

Nuclear Reactor Regulation  
Karin Rantamäki

May 7, 2018

## Reactor Safety Committee Meeting 1/2018

Date March 20, 2018, 9:30-16:20

Place STUK, Laippatie 4, Meeting room Röntgen 4386

Participants	Lasse Reiman	Chair
	Richard Donderer	Member
	Philippe Jamet	Member
	Ralph Schulz	Member
	Keijo Valtonen	Member
	Karin Rantamäki	Secretary
	Petteri Tiippana	
	Kirsi Alm-Lytz	
	Tomi Routamo	Items 1-4
	Kim Wahlström	
	Juhani Hyvärinen	Items 1-5

Absent:	Gabor Petofi	Member
	Lennart Carlsson	Member

### 1 Opening and adoption of agenda

Lasse Reiman opened the meeting at 9:35 and welcomed everyone. He presented Juhani Hyvärinen who is a member of the NSAC (YTN). He is a professor in Nuclear Engineering at Lappeenranta University of Technology.

The agenda was approved and can be found in Appendix 1.

### 2 Approval of the minutes of the previous RSC meeting (1/2017)

The minutes of the previous meeting were approved.

### 3 Current status of Finnish nuclear field

Petteri Tiippana presented the new strategy of STUK. The strategy for the period 2018-2022 is very STUK oriented. The vision consists of four main topics: The happiest civil servants, the best government agency, the most satisfied customers in the world ensuring a radiation-safe Finland also in the future. The strategy has been set up together with the staff.

He discussed the changes in the field and presented the strategic objectives how to reach the goals mentioned in the vision. The objectives are concrete and have been worked out with the staff. The staff has participated actively in the work. One of the most significant questions is how to be more risk-informed and ensure a commensurable oversight in all regulated areas. This may become a topic for a RSC meeting.

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He finished his talk with presenting an overview of the current activities in the Nuclear Field in Finland:

- Regulations, YVL-guides under review
- LO1/2 just finished the PSR<sup>1</sup>, I&C modernisation, modernisation and Fukushima improvements
- OL1/2 review of license renewal incl. PSR<sup>1</sup>, modernisation and Fukushima improvements
- OL3 commissioning on-going, licence application under review, preparing for loading and start-up
- Fennovoima not much progress, review of licence documentation, PSAR documentation is delayed
- Spent fuel repository under construction, licence application
- FiR applied for licence for decommissioning.
- Terrafame has applied for a license to start the production of uranium.

Digitalisation raised discussion how this will be increased and utilized. There are no answers yet but STUK intends to develop its work-ways in such a way that it would support digitalisation or vice versa. Being more risk-informed and in highlighting licensee's responsibility one also needs to consider reducing the workload of the regulator, in other words to give up some work that is being done now. However, this is not an easy task since you are creating a new philosophy, and to some extent changing of the roles of the regulator and the utilities. This is a major change and also needs a lot of communication with the staff, public and media.

The presentation slides can be found in Appendix 2.

#### 4 **Feedback on last meetings topic, Oversight of organizational issues**

Tomi Routamo gave a follow-up on the oversight of organizational issues.

STUK has had regular meetings with TVO. TVO has many ongoing actions to improve the situation. However, it is still too early to say that significant improvements can be seen. The changes in the management have raised feelings in both directions. However, the final effects remains to be seen. TVO has also increased meetings with the middle-management.

There have been some difficulties in the negotiation between TVO management and the union people. This has among other things caused some difficulties for TVO management to create trust between them and the staff. The communication through the union seems not work too well. There needs to be other channels and lately the directors have used other channels too.

Concerning the RSCs recommendations for actions given in the previous meeting, Kirsi Alm-Lytz explained how STUK has taken into account them.

1. Actions directly related to the case

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<sup>1</sup> PSR, Periodic Safety Review

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- a) link to operating licence: the statement on the licence application will only be given after STUK is convinced that the actions TVO is taking do improve the situation.
  - b) utility to present the actions, verifying the performance and reporting to STUK; STUK has had regular meetings with TVO's management where they have presented there ongoing and planned actions and their analysis whether the performance is improving
  - c) results from WANO-missions; STUK gets the results from the currently ongoing pre-OSART-mission
2. General actions for consideration
- a) corporate level oversight should be done and regulated on a more general level than currently
  - b) regular meetings with the management have been held and also few meetings with the directors
  - c) in January STUK interviewed some staff members. TVOs own survey on safety culture gave an impression that there is slight improvement in many areas.

The improvement is a slow process. To be sure that the situation improves permanently will take time and needs to be done through normal oversight.

The committee would like STUK to present a programme TVO has communicated to the staff. The topic will be discussed in the next Nuclear Safety Committee meeting.

## 5 Modernisation of old I&C-systems

Modernisation of existing I&C systems was the main subject for the meeting. The I&C systems of the operating power plants are getting obsolete with the NPPs. Thus, these systems need to be renewed. There are lots of issues to be considered in such work. Kim Wahlström presented possibilities and pitfalls.

Timing of a renewal project is a major issue. Defining the prevailing phase of the lifecycle, and consequently, the time when to renew the system, is not easy. The old systems are often very robust and the failure rate may be very low until the end of their lifetime. Ageing management programmes may help here. Also keeping the know-how and finding qualified staff relates to this question.

Another major issue is the extent of the renewal project. Things to be considered here are the estimated lifetime of the plant, the new regulatory requirements, economy, controllability of the renewal work, risk management of the project and the maintenance of the modified system.

He also discussed the advantages and disadvantages of the principal approaches. The system can be replaced by a similar new one using the same technology or with a totally new technology. In addition, he described possible platform techniques and their advantages and disadvantages. The failure mechanisms of both conventional and software-based I&C were considered.

In large renewal project, new regulatory requirements need to be taken into account. However, on existing plants this may cause problems. Therefore, an important issue is to define which new requirements have to be taken into account. It is not straightforward

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to evaluate the effect of the changes on the overall safety of the plant. The role of the regulatory body in the renewal project was also discussed.

He finished his talk with showing a summary of I&C renewals already made on the Finnish operating plants.

The presentation slides can be found in Appendix 3.

**Ralph Schulz** presented the Swiss practices. The licensee is responsible for monitoring and predicting the renewal need and its timing. It is done as part of the ageing management program and the periodic safety review. For monitoring the licensees use e.g. statistics of failure rates and modes. In Switzerland, only production stops or availability of spare parts has led to renewal projects so far.

Switzerland has good experience of starting big projects with a conceptual project phase, sort of pre-project. They have also split the large projects into subprojects. Both replacing the old system with a new similar one and implementing a new technology are possible. Conventional hard-wired, analogue technology is required for special safety systems (additional bunkered safety systems). There are no restrictions concerning the platform but qualification and diversity are required. The regulatory requirements are written for existing NPPs and there are no new construction projects. He also mentioned the international requirements that are applied. Qualified products should be used since the qualification process is time-consuming. This needs a common understanding of the qualification requirements already before the renewal project. He finished his presentation with summarising the major I&C modernisation projects in Switzerland. All the platforms used in these projects were qualified.

The presentation slides can be found in Appendix 4.

**Richard Donderer** summarised the German situation. All I&C renewal projects have been stopped after the phase-out decision. Instead of renewal of the systems, spare parts are used from permanently shutdown plants, components are repaired or refabricated. In Germany, the failure rate is monitored as part of the ageing management programs. Renewal projects take always time. The complete description of the task to be performed should be clearly defined at the beginning of the project. In Germany, both the replacement of the system with similar new one or renewal with totally new technology are possible. For single specific functions, replacing the system with the same technology may be better while in larger renewals, implementing new technology has its advances. In eastern European countries, several VVER-plants have good experience with software based functionality. In the case of change from analogue to digital technology, German regulations added specific requirements in particular with regard to the CCF potential. Also the supervision needs some extra effort. Diversity is required as well as dissimilarity. The diverse system can also be a digital system, it is not necessary to have a hard-wired back-up system, although it may be sometimes the easiest solution. In Germany, it would not be recommended to promote any platform by the regulator. However, if advances are seen these should be communicated.

The presentation slides can be found in Appendix 5.

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**Philippe Jamet** gave a presentation on the French practices. Safety of I&C systems is assessed in the frame of aging management, operational experience feedback and periodic safety reviews. . The most recent plants (N4 and EPR) use digital I&C. Significant delays were seen in the design phase before the safety demonstration could be established. For the oldest plants (900 MW and 1300 MW reactors) the conventional I&C has continuously been improved and the process has been smooth. The general architecture of the I&C of 900 MW and 1300MW plants has been kept and improvements were implemented on the basis of modules replacements or adjunctions. Several modules have been changed from analogue to digital. This was in particular the case for the protection system. The TMI accident was a strong driver in changing into digital I&C for N4 and EPR. The regulator did not select or compare possible platforms. However, they developed tools to assess the safety of the digital I&C. He also presented the regulatory requirements applied in France. An ageing management programme is required from the utility. The utility has to demonstrate in the periodic safety that the I&C system remains fit for purpose for the 10 following years. This comprises both spare parts and knowledge. Delays in the projects should be the concern only if the safety of the plant is affected. The regulator can require compensatory measures, enforcement if needed or stopping the operation in case of major degradation of safety. Promotion of a particular platform is not the responsibility of the regulator. However, if certain solutions are not compatible with the regulatory requirements, it should be expressed.

The presentation slides can be found in Appendix 6.

**Keijo Valtonen** presented a collection of information of renewal projects all over the world. All the countries have the problem with spare parts availability and qualified personnel. The lifetime extension from 40 to 50 years causes issues with the I&C renewal since the projects tend to take several years. Thus, the remaining lifetime of the plant after the renewal may be too short. Vattenfall has published a report on how they handle the analogue technology [[Life Time Extension of Present Analogue I&C Systems, 2015](#)].

He discussed the use of various platforms. His conclusion is that the only realistic strategy for I&C renewal is to keep the analogue system analogue and digital systems digital. New requirements are developed for new NPPs and cause thus problems for existing plants. The layout and process systems in existing plants do not enable fulfilling of the new criteria. Therefore, it makes no sense to require all new requirements from the existing plants.

The presentation slides can be found in Appendix 7.

### **Summary of the discussion on the modernisation of I&C systems**

The questions STUK posed were not very easy to answer. Also the motivation behind the questions was not too clear for the members. However, the presentations were good and useful for STUK since STUK wanted to hear experiences from other countries. The discussion concentrated on a few topics. The main strategy for I&C renewals varies from country to country. In France the process has been stepwise module by module. In Switzerland, the renewals were larger changing from analogue to digital. Germany has stopped all the renewal projects. However, if they would be done diversity would be required.

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The reasons for I&C renewals is mostly the lack of spare parts. In some cases also advantages can be achieved with digital I&C compared to analogue one. These are the main reasons for the renewal. The regulatory requirements have not been the main driving force. The digital system can also provide a way to improve safety or solve some safety related problems or questions. However, when considering the renewal of the I&C system of an existing NPP it doesn't make sense to require more from the I&C system than the overall plant.

The renewal projects are time consuming. However, the delays in the project are not necessary the concern of the regulator. The regulator should be worried only if the delays affect the safety of the plant. In some cases the changes are simple and easy to make. In others, they are more complicated. The technology is changing fast which should be taken into account.

The general approach to start with the reactor protection system seems to be good. There are some good experiences in Europe of changing from analogue to digital. However, there are questions related to the man-machine operation or other details where both advantages and disadvantages can be seen when using digital systems. The classical panels will always be needed in the control room. Therefore, the operators need to be trained to operate on both systems. They need e.g. to switch from digital panels to the classic panels during accident condition. This means that they have to use two operation interfaces. A big question is also the training of the staff and to maintain the expertise of the old technology. This also relates to the thing that the regulations enable safety improvements.

The regulator shouldn't promote certain platforms. However, if a certain platform conflicts with the regulatory requirements it should be stated clearly. A uniform I&C platform would be preferred, not mixing different platforms. In OL1&2 the systems have been renewed during a long period of time which has resulted in a mix of techniques. This causes problems with e.g. maintaining expertise. The utilities may also be concerned that the renewed YVL-guides would be applied as such for the renewal projects. The reasons behind the choices to remain with the old analogue technology should be understood by the regulator. These issues should be discussed with the utilities.

One concern STUK has is whether the utilities monitor the right things related to the ageing management. Is it enough to only collect failure data? As the regulator STUK can ask the utilities to demonstrate that it is enough. STUK could also look what other countries do related to ageing of I&C systems. There are many other disciplines also where software based solutions are used. Trains, planes and military equipment for example all use software. What is the difference between these and the nuclear field?

Petteri Tiippana thanked the participants for their contribution. STUK got a lot of good insights to think about.

## 6 Any other business

No other business.

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**7 Next meeting, all**

The next meeting will be on December 12, 2018. The subject of the meeting will be discussed internally at STUK and the committee will then be informed. It will be related either to STUKs strategy or Fennovoima. Presentations of the RSC members can be sent to the secretary a few days before the meeting. She will distribute them to the whole group after the meeting

**8 Closing of the meeting**

The meeting was closed at 16:20.

Distribution RSC members  
PT, KiA, ToR, TV, KW, NSAC (YTN)

**Appendices**

1. RSC meeting 1/2018 agenda
2. STUKs Strategy 2018-2022, presentation slides by STUK
3. Modernisation of old I&C-systems, possibilities and pitfalls, presentation slides by STUK
4. STUK RSC ENSI Contribution I&C Renewal, presentation slides by Ralph Schulz
5. Answers to STUKs Questions, presentation slides by Richard Donderer
6. I&C Renewal Projects - Related ASN Experience, presentation slides by Philippe Jamet
7. Modernisation of old I&C systems, presentation slides by Keijo Valtonen