

Nuclear Reactor Regulation
Rantamäki Karin

November 4, 2021

Reactor Safety Committee Meeting 1/2021

Date October 7, 2021, 10:00-13:00

Place Teams

Participant	Timo Vanttola	Chair
	Sylvie Cadet-Mercier	Member
	Lennart Carlsson	Member
	Richard Donderer	Member
	Ralph Schulz	Member
	Zdeněk Típek	Member
	Kirsi Alm-Lytz	Permanent expert member
	Karin Rantamäki	Secretary
	Petteri Tiippana	STUK
	Tomi Routamo	STUK
	Tapani Virolainen	STUK

Absent

1 Opening and adoption of agenda

Timo Vanttola opened the meeting at 10:01 and welcomed everyone. A short round-table introduction was performed.

The agenda was approved and can be found in Appendix 1

2 Approval of the minutes of the previous RSC meeting (2/2020)

The minutes of the previous meeting were approved.

3 Update on STUK's oversight activities and development of strategic oversight and regulation renewal

Kirsi Alm-Lytz gave an update on the status of oversight activities in the nuclear field in Finland. On the regulations side STUK has finalised the update of the YVL-guides. Ministry of the Employment and the Economy intends to start a large project to renew the whole nuclear legislation.

STUK is about to finish the review of the periodic safety assessment for Loviisa power plants. Fortum is considering whether to apply for a continuation of its operating license or to decommission the units after current licenses expire (2027 Unit 1 and 2030 Unit 2).

The spent fuel repository is under construction in Olkiluoto. STUK expects to start reviewing the application for operating license next year.

Tomi Routamo continued with an update on the OL3 project status. The fuel was loaded in spring 2021. During the hot functional tests, the low-pressure turbine sealing was damaged causing a long overhaul and a further delay in the schedule.

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The first criticality is currently scheduled in January 2022. After the first criticality there are still hold points for STUK at 5%, 30% and 60 % power levels to raise the power. The committee was interested in how the Taishan feedback is used in Finland. TVO has received some information but TVO's fuel manufacturer is different from the Chinese utility. STUK considers the practices used in Olkiluoto 3 are adequate, but once the information from Taishan 1 is available it has to be considered in future activities.

Tapani Virolainen continued with the Fennovoima case. The licensing approach for achieving construction license is new and was recently presented to STUK. STUK is currently reviewing it. In the new approach Fennovoima is planning of having regulatory hold points after Construction License is received. The first major hold point would be the first nuclear safety concrete. Another would be e.g., automation. He also presented Fennovoima's list on key licensing issues. He finished by discussing the PSAR submission schedule.

Kirsi Alm-Lytz continued by describing the development of STUK's oversight based on the goals of STUK's strategy. She also briefly discussed what is not changing; the basic authority principles will remain. She finished by discussing STUK's role as a nuclear safety/security/safeguards regulator and the need for a cultural change at both STUK and the licensees.

The committee was interested in the development of tools to support the oversight. STUK has decided to start the work in the branch of 'use of radiation' where co-operation can be done with other authorities. Currently STUK is in the phase of creating a road map for the development of a tool for supporting the oversight in nuclear oversight field. The concept of design authority and its use in Finland was also discussed.

The use of terminology related to risk-informed methods was discussed. The term risk-informed seemed not consistent with safety-oriented approach since it is based on probabilistic methods. Therefore, one should be careful with what is meant by risk-informed methods. PRA is based on probabilistic methods, and the core melt frequency is not always the best indicator of safety. Also, the difference between risk-based and risk-informed was discussed. In Finland risk-informed methods use also deterministic methods in addition to probabilistic methods. In Switzerland this is called integrated oversight as it combines various methods for oversight.

The presentation slides can be found in Appendix 2.

4 Diverse measurement of OL1/2 reactor pressure vessel water level

Tomi Routamo presented the main technical topic of the meeting: the diverse measurement of the reactor pressure vessel water level. He started by explaining the current measurements in OL1/2 as well as the failure modes and their consequences to the plant. He continued with describing the current STUK requirements for measurements actuating safety functions (YVL-B.1 5229, 5230) and the correspondence between STUK and TVO. He also presented some concerns TVO has presented on a solution with a float-based level measurement that had been presented earlier but withdrawn lately. He continued with the new, alternative proposal by TVO and STUK's concerns on this solution.

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The presentation slides from STUK can be found in Appendix 3.

In the discussion the committee brought out that STUK should consider the ultimate consequences if the level measurements are lost. It should also be known in which kind of situations this can happen and how it is dealt with. There was also a discussion on automatic vs manual (operator) actuations. Automatic actuation would be needed for fast phenomena. If the process is slower manual actions are fine as there is more time for them.

The committee also pointed out to STUK that the YVL-requirements presented here are very strict if applied throughout the safety functions. The requirements may be difficult to fulfil as there are not necessarily always diverse parameters available. The question was also whether such requirements are on the higher level of legislation and whether the presented requirements are fulfilled in Loviisa or for VVER-1200. The requirement for diversification is also found in STUK's regulation. In Loviisa, and in PWR in general, the diversification of the water level measurement can be done. However, in OL3 a similar question was raised when considering diversification of the steam generator water level measurement. In this case diversification has been done using diverse sensor, not on two separate parameters. The committee suggested that in setting up this kind of requirements and applying them to a specific case other reactor designs and other safety functions should also be considered.

Sweden and Germany have also been struggling with this same question. Swedish reactors use diverse sensors which is not the case in Finland. This would not fulfil the requirement of diverse parameter. The diverse sensors would not solve the problems considered in this case, as their nature is phenomenological. In 2010, all German plants installed temperature measurements in the top of the core. The water level change would be detected by these measurements. The regulation in Germany is similar to the one in Finland. Richard Donderer offered to provide some further information on the topic.

The risk picture in the case of the signal failure in the measurements was further discussed. In Germany, the PSA shows that the common cause failure of water level measurement was one of the main contributors to the core damage frequency. Therefore, additional measurements were added in 2010. The German solution seemed interesting in the committee's opinion. In Switzerland, improvements have been required on the existing measurements rather than requiring new, diverse measurements.

Ralph Schultz asked, if there are any experiences on the suggested float-based measurement elsewhere. STUK did not know any such experience but mentioned that the approach was experimentally studied in Finland at LUT University.

The committee's opinion was that TVO should show all analyses that they have used in their decision making, e.g., the fatigue analysis of the piping. The question was raised how open TVO had been on the matter. It appears that TVO has considered uncertainties in the analyses so wide that implementation is not supported although the analyses would show that the piping could withstand the loads due to thermal stresses. The committee pointed out that since the piping is connected to the reactor, this adds up uncertainties and for example raises the question on occupational

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exposure of the workers when installing. This should also be taken into account. The committee's opinion was that TVO should provide a sound detailed justification on the approach they see feasible to be implemented at the plant to improve the safety in this matter.

There are also international concerns on the topic. OECD/NEAs working party on BWR, has also discussed this issue and set up a questionnaire, which will result in a report. This might also bring some insight into the matter. The committee recommended strongly that the international views and possible operational experiences, if such exist, should be taken into account in the decision making.

The supporting slides prepared for the discussion by members can be found in Appendices 4 and 5.

STUK thanked the participant for the active discussion. STUK got some good ideas as it has been considering this issue as an isolated case. The new ideas are welcome and STUK will be considering them. STUK needs to go back and look at the new information there exists about this issue. The German solution in using temperature measurements in a clever way may bring alternative proposals.

STUK will consider the following recommendation it got from the committee:

- the overall consequences of the failure of the measurement
- the contribution of the common cause failure of these measurements to the core damage frequency
- additional measures that could be considered to treat this case as a DEC situation instead of DBC
- it is not a sound solution that operators could act in 10 min; the time is too short; it should be evaluated if the additional temperature measurements suggested by TVO could be used to trigger an automatic safety function
- actions taken in other countries (e.g., Germany and Switzerland) on this matter
- YVL requirements are very strict and may in some cases be difficult to fulfil.

The additional information from Germany would be very much welcomed as well as the information from the OECD/NEA working party on BWR.

5 Any other business

The term of the committee comes to an end by the end of the year. Petteri Tiippana thanked the committee for their valuable contribution during the three years. The work done by the members has been very useful for STUK and is much appreciated.

6 Next meeting

No next meeting as the term comes to end.

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7 Closing of the meeting

The chair thanked the participants for their active participation and closed the meeting at 13:00.

Distribution: RSC members, NSAC members
Tiippana, Alm-Lytz, Heinonen, Routamo, Virolainen, Luukka

Appendices

1. RSC meeting 1/2021 agenda
2. RSC Meeting October 2021 Kia, presentation slide by Kirsi Alm-Lytz
3. PSD-project RSC 10-2021, presentation slides by Tomi Routamo
4. RSC October 2021 Cadet, presentation slides by Sylvie Cadet-Mercier
5. STUK RSC 2021 - SUJB, presentation slides by Zdeněk Típek