a number of simulations were performed in order to study sensitivity of dryout power to conditions in the top part of the bed. The heat-releasing volume was of height 0.23 m, top 0.04 m were filled with passive porous material. Simulations carried out for system pressure 2 bar, heating power 30 kW (correspond to experimental power).

Simulations show that dryout conditions are very sensitive to particle diameter and porosity of the bed. Generally, reasonable agreement between simulations and experiments was achieved. However, for the side-only flooding, results were shown to be very sensitive to conditions in the top (unheated) layer. Therefore, special attention must be paid in the experimental procedures to decrease the uncertainty in how tight is the contact between the impermeable top lid and particulate debris bed underneath it, in order to make quantitative comparisons and validation possible.

DECOSIM numerical simulations of debris bed coolability were carried out for a wider range of debris bed configurations, including conical, cylindrical, Gaussian, and mound-shaped beds. The function describing the dependence of dryout heat flux on the width-to-height ratio was found for each shape. A unified shape function describing all configurations within 10% accuracy was proposed, and an analytical expression for it was found. As a result, a surrogate model for 2D debris bed coolability is developed applicable to wide range of debris bed shapes, properties, and system conditions.

Definition of the reference cases for coolability analysis in plant accident conditions is ongoing. Code–to–code comparison for the selected cases and development of recommendations and best practice guidelines for simulations is planned. A set of surrogate models for computationally efficient prediction of the onset of debris bed dryout and post-dryout debris bed coolability have been developed.

2. Investigation of particulate debris spreading, PDS-C tests and pre-test analysis to determine COOLOCE test conditions and procedure, PDS-P (pool) tests on particulate debris spreading in a pool (Task 4).

Experiments in PDS-C (Particulate Debris Spreading – Closures) facility with different types of particles (stainless steel cylinders, spheres, their mixtures, gravel, and zirconia-silica beads) have been carried out. A scaling approach has been developed and validated against experimental database for characterizing empirical closures for the particulate debris flux in non-dimensional variables. A model for prediction of particulate debris spreading based on the proposed scaling approach has been developed. The sensitivity

guidelines for future needs will then be collected to common report. The remaining tasks related to the validation and development of the simulation models and codes will be carried out. VTT is participating to the joint analytical activity on debris bed coolability including code–to–code comparisons, development of recommendations and best practice guidelines for simulations, defining reference cases for coolability analysis in plant accident conditions and code validation against experiments (Task 7).

2. Steam explosion analysis using the MC3D code to analyze steam explosion in a BWR containment (Task 8).
The expertise in MC3D use has been broadened by simulating an experiment performed with partially metallic melt, i.e. TROI-TS5. Also the sensitivity of the simulation results to selected input parameters has been evaluated. During this work a script to automate the simulation process was developed.

A literature survey of the state-of-the-art on steam explosions is being prepared for the Master´s Thesis theoretical part. Selected reactor application cases will be analysed with MC3D examining also the sensitivity of the results to key input parameters. Especially the effect of vessel breach mode will be analysed.

Status of all tasks from previous years

Task 1. Investigation of the effect of the bed geometry and particle size on coolability in 2D debris bed
Synthesis of the COOLOCE experiments performed 2011-2014 is being prepared to combine the results from all six debris shape variations: conical, truncated cone, cylindrical with top flooding, cylindrical with lateral flooding, cylindrical with an agglomerate simulant and cone on a cylindrical base. The geometries which allow multi-dimensional flooding generally have greater dryout power compared to geometries in which the water infiltration into the debris bed is limited by closed walls. On the other hand, it is emphasised that the coolability is strongly dependent on the height of the debris bed and, according to the experiments and the simulations; the effect of the bed height is often greater than the effect of the flooding mode.

Task 2. Investigation of the effect of debris agglomeration on coolability
The effect of agglomerate was studied in the COOLOCE-11 experiments performed in 2013. When comparing the results to previous experiments it was found out that the bed with both top and lateral flooding had the best coolability: the measured dryout heat flux (DHF) was 50-70% greater than the DHF of the test bed with top flooding only. Also, the test bed with the agglomerate simulant had better coolability than the top-flooded test bed, with 10-40% greater DHF. These results are also discussed in the synthesis performed in the frame of Task 1.

Task 3. Investigation of the effect of initial pool subcooling on coolability
The effect of initially subcooled water pool was analysed in the COOLOCE-9 experiments. The experiments suggest that the subcooling may increase dryout heat flux and increase coolability. A synthesis of the results is included in the 2014 report.

Task 4. Investigation of particulate debris spreading
No planned activities due to reductions in funding for SAFIR2018.

Task 5. Investigation of the effect of the heaters' geometry on the DHF
The effect of heater´s geometry will be assessed performing experiments in the POMECO-HT facility with the same ceramic beads as used in the COOLOCE experiments. Preparations for sending the debris bed material to KTH have been made.

analysis of the model has been carried out. The model has been used to quantify the uncertainty in the efficacy of the particulate debris spreading. The model has been applied for selected prototypic sever accident scenarios where efficacy of particulate debris bed spreading has been assessed.

A new sets of tests (~64 tests) has been carried out on upgraded PDS-P facility. The debris spreading driven by large turbulent flows in the pool has been investigated. The post-test analysis of the experimental data suggests that gas injection rate in the pool, pool dimensions and particle properties have strong influence on debris bed formation. A correlation for particle spreading efficiency, relating the tangent of particle spreading angle to two non-dimensional parameters based on the ration of characteristic particle sedimentation velocity to superficial gas velocity, as well as pool aspect ratio, was proposed and validated against PDS-P experimental data. Further experimental work is required in order to develop a database on particle spreading in the pool with wide ranges of pool configuration, particle properties and debris release conditions. The results of PDS-P tests are important for validation of the codes capable to predict complex multi-phase phenomena in severe accident conditions.

3. Investigation of the effect of the particle size on the DHF in POMECO-HT and POMECO-FL (Task 1d).
It is planned to arrange delivery from VTT of the small particle beads used in COOLOCE facility to clarify the effect of the particle size and morphology on the DHF.

4. DEFOR-A series of tests with corium simulant material on debris bed formation (Task 2).
New DEFOR-A tests are under discussion and planning.

5. Application of MC3D and TEXAS-V to analysis of steam explosion in a BWR containment (Task 8).
The steam explosion calculations in the flooded drywell of Nordic BWR have been carried out using MC3D and TEXAS-V codes. The sensitivity studies to the scenario and modeling parameters are ongoing. Morris diagrams were used to characterize sensitivity of the explosion impulse to the input parameters for TEXAS code. The database of TEXAS solution is under further development. New surrogate models for approximation of TEXAS-V output are proposed and implemented. Two approaches are used: (i) training of the Artificial Neural Networks and (ii) implementation of other advanced interpolation algorithms. The surrogate model will be used to perform extensive statistical analysis of steam explosion loads in a Nordic BWR containment.

6. Reporting of the POMECO-FL, POMECO-HT and PDS experiments and code development results.
Reporting for 2014 has been started.

Work at VTT Technical Research Centre of Finland Ltd DECOSE-NKS and SAFIR2018:

Eveliina Takasuo, Anna Nieminen, Magnus Strandberg

Status of Task for 2015

1. Post-test analysis of the COOLOCE experiments conducted thus far.
A comprehensive assessment of the effect of the debris bed geometry on coolability is ongoing for the six debris bed geometries that have been addressed in the experiments in 2012-2014. Several reference cases will be analysed and compared. VTT will provide the final results in September. Clearly-defined

Task 6. Development of advanced instrumentation
No planned activities due to reductions in funding for SAFIR2018.

Task 7. Joint analytical activity on debris bed coolability
Best practice guidelines for the reliable assessment of debris bed coolability based on the experiences using two-phase flow simulation codes are under development.

Task 8. Analysis of steam explosion in a Nordic BWR containment
MC3D and TEXAS have been applied to analysis of steam explosion in Nordic BWR conditions. Result are summarised in the reports.

Overall Project Summary

Comparison between plans and results with explanation of any deviations:
There are no major deviations between plans and results except for:

- Additional experiments with COOLOCE facility at VTT (Task 2, Task 3, and Task 4) will not be performed due to the reduction of funding in SAFIR2018. Instead the focus will be on analytical activities and application of the validated codes to prototypic plant conditions.

Expected submit date of the final report

- Expected date for submitting the reports for 2014 is mid of June 2015.

Any issues you would like the board to know

- Project contract signing by KTH has been delayed. Partially due to the delay with signing the APRI contract – which provides the main source of co-funding for the NKS-DECOSE project.

A5. Status report L3PSA

Memo

NPSAG / NKS-R L3PSA - Addressing off-site consequence criteria using Level 3 PSA: Spring 2015 status report

To:	NPSAG / NKS-R	**Cc:**	
From:	Level 3 PSA working group	**Date:**	22 May 2015
Project no:	211975		

1 Summary

Purpose of Project

Level 3 PSA provides a tool to assess the risks to society posed by a nuclear plant, and could be integral in making objective decisions related to the off-site risks of nuclear facilities. This study intends on furthering Nordic understanding of the potential of Level 3 PSA to determine the influences and impacts of off-site consequences, the effectiveness of off-site emergency response, and the potential contributions of improved upstream Level 1 and Level 2 PSAs.

Progress of the activity

The first year activities, completed during 2013, included an industrial survey, an investigation of appropriate risk metrics, and participation in the development of guidelines and standards. The next phase of the project will primarily focus on the pilot project and the guidance document.

The pilot project is split amongst a Finnish Project, and a Swedish Project. The Finnish project has been underway since 2013, while the Swedish project is starting in earnest during the second year of the project (2014). A significant amount of the work completed during the first year of the project was pilot project scoping and planning. This includes outlining the project goals, required inputs, definition of the steps required for performing such a study and the reports that will be produced.

Since January, significant progress has been made in formally defining the Scope of Analysis. The Scope of Analysis report has been mostly completed, and the working group is currently performing the Study concurrently with the development of the Methodology Specification. These reports will be further developed through the end of the year and completed in the first quarter of 2016.

The guidance document work is also ongoing. A proposal for a draft outline has been developed by the working group.

A comparison between plans and results with explanation of any deviations

Last year's progress on the Pilot projects was modest as compared with the project plan developed in 2013. This slight deviation in the progress of the pilot project is only slight and will not compromise the overall project plan. The working group has better distributed project responsibilities in order to complete the project according to the proposed schedule.

Expected submission date for Phase III of project

The third and final seminar will be held in January 2016. The second year report will be completed immediately following that meeting (approximately beginning of March 2016), incorporating the findings from the seminar.

Issues the board should know

Vattenfall AB has been added to the working group in this, the final year of the project. Vattenfall's experience with dispersion and consequence calculations as well as their involvement with the parallel NKS project NORCON has been very beneficial to the project.

2 Progress of activity

In general, the work has progressed very well, and has fulfilled all planned deliverables to date. The progress of the Pilot project is, however, a little behind the schedule developed for the Pilot project at the beginning of 2014. This is due to delays in deciding where the input data would be derived from.

This issue was discussed in the autumn of last year with stakeholders and plans for how the project could proceed. With the input source and input specification report discussed within the group the project will be able to continue. In order to maintain the overall project schedule project responsibilities have been better divided amongst the working group members.

Work on the Guidance document will begin with a Kick-off meeting June 1st 2015 in Uppsala. During this meeting stakeholder involvement, development logistics, and document scope will be discussed.

3 Project funding

3.1 Project timeline, distribution and deliverables

Table 1. List of project deliverables.

Deliverable	Date
Detailed project plan	May 2013 (complete)
Reference group meeting	May. 2013 (complete)
Project seminar 1	Jan. 2014 (complete)
First year report	Jan. 2014 (complete)
Major Sub-report Survey of Level 3 PSA Industrial Purpose/Application Status of Task 1 - Risk Metrics (complete) Status of Task 2 - Regulation & Standards (ongoing) Status of Pilot Application (SAFIR/PRADA – VTT)	
Project seminar 2	Jan. 2015 (complete)
Second year report	Jan. 2015 (complete)
Major Sub-sections Level 3 PSA Regulation, Guides and Standards Report Status of Pilot Application (33%)	
Final report (Following year 3)	Jan. 2016
Major Sub-report Level 3 PSA Guidance document Input from previous tasks including pilot application Including: 1. Recommendations for Level 1 and 2 PSA 2. Methodology guidance	

4 First year activities (2013)

The first year activities are fully described in Reference [1].

5 Second year activities (2014)

The second year activities are fully described in Reference [2].

The pilot project was the primary focus of the 2014 activities within the project.

The tools and methods used for performing the analysis have been limited to those that are available and the working group has experience using.

The activities within the pilot project have been focused on working to characterize and collect input data, and development of the Scope of analysis.

Additionally, work has also continued in support of the IAEA's development of a TECDOC for Level 3 PSA. This work is expected to continue over the next few years.

5.1 Swedish pilot project organization

Three reports are being developed to document the work completed in the pilot project:

- Level 3 PSA Pilot Study input specification
  - Based on LENA requirements / assumptions what inputs are need
  - what formats are required
  - What limitations have been found
  - What additional information could be (could have been) useful.
  - Complete before Summer semester
- Scope of analysis
  - Satisfy as many of the goals we prescribed in the previous meeting with the resources available
  - Countermeasures
  - Results
  - Uncertainties
  - Complete by year end
  - Start concurrently with Input specification
- Methodology specification
  - Describe LENA
  - Complete by year end
- Application and result interpretation specification
  - Complete during 2015

5.2 Regulations, guides, and standards

Progress on the Level 3 PSA standard has been modest over the past year. The Standard writing committee began work on the standard in 2004, and progress has been somewhat un-even over the past several years. The standard has had periods of significant progress, and periods of somewhat slow development. Judging based on the current status of the Level 3 PSA standard, the related Level 2 PSA standard, and the relatively modest progress of each during the past year, the completion of the ANS/ASME guidance on Level 2 and Level 3 PSA will take several more years.

The IAEA work will continue the next several years. The IAEA TECDOC is in the very early stages of development, and several more Consultant Meetings will be required to continue and eventually complete it. The IAEA has also discussed the possibility of additional regional workshops, but it is possible that there will be no additional regional workshops.

6 Comparison between planned and actual progress

Last year’s progress on the Pilot projects was modest as compared with the project plan developed in 2013. This slight deviation in the progress of the pilot project is only slight and will not compromise the overall project plan. The working group has better distributed project responsibilities in order to complete the project according to the proposed schedule.

7 Expected date for final report

The third and final year seminar will be held in the first quarter of 2016. The second year report will be completed immediately following that meeting, incorporating the findings from the seminar.

8 Other issues for information to NKS/NPSAG

Vattenfall AB has been added to the working group in this, the final year of the project. Vattenfall's experience with dispersion and consequence calculations as well as their involvement with the parallel NKS project NORCON has been very beneficial to the project.

9 References

[1] "Addressing off-site consequence criteria using Level 3 PSA — Phase 1 Status Report", NKS-R, NKS-303, March, 2014.

[2] "Addressing off-site consequence criteria using Level 3 PSA — Phase 2 Status Report", NKS-R, NKS-337, April, 2015

A6. Status report LESUN

Project: Learning from Successes in Nuclear Power Plant Operation to Enhance Organisational Resilience (LESUN).

The purpose of the LESUN project is to improve nuclear safety by enhancing organisational learning from successful actions and decisions. The specific goal is to develop an Operating Experience method for capturing, analysing and communicating lessons learned based on successes.

Overall, the project is progressing according to plan.

Project Group in 2015: Pia Oedewald (VTT) *(until 31/05/2015),* Kaupo Viitanen (VTT), Marja Liinasuo (VTT) *(from 15/04/2015)*, Hanna Koskinen (VTT) *(from 15/05/2015)*, Christer Axelsson (RAB), Rossella Bisio (IFE) and Ann Britt Skjerve (IFE, co-ordinator).

Milestones:

No.	Activities	Duration (planned)	Status
1	Literature review	January-August 2015	On-going, almost completed.
2	Data collection: Empirical studies in two Nordic NPPs	March-October 2014	Preparations on-going.
3	Data analysis (dep. on data collection period)	March-November 2014	
4	Dissemination seminar	December 2015	
5	Intermediate report	December 2015	

Overall status:

Overall, the project progresses according to plan. The literature review is close to being completed, and preparations for data collections are ongoing. It is expected that the main part of the data collection will be completed in June in Finland (Loviisa) and in June and August in Sweden (Ringhals). Project coordination is carried out using regular video-meetings. On May 26-27, the project team will meet in Halden for a lunch-to-lunch workshop to complete the preparation for the empirical work.

There will be changes to the LESUN project team before the summer vacation. By the end of May, Pia Oedewald will unfortunately no longer be a part of the LESUN project, as she resigns from her position at VTT. To compensate for this, two experienced researchers from VTT, Marja Liinasuo and Hanna Koskinen, join the project team during April and May.

Status on the individual activities:

Ad 1) Literature review
A literature review has been carried out focused at understanding the characteristics of successes, with a special focus on successes in an operational domain. The outcome of the

review has been documented in a 13-pages draft document. It will be reported as an integrated part of the intermediate report.

Ad 2) Data collection: Empirical studies in two Nordic NPPs
A method for addressing successful performance in NPP operations is currently being developed. The method is intended to support both data collection and data analysis. It is based on the assumption that to derive lessons learned from success in an operational setting, analyses need to be multi-levelled and reflect perspectives of the various stakeholders. Further, that lessons learned from successes should not be used to cement a particular task performance approach, but rather to build global insights in the operational environment, which assist stakeholders in successfully adapting their performance during task performance. The main part of data collection at Loviisa and Ringhals is expected to be performed in June and August.

Expected submit date of the Intermediate/final report:
We expect to submit the *final report* 31, December 2015.

A7. Status report MODIG

AFT/NKS-R(15)116/9
MODIG — Modelling of DIGital I&C
Status May 2015/Jan-Erik Holmberg, Risk Pilot AB

Task	Status
#1. Development of a method for the analysis of spurious actuations for PSA	Detailed working plan for 2015 prepared. Progress 10%
#2. Clarification of the role of PSA when assessing defence-in-depth, diversity and complexity in design.	Literature collected, and a general description of the defence-in-depth principle prepared. Progress 40%
#3. Software reliability: Further explore additional field data (AREVA, Siemens), test of the developed method on real implementation, assessment of the software complexity, improvement of the CCF treatment.	One working meeting held. Detailed working plan for 2015 prepared. Preliminary agreement with AREVA for collaboration. Progress 20%
#4. Initiation of WGRISK task on failure data collection	Proposal submitted to WGRISK in March 2015. As a feedback, WGRISK asked to merge this proposal with another proposal on taxonomy for diversity assessment of digital I&C. Progress 50%
#5 Plan for 2016–18	Preliminary road maps prepared for each task 1–4 Progress 5%
#6. Interim seminar 2015	Tentative plan is to hold it together with the SAFIR project SAUNA on September 30, 2015 in Espoo Progress 5%
#7. Interim report 2015	Table of contents prepared. Expected submit date of the report December 31, 2015. Progress 5%

No deviation to the original plan
Overall progress 20%

A8. Status report PLANS

Status report *PLANS, Planning Safety Demonstration, NKS_R_2015_117*

The status report is sent to the following programme manager of NKS-R: Karin Andgren

Reported by: Vikash Katta, Institute for Energy Technology, Norway (Project manager)

Date: 18/05/2015

Status of activities and milestones

As per the project plan, the main activity at the early stages of the project is to organise a workshop to kick-off the project. The objective of such a workshop is to agree upon the scope of the work and define a research roadmap. With a small deviation (as explained in the next section) from the original plans, we have performed the following activities:

A **project kick-off meeting** with project partners was organised on March 23rd, 2015 at SSM, Stockholm. The project partners discussed on how to achieve the activities planned for 2015. In particular, discussions were held on how to further develop a safety demonstration plan guide. In addition, the partners discussed and agreed upon organising an industry expert workshop. The main intention of organising the expert workshop was to engage utilities and vendors as early as possible in the project so that the results developed in the project addresses some of their challenges.

An **industry expert workshop** on "Safety demonstration and planning in Nordic NPP digital I&C projects" was organised by the project. The workshop was hosted by SSM at their premises in Stockholm on 12/05/2015. The workshop had participants (I&C experts) from STUK, TVO, Fortum, OKG, Ringhals, ÅF, ELE Engineering AB in addition to experts from IFE, SSM, Solvina and VTT.

The workshop focused on the challenges and possible solutions to safety demonstration. The participants discussed how safety demonstration planning at the early stages of the project can address several of the challenges related to safety demonstration. One of the main conclusions of the workshop is that there is a lack of awareness on importance of safety demonstration in the industry especially at the management level. One of the concrete suggestions from the experts to the PLANS project is the project should help the community to bridge the knowledge gap that exists in the personnel from several departments, including management, involved in digital I&C projects. PLANS project intends to address this with developing a guide for safety demonstration planning and to show how safety demonstration plan fits into the overall system engineering process.

The project also had an early start with setting up a **Nordic consortium** for NPP digital I&C experts (promised as a result of PLANS project) by inviting the participants of the industry expert workshop to join the consortium.

Deviation and explanation

There has been one small deviation with respect to arranging the workshop for kicking-off the project. However, this will not have any effect on the expected results of the project. We have conducted the kick-off meeting on March 23rd at the SSM premises and not in conjunction with the 3rd Scandinavian conference on system & software safety (as planned in the proposal). As per the original plan, we intended to invite some of the experts attending the conference to our meeting. Instead, we have decided to organise an industrial expert workshop on May 12th, 2015 and to invite NPP I&C experts to this workshop.

Status of deliverables

1. An internal report on the summary of the industry expert workshop will be finalised by the end of May. This can be made available to NKS, if desired.
2. A final report of the project is expected to be submitted by December 3rd, 2015.
3. A revised version of the safety demonstration plan guide will be made available in November.
4. A website (http://nordicnsec.ife.no) for Nordic nuclear safety experts consortium on safety demonstration of digital I&C systems has been setup.

Issues

None