

Nuclear Reactor Regulation
Karin Rantamäki

January 11, 2019

Reactor Safety Committee Meeting 2/2018

Date December 12, 2018, 9:30-16:40

Place STUK, Laippatie 4, Meeting room Röntgen 4386

Participants	Lasse Reiman	Chair
	Lennart Carlsson	Member
	Richard Donderer	Member
	Gabor Petofi	Member
	Ralph Schulz	Member
	Keijo Valtonen	Member
	Karin Rantamäki	Secretary
	Petteri Tiippana	
	Kirsi Alm-Lytz	
	Tomi Routamo	
	Tapani Virolainen	Items 3b-7
	Jukka Mononen	Items 3b-7
	Kim Wahlström	Items 1-3
	Pia Oedewald	Items 1-3
	Janne Nevalainen	

Absent: Philippe Jamet Member

1 Opening and adoption of agenda

Lasse Reiman opened the meeting at 9:35 and welcomed everyone. This meeting is the last meeting during this mandate.

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

2 Approval of the minutes of the previous RSC meeting (1/2018)

The minutes of the previous meeting were approved.

3 Follow-up of last meetings topics

a. Modernisation of old I&C-systems

Kim Wahlström presented a follow-up on the topic of the previous meeting, Modernisation of old I&C systems. He presented shortly the evolution of the topic after the previous RSC meeting. He also described how the recommendation and suggestions of the committee had been taken into account.

STUK has nearly finalised the update of the YVL-guides. YVL-E.7 has been finalised and YVL-B.1 which contains system level I&C design is close to finalisation. No major changes concerning I&C were made. The main change was to allow the use of programmable IC-circuits in safety class 2 and 3. Appropriate safety standards can now be used as was recommended by the committee.

Nuclear Reactor Regulation
Karin Rantamäki

January 11, 2019

He finished his talk by discussing the current status of the I&C renewals in Finland. In Olkiluoto 1&2, a renewal of the protection system (safety class 2) is planned. In Loviisa 1&2, limited scope I&C renewals were completed in the 2018 outage. The operating licence of Lo1 is expiring in 2028. Therefore, other renewal projects are planned if Fortum is going to continue plant operation after that.

The presentation slides can be found in Appendix 2.

b. Oversight of organizational issues

In the previous meeting the committee told that it would like STUK to present the programme that TVO has communicated to the staff. Pia Oedewald presented a follow-up on the topic of Oversight of organizational issues. She started with discussing the timeline in conjunction with STUK's oversight actions as well as TVO's own actions.

She reviewed briefly the problems that had been seen. Already during the spring 2018 evidence of improvement could be seen. She discussed the improvements as they have been observed by STUK. The personnel resources, clarity of work processes and decision making practices at TVO improved but work was still needed. During the fall 2018 significant improvements in the work climate have been observed. STUK continues intensified oversight of TVO's organisational issues.

The RSC appreciated the work STUK has done but sees the need for STUK to continue oversight of the effectiveness of TVO's improvement actions.

The committee discussed the relation between the operator and the owner. STUK has had discussions with the main owner representatives on the director level but has not conducted any oversight activities on the owner. It was explained that SSM has studied the correspondence between the owners and the operator in similar situations. STUK appreciated this suggestion.

The presentation slides can be found in Appendix 3.

4 Current status of Finnish nuclear field

Petteri Tiippana presented the main issues of the status of the Finnish nuclear field.

Concerning the operating plants Loviisa had large outages on both units. OL1&2 obtained the operating licence for 20 more years.

Concerning the new reactors, OL3 is in the operating licence phase. STUK has basically done its work on the safety assessment. The remaining issue is the vibration of the pressuriser surge line. TVO & AREVA are working on a technical solution consisting of a damper to be installed in the line. Concerns have been raised on the damping material which is bitumen. Tests on the behaviour of the bitumen in LOCA conditions are ongoing in Finland and Germany and the results are expected in early January. After that STUK can support the operating licence if the tests are finished successfully. AREVA has released a new schedule for the project. According to the schedule, the fuel loading will take place in summer 2019 and commercial operation will start in early 2020. Fennovoima has not progressed much and STUK has not obtained most of the licencing documentation.

Nuclear Reactor Regulation
Karin Rantamäki

January 11, 2019

Some interest in SMRs from some cities and municipalities have been expressed. E.g. Helsinki has a goal to be carbon neutral by 2035. STUK should prepare itself to be ready if some real interest is expressed.

On other nuclear facilities he mentioned that the research reactor Fir-I has applied for decommissioning licence. Safety assessment should be ready early next year. In addition STUK is reviewing an application from a mining company to extract uranium.

The ministry has been discussing a full renewal of the nuclear legislation. If it realises it will mean a lot of work for all parties. The radiation safety act will come in force on December 15, 2018 as well as STUK's regulations on nuclear safety (STUK Y/1/2018), emergency preparedness (STUK Y/2/2018) and nuclear waste (STUK Y/4/2018).

Utilities have put up an effort related to component approvals for nuclear power plants (KELPO) with the aim to streamline the regulatory review and approval of components as well as regulatory oversight during manufacturing and installation of the components. STUK has participated in this effort. STUK sees that it is good that the utilities co-operate on the procurements. However, this may also affect the YVL-guides. European Commission has indicated some interest on this kind of approach. This topic is something the RSC could follow in the future.

5 **Lifetime and ageing issues in licensing process, Regulatory approach**

Tomi Routamo presented the topic. He started with the background and discussed the decision making process in Finland and STUK's role in it. He then presented some case examples with Jukka Mononen giving the more detailed explanation on the technical issues.

Case Loviisa: The reactor pressure vessel (RPV) operating permits were earlier granted separately from the plant licences. However, now they are combined. The most critical RPV part is a LO2 core area weld that is approaching acceptance limit due to neutron radiation. The RPV embrittlement was discussed in detail including reasons for this type of ageing and also actions that have been performed to mitigate this. In Loviisa 1, the outermost assemblies were replaced after 3 years of operation to reduce the neutron flux to the RPV. In Loviisa 2, this was done already from the beginning. In addition, the LO1 RPV weld was annealed in 1996 and therefore, it is currently in better condition than LO2. The LO2 RPV has not been annealed, which is one of the possible mitigation methods in the future.

Safety margins as well as the acceptance criteria were also discussed. The embrittlement transition temperature is increasing during the years of operation. The margins at the Loviisa power plants analyses are already quite small, 0°C for LO2 and 15 °C for LO1 at the end of their planned operation (2027 for LO1 and 2030 for LO2).

Case Hanhikivi: Hanhikivi 1 will be a VVER-1200 (AES 2006) with a lifetime of 60 years. The limiting issue is a weld in the RPV core area. The alloys used for the RPV have an important impact on the embrittlement rate. The situation has improved since the building of Loviisa power plant but the tendency for embrittlement is still present in Hanhikivi type modern VVER plant designs.

Nuclear Reactor Regulation
Karin Rantamäki

January 11, 2019

It seems that the 60 years lifetime is possible but STUK does not agree on the present justification. Most of the RPV analyses shows over 60 year lifetime but the core area weld remains below the 60 years when analysed using a conservative fuel cycle. However, such a core will hardly be used in reality.

The presentation slides can be found in Appendix 4.

Ralph Schulz presented the Swiss practices on the ageing management and lifetime issues. The ageing management plan (AMP) is required in the Swiss Nuclear Energy Ordinance and there are regulatory guides concerning it. However, no formal approval of this document (AMP) exists. The operator has to give an annual reporting or evaluation, and the authority makes detailed technical reviews and inspections. If issues or problems are seen requirements are set.

In Switzerland there are no time-limited operating licenses, the power plants may be operated as long as they are considered safe. There is no formal licence renewal process but operation beyond the design life requires additional long-term operation (LTO) safety reviews. He presented the content of a LTO-Safety Review. He also discussed the Criteria for a Provisional shutdown due to aging effects, which are written in the ordinance. The main difference between the LTO-Safety Review and a Periodic Safety Review is the criteria for the provisional shutdown.

The presentation slides can be found in Appendix 5.

Lennart Carlsson gave a presentation on the Swedish practices. There is a requirement for ageing management programme in SSM's Regulation, but there is no regulatory approval. However, SSM carries out inspections. In principle the AMP should be constantly up-to-date, in practice it is updated with a 10 year interval or due to changes. There are no requirements for the review of the AMP. The authority selects some areas for a more detailed examination.

No time-limited licenses or license renewal processes exists in Sweden. However, systems, structures and components that are included in the safety analyses are under special attention. For components that cannot be replaced there are special requirements. A constant improvement of methodology to detect faults is required. This of course may result in detection of new faults that could not have been detected previously.

Lennart Carlson pointed out that in Sweden in general the authority approves very few things. On the contrary, it is the responsibility of the licensee to demonstrate that they comply with the regulations.

The presentation slides can be found in Appendix 6.

Richard Donderer presented the German situation. An AMP must exist and the requirements are detailed in a KTA 1403 standard. It has to be part of the licencing documentation, without it no licence is granted. There is no separate approval of the document. There is a requirement that the AMP has to be constantly up-to-date. Consequently, no fixed time interval is required for updating. He also described the details of the regulatory review on the programme.

Nuclear Reactor Regulation
Karin Rantamäki

January 11, 2019

There are no time-limited licences. The lifetime is part of the component analysis, and it has to be demonstrated regularly that the component fulfils the requirements. As long as the components fulfil the related requirements the plant may operate. However, no regulatory approval of the component lifetime exists. No specific treatment exists for components that cannot be replaced. Such components are not limiting the lifetime at the moment as they have been designed in a conservative manner.

The ageing management plan and the lifetime forecast is part of the periodic safety assessment. If the lifetime would be less than e.g. the 10 years, the licence to operate would be shortened correspondingly.

The presentation slides can be found in Appendix 7.

Gabor Petofi gave a presentation on the Hungarian practices. Hungary has updated its regulations concerning ageing and lifetime issues in 2005 and 2011. An ageing management plan is required and the licensee may choose the method they use to demonstrate the fulfilment of safety functions. He discussed the requirements for the ageing management as well as the contents required by giving some examples. He also discussed the ageing management oversight methods used by the regulator.

The Long-term-operation (LTO) licencing process is a three-stage process (one for environmental and two for nuclear safety) which he described. He also discussed the licencing concept in which the focus is on the passive long-lived components. A minimum list for time-limited ageing analyses has been defined and included in the guidelines. The licensee has also made some addition to the list. Gabor Petofi also gave an example on the conditions and requirements in long-term operation licence. The component lifetime is part of the licencing process but no actual component level approval procedure exists. The modifications need to be approved as part of the FSAR modification.

In summary, Hungary has detailed requirements on ageing management. The regulatory oversight is rather strict. The licence was granted for 50 years, but the safety demonstration has to be done for 60 years.

The presentation slides can be found in Appendix 8.

Keijo Valtonen presented his views on the topic. He discussed the principles of ageing management. The systems, structures and components (SSCs) are usually divided into passive and active ones in ageing management process and there are differences how active and passive SSC's are treated in the AMPs. Age related degradation of passive SSCs can be treated through periodic condition assessments while performance test can be used for active ones. The ageing management of the active SSCs should be part of the plants maintenance programme (which contains ageing management), and only passive ones should be subject to the ageing management review for a licence renewal. For some components the division may be slightly more complicated.

The presentation slides can be found in Appendix 9.

Nuclear Reactor Regulation
Karin Rantamäki

January 11, 2019

Summary of the discussion on the Lifetime and ageing issues in licensing process

Lasse Reiman summarised the discussion. Ageing management is not necessarily an unambiguous concept. For example in Switzerland ageing management is complementary to maintenance while in Finland maintenance is included in ageing management.

According to IAEA and WENRA, periodic safety reviews (PSR) are to be carried out every ten years. Switzerland has a dedicated LTO-PSR when the NPP is reaching the original design lifetime. Ageing management issues are always part of the PSR but they are emphasized when going into LTO. The content of AMP was not really discussed in this meeting. A common understanding would be needed for the discussion. This was discussed in the European topical peer review (TR) performed during this year. Countries have different understanding of ageing management and thus differences in understanding of the content of the AMP. As a result of the TR, there is an expectation to all countries to apply the new IAEA safety guide on ageing management which should ensure more consistent scope of AMPs.

The presentations of this meeting gave good insight and valuable content for STUK. AMPs are mostly not approved as separate documents but rather as part of the licencing documentation. Some acknowledgement of the regulator is needed although practices vary from country to country. The programme usually needs to be reviewed and updated regularly (kept up-to-date) or when needed, in most cases there are no fixed time limits. In the periodic safety review in most cases it was required to update the documentation and the regulator to see that this is done. Concerning the level of detail of the regulatory review on the programme there are large differences between the countries. In some countries the programme is reviewed in detail and in others the review is based on sample cases. In all countries, the review is complemented by inspections to oversee that AMPs are implemented as described and required.

On lifetime issues, the practice varies when it comes to the question on demonstrating the lifetime of a component over the planned plant lifetime or over the whole license period. Component lifetimes are generally not approved by the regulator. However, this raises questions of what is understood by regulatory approval. It depends on the type of component, not all components are equal in this respect. The component lifetime approval also relates to the question on how to maintain the qualification, if e.g. the environmental conditions change from what was estimated in the design phase. Even though regulators do not directly approve component lifetimes there are indirect ways to take this into account in e.g. periodic safety reviews. For components that cannot be replaced e.g. RPV, no general specific approach existed nor an ageing management role in this context. Therefore, such components are usually treated separately.

LTO was excluded from the topical peer review. However, some countries addressed this. Countries that are entering or have entered the LTO have implemented more robust methods for ageing management.

In general, the approach is similar in the sense that safety is reviewed although details and practices vary.

The discussion moved then to the field of new-built and design phase of plants. The question was raised on the issue that what if the authority cannot ensure itself that the non-

Nuclear Reactor Regulation
Karin Rantamäki

January 11, 2019

replaceable component fulfil the criteria for their full design lifetime. The common understanding was that this should be made clear in the safety assessment. However, the original analyses do not necessary limit the lifetime if other or later analyses prove otherwise. Also the level of conservatism and its impact on the lifetime was discussed.

The aim in the periodic safety reviews and also in the renewal of the operating licence is to show that the plant can be operated safely during the next PSR period or duration of the license. The licensee should provide adequate evidence, containing the improvement plans if necessary, to the regulator for this purpose. Extending the operating time in short periods may result in reluctance by the licensee to implement safety improvements and is therefore not recommended. A preferred option for the regulator is to set conditions to implement safety improvements on a timely manner and/or to set restrictions in the licence to operate the plant. The licensee needs to have a plan how to implement some changes during extended lifetime to ensure the safe operation.

6 Any other business

As this was the last meeting during the mandate of the Reactor Safety Committee, Petteri Tiippana presented STUK's compliments to the members of the committee. He thanked the chair and participants for their strong contribution during the three years. The meetings have been very useful and STUK has got a lot of insight to think about. The follow-up discussions have also proven useful. Lasse Reiman also thanked the participants for their input and work during the years.

7 Closing of the meeting

The meeting was closed at 16:40.

Distribution RSC members
PT, KiA, ToR, TV, KW, PoE, JuM, JN

Appendices

1. RSC meeting 2/2018 agenda
2. I&C_mod_follow_up, presentation slides by Kim Wahlström
3. Oversight of organizational issues at TVO- RSC follow up 12_2018, presentation slides by Pia Oedewald
4. 20181212 - RSC - Lifetime and ageing issues in licensing process, presentation slides by Tomi Routamo
5. STUK RSC ENSI Contribution Ageing & Lifetime, presentation slides by Ralph Schulz
6. STUK 12 December 2018, presentation slides by Lennart Carlsson
7. Answers Donderer, presentation slides by Richard Donderer
8. Regulatory oversight for AM and LTO in Hungary, presentation slides by Gabor Petofi
9. Lifetime and ageing issues in licensing process, presentation slides by Keijo Valtonen