

# PROBABILISTIC RISK ASSESSMENT AND RISK MANAGEMENT OF A NUCLEAR POWER PLANT

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With regard to new nuclear facilities, this Guide shall apply as of 1 December 2013 until further notice. With regard to operating nuclear facilities and those under construction, this Guide shall be enforced through a separate decision to be taken by STUK. This Guide replaces Guide YVL 2.8.

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## Authorisation

According to Section 7 r of the Nuclear Energy Act (990/1987), *the Radiation and Nuclear Safety Authority (STUK) shall specify detailed safety requirements for the implementation of the safety level in accordance with the Nuclear Energy Act.*

## Rules for application

The publication of a YVL Guide shall not, as such, alter any previous decisions made by STUK. After having heard the parties concerned STUK will issue a separate decision as to how a new or revised YVL Guide is to be applied to operating nuclear facilities or those under construction, and to licensees' operational activities. The Guide shall apply as it stands to new nuclear facilities.

When considering how the new safety requirements presented in the YVL Guides shall be applied to the operating nuclear facilities, or to those under construction, STUK will take due account of the principles laid down in Section 7 a of the Nuclear Energy Act (990/1987): *The safety of nuclear energy use shall be maintained at as high a level as practically possible. For the further development of safety, measures shall be implemented that can be considered justified considering operating experience, safety research and advances in science and technology.*

According to Section 7 r(3) of the Nuclear Energy Act, *the safety requirements of the Radiation and Nuclear Safety Authority (STUK) are binding on the licensee, while preserving the licensee's right to propose an alternative procedure or solution to that provided for in the regulations. If the licensee can convincingly demonstrate that the proposed procedure or solution will implement safety standards in accordance with this Act, the Radiation and Nuclear Safety Authority (STUK) may approve a procedure or solution by which the safety level set forth is achieved.*

# 1 Introduction

**101.** Under Section 35 of the Nuclear Energy Decree (161/1988), the applicant for a construction licence shall submit to STUK a design phase probabilistic risk assessment and under Section 36 of the Decree, the applicant for an operating licence shall submit a probabilistic risk assessment.

**102.** Under Section 3 of the Government Decree (717/2013), *the safety of a nuclear power plant and the technical design of its safety systems shall be evaluated and justified analytically and, when necessary, experimentally.* Analytical methods include analyses of disturbances and accidents, analyses of internal and external impacts, strength analyses, fault tolerance analyses, failure modes and effects analyses, and probabilistic risk assessments.

**103.** The Probabilistic Risk Assessment (PRA) of a nuclear power plant and separate qualitative and quantitative studies that complement it form the foundation for nuclear safety-related risk management.

**104.** Nuclear power plant risk management covers the design, construction, commissioning, operating and decommissioning phases. The PRA shall be kept up-to-date in every phase.

**105.** The first part, a Level 1 PRA, determines accident sequences leading to nuclear fuel damage and estimates their probabilities.

**106.** The second part, a Level 2 PRA, assesses the magnitude, probability and timing of a release of radioactive substances leaking from a nuclear power plant.

**107.** The third part, a Level 3 PRA, assesses the risk to people and the environment from a release of radioactive substances.

**108.** The PRA is constantly updated and specified taking into account operating experience feedback, plant modifications, new research results and the advancement of computation methods.

**109.** The PRA supports decision-making in risk management relating to the safety of nuclear power plants.

# 2 Scope of application

**201.** This Guide shall be applied to the applicant and holder of the Government decision-in-principle, nuclear power plant construction licence and nuclear power plant operating licence according to the Nuclear Energy Act. When considering other nuclear facilities this Guide is applied to the spent nuclear fuel storages.

**202.** This Guide deals with the Levels 1 and 2 of the PRA and presents requirements and guidelines for the drawing up, contents, scope and application of the PRA to light-water reactor nuclear power plants. This Guide applies to risk analyses made during the design, construction and operating phases of a nuclear power plant. This Guide also applies to spent nuclear fuel storage in pools adjacent to the reactor and spent nuclear fuel storage in separate storages and to nuclear power plants at which power operation has ended but still contain spent nuclear fuel. The requirements for risk analyses concerning spent nuclear fuel encapsulation and final disposal are given in Guide YVL D.3.

**203.** The PRA shall analyse the nuclear power plant's power operation, low power and shutdown states as well as the transfers between them.

**204.** Requirements for the use of the PRA and risk-informed safety management are given also in the following Guides:

- YVL A.1 Regulatory oversight of safety in the use of nuclear energy
- YVL A.3 Management system for a nuclear facility
- YVL A.6 Conduct of operations at a nuclear power plant
- YVL A.8 Ageing management of a nuclear facility
- YVL A.10 Operating experience feedback of a nuclear facility
- YVL A.12 Information security management of a nuclear facility

- YVL B.1 Safety design of a nuclear power plant
- YVL B.2 Classification of systems, structures and components of a nuclear facility
- YVL B.3 Deterministic safety analyses for a nuclear power plant
- YVL B.7 Provisions for internal and external hazards at a nuclear facility
- YVL B.8 Fire protection at a nuclear facility
- YVL C.3 Limitation and monitoring of radioactive releases from a nuclear facility
- YVL C.5 Emergency arrangements of a nuclear power plant
- YVL D.3 Handling and storage of nuclear fuel
- YVL E.5 In-service inspection of nuclear facility pressure equipment with non-destructive testing methods
- YVL E.11 Hoisting and transfer equipment of a nuclear facility.

205. This Guide does not cover risks arising from acts of sabotage. Requirements for the security of nuclear power plants and the use of the PRA in the risk analysis for nuclear security are set forth in Guide YVL A.11.

## 3 Development and use of the PRA

### 3.1 General requirements

301. The PRA shall be used in the development of a risk-informed management system in such a way that the strictest quality requirements are assigned to products and functions with the highest risk-significance. The use of the PRA and the principles of risk-informed decision-making shall be described in the management system. Requirements for a nuclear power plant's management system are given in Guide YVL A.3.

302. The design, construction and operation of a nuclear power plant shall be managed in a risk-informed manner so that safety is always put first.

303. The licensee shall have guidelines defining the responsibilities, resources and procedures associated with the development, review, improvement, maintenance, archiving and utilisation of

the PRA. The guidelines shall cover the procedures used to keep the analyses and computerised models up-to-date, processing of errors and flaws; modifications, flow of information within the organisation, the PRA applications, updating schedules as well as internal reviews and approvals. The guidelines in question shall be submitted to STUK for information.

304. The PRA shall be used in the development of a risk-informed ageing management programme in accordance with Guide YVL A.8.

305. The design of a nuclear power plant unit shall be such that the mean value of the frequency of reactor core damage is less than  $10^{-5}$ /year.

306. A nuclear power plant unit shall be designed in compliance with the principles set forth in Section 10 of Government Decree (717/2013) in a way that

- a. the mean value of the frequency of a release of radioactive substances from the plant during an accident involving a Cs-137 release into the atmosphere in excess of 100 TBq is less than  $5 \cdot 10^{-7}$ /year;
- b. the accident sequences, in which the containment function fails or is lost in the early phase of a severe accident, have only a small contribution to the reactor core damage frequency.

Release assessments shall take into account all of the nuclear fuel located at the plant unit. A spent nuclear fuel storage external to the plant unit is considered a separate nuclear facility for whose analysis the aforementioned criteria apply.

307. The applicant for a construction and operating licence shall demonstrate by means of the PRA that the plant meets the numerical safety objectives set forth in paras 305 and 306.

308. For the purpose of construction and operating licence reviews, the licence applicant shall commission an independent external peer review for the PRA, which is to be submitted to STUK. The review shall analyse the used reliability data and other input data, modelling methods and

their application in practice. The review shall pay particular attention to the realisation of the requirements presented in this Guide and in the IAEA's PRA-related guides. A review report shall be drawn up, which states the scope of the review, the procedures used and the review findings.

### **3.2 PRA during the design and construction licence phases of a nuclear power plant**

**309.** The PRA shall be applied in the nuclear power plant's layout and systems design to assess the probability of hazards and event sequences affecting the safety of the nuclear power plant and to demonstrate the adequate reliability of safety functions and the balance of the design.

**310.** The frequency of events exceeding the plant design bases and their impact on safety systems as well as potential losses of safety functions shall be analysed in the PRA.

Design shall take into account situations during which the minor exceeding of a design basis could result in significant impairment of safety, i.e. the so-called cliff edge phenomena. Cliff edge phenomena might occur during some internal and external events, such as internal fires and flooding, exceptional weather conditions (e.g. strong winds, blizzards, elevated sea level), any other harsh environmental conditions (e.g. algae, oil, explosions) and seismic events. The analysis shall cover also accidents of long duration, e.g. a long-term loss of AC power and the loss of the ultimate heat sink.

**311.** For the review of the nuclear power plant's construction licence application, the licence applicant shall submit to STUK

- a. for approval the Level 1 and Level 2 design phase probabilistic risk assessments, the computerised PRA model included.
- b. for information the PRA peer review report and a report on how the results of the review have been or are intended to be taken into account in the PRA.

**312.** The PRA shall be used in the risk-informed development of the in-service inspection programmes of Safety Class 1, 2 and 3 as well as Class EYT system piping in accordance with

Guide YVL E.5. The licence applicant shall submit with the construction licence documents to STUK for information a document presenting the development principles of the risk-informed in-service inspection programmes for the piping and the preliminary methodology description and input documentation for the risk-informed selection process.

**313.** The PRA shall be applied to determine the safety classification of structures, systems and components. It shall be ensured by the PRA that the safety classification of every structure, system and component corresponds to its safety significance. The PRA application regarding safety classification shall be submitted to STUK for information with the safety classification document.

### **3.3 PRA during the construction and operating licence phases of a nuclear power plant**

**314.** For the review of the nuclear power plant's operating licence application, the licence applicant shall submit to STUK

- a. for approval the Level 1 and Level 2 probabilistic risk assessments, the computerised PRA model included.
- b. for information the PRA peer review report and a report on how the results of the review have been or are intended to be taken into account in the PRA.

**315.** The licence applicant shall update the computerised PRA model and documentation as the plant's detailed design and construction proceeds and in case of significant modifications in particular. The updated Level 1 and Level 2 computerised PRA model, PRA documentation and justifications for the modifications shall be submitted to STUK for information as the construction proceeds, at least once a year.

**316.** If the plant design is significantly modified during the construction phase, the PRA shall be used to reassess the safety classification in the same way as during the design phase. The updated application shall be submitted to STUK for information if significant modifications are made and with the submittal of the safety classification document.

**317.** The PRA shall be used in the risk-informed development of the Operational Limits and Conditions (OLC) to assess their coverage and balance. The description of the risk-informed method shall be submitted to STUK for approval during construction and the application for information in connection with the submission of the OLC document. The PRA shall be used to determine the surveillance test intervals and allowed outage times of systems and components important to safety. The Operational Limits and Conditions and allowed outage times applied on structures, systems and components shall be separately analysed for every plant operational state. The PRA shall also be used to analyse failures where the change of the operational state may cause a greater risk than repairing the failure without changing the operational state.

**318.** The PRA shall be used in the risk-informed development of testing procedures for systems and components important to safety. The description of the risk-informed method shall be submitted to STUK for approval during construction and the application for information no later than with the submission of the Operational Limits and Conditions document.

**319.** The PRA shall be used in the risk-informed development of on-line preventive maintenance programmes carried out during power operation for systems and components important to safety. The description of the risk-informed method shall be submitted to STUK for approval during construction and the application for information no later than with the submission of the Operational Limits and Conditions document.

**320.** The licensee shall apply the PRA in the risk-informed development of pre-service and in-service inspection programmes for piping and submit the methodology descriptions and applications of the inspection programmes to STUK in accordance with Guide YVL E.5.

**321.** Personnel training shall address PRA-identified safety-significant actions relating to maintenance and operation as well as the most significant disturbances and accidents. The plan-

ning of simulator training for control room operators shall also ensure that the most important accident sequences and risk-significant operator actions are covered by the training.

**322.** The most significant event sequences analysed in the PRA shall be used to support the development of the abnormal and emergency operating procedures.

**323.** The frequencies of initiating events specified in the PRA shall be used as support in determining to which event category specified by the Government Decree (717/2013) the various initiating events belong based on their probability.

**324.** The PRA shall be used as support in deciding which severe accident event sequences are analysed in accordance with Guide YVL B.3 for radiation effects (releases and doses) caused by an accident and also in deciding which accident sequences are used in emergency planning in accordance with Guide YVL C.5.

**325.** In developing commissioning test programmes, the PRA shall be used to assess the coverage and balance of the programmes as well as to reduce the risks arising from the commissioning tests.

### **3.4 PRA during the operation of a nuclear power plant**

**326.** The licensee shall use the PRA to enhance nuclear power plant safety, to identify and prioritise plant modification needs and to compare the safety significance of alternative solutions.

**327.** The licensee shall submit to STUK a risk assessment of the safety significance of the plant modification in connection with the submission of the plant modification's conceptual plan in accordance with Guide YVL B.1 and as part of the pre-inspection documentation. The plant modification plan shall also include an assessment of the risk involved in implementing the modification. A corresponding risk assessment shall be submitted to STUK also when a significant change is made in the procedures or when a new significant risk is identified.

**328.** The PRA shall be applied to assess the safety classification whenever the plant or the computerised PRA model is significantly modified during operation. The applications shall be submitted to STUK for information.

**329.** The PRA shall be used to manage risks relating to maintenance outages, refuelling outages and the related operational states as well as the transfers between the operational states. The applications shall be submitted to STUK for information.

**330.** The PRA shall be used to assess the Operational Limits and Conditions. The applications shall be submitted to STUK for information. The need to revise the Operational Limits and Conditions shall be assessed whenever new risk factors are identified or extensive plant modifications or changes to the procedures are made. When applying for an exemption from the Operational Limits and Conditions, an assessment of the risk posed by the planned exemption shall be given.

**331.** The PRA shall be used to develop in-service inspection programmes as well as testing and preventive maintenance programmes for structures, systems and components and also in developing an ageing management programme. The methodology descriptions and their updates shall be submitted to STUK for approval and the applications for information.

**332.** The PRA shall be used to develop abnormal and emergency operating procedures as well as to develop training for maintenance personnel and operators relating to disturbances and accidents. The most important accident sequences and risk-significant operator actions shall be practised in simulator training at least every three years.

**333.** The licensee shall keep the PRA updated and extend it, where necessary, as described in para 108. Guide YVL A.1 states that all revisions of documents referred to in Section 36 of the Nuclear Energy Decree, the PRA included, shall be approved by STUK prior to their introduction into use. However, the documentation

and the computerised model of the PRA may be updated and introduced into use based on the licensee's own approval procedure. Information on the changes shall be recorded and submitted to STUK in accordance with para 334.

**334.** The licensee shall keep account of all modifications made to the computerised PRA model and input data and their causes and impacts on the results of the PRA. After significant changes to the computerised model and input data, a description of the changes and the updated computerised PRA model shall be submitted to STUK for information without delay. All changes made to the PRA documentation and the updated computerised model shall be submitted to STUK for information in one go at least once a year. The PRA and computerised model shall be submitted for approval in accordance with para 314 for the purpose of operating licence review and periodic safety review if so required by the operating licence.

### **3.5 Risk assessments for a nuclear power plant due for decommissioning**

**335.** The licensee shall assess the risk relating to a nuclear power plant that is due for decommissioning.

- If there are other nuclear power plant units at the plant site, the risk impact on these units due to ending power operation and the decommissioning of systems shall be assessed.
- The PRA shall be applied to assess the risk of nuclear fuel damage after power operation has ended for as long as there is still nuclear fuel at the nuclear power plant unit to be decommissioned or in the intermediate storages for spent nuclear fuel referred to in para 202. The assessment shall cover all nuclear fuel handling procedures, transfers and storage locations.

**336.** Provision shall be made for the nuclear power plant's decommissioning and the associated risks shall be identified already during the plant's design phase. The corresponding risk assessment shall be submitted to STUK during the construction licence application phase. The risk assessment of decommissioning shall be submitted to STUK for approval in good time before the plant's power operation is ended.



## 4 Contents and documentation of the PRA

**401.** In the PRA, the following shall be analysed as initiating events: the plant's internal failures, disturbances and human errors, loss of off-site power supply, fires, flooding, hoisting of heavy loads, abnormal weather conditions, seismic events and other environmental factors as well as external factors caused by human activities. In accordance with para 205, the PRA need not address risks arising from acts of sabotage.

**402.** The feasibility of the methods, expert assessments and reliability data used in the PRA shall be justified and their uncertainties assessed.

**403.** The PRA shall utilise operating experience feedback collected from similar plants or corresponding applications. The licensee shall maintain a database of the reliability of safety-related components as well as initiating events and human errors.

- In the PRA of an operating plant, plant-specific reliability data shall be used. If the plant-specific reliability data is inadequate, reliability data from other similar plants or corresponding applications or, in their absence, generic reliability data, shall be used.
- Provided that no adequate design, site and reliability data is available for the design phase PRA, or if technology is used in systems for which no established methods are available for assessing reliability, expert assessments and experiences from similar applications in corresponding operating environments may be used.

**404.** The PRA shall be comprehensively and consistently documented.

**405.** The Level 1 PRA shall determine the accident sequences leading to reactor core damage and their probabilities. The Level 1 PRA shall present at least the following:

- overall description of the plant
- definition, description, categorisation and frequency estimation of initiating events

- success criteria for the safety and auxiliary systems and a description of the physical assessment methods used to determine them
- event trees by initiating event category
- description of accident sequences and the procedures used to determine them
- human reliability analysis
- analyses of dependencies and common cause failures
- fault tree analyses including descriptions of systems and functions
- system-specific failure modes and effects analyses (FMEA)
- reliability data and expert assessments with their justifications
- importance measures for basic events and systems
- uncertainty analyses
- results and their evaluation with conclusions, including the assessments of the balance of the design and the adequacy of the defence-in-depth required in Guide YVL B.1

**406.** The Level 2 PRA shall assess the amount, probability and timing of a release of radioactive substances leaking from the nuclear power plant during severe accidents.

- The Level 2 PRA shall assess the physical progression of the accident and the timing of the release. The assessment shall cover the release of radioactive substances to the containment, releases to the environment due to a failure or non-leaktightness of the containment, and containment bypasses via containment-penetration pipelines connecting to the primary circuit as well as controlled releases along a planned release route.
- The results of the Level 2 PRA shall present:
  - an assessment of the amount and type of radionuclides released to the environment as well as release initial height, timing and probability with uncertainties
  - a summary of the functionality of the severe accident management strategy, including assessments of the success probabilities of severe accident management functions by plant damage states and release categories.
  - a summary of the main results and their evaluation with conclusions.



- The Level 2 PRA shall analyse i.a. the following phenomena:
    - leak or bypass of the containment in consequence of containment overpressure, isolation failure, steam generator failure, interfacing systems LOCA, or seal failures of containment penetrations or access locks
    - reaction forces and missiles in various accident phases, especially in conjunction with a reactor pressure vessel breach or other damage to the primary circuit
    - amount, timing, dispersion concentration and the probabilities and effects of hydrogen burn and explosions
    - steam spiking and steam explosion due to interactions between molten corium and coolant
    - melt-through mechanisms of the reactor pressure vessel, their timing and consequences of loading caused by them.
    - other factors endangering primary circuit integrity
    - rapid pressure increase in the containment due to, for example, damage to the primary circuit, hydrogen burn or interactions between molten corium and coolant
    - recriticality of the reactor core
    - slow pressure increase in the containment due to decay heat or generation of non-condensable gases
    - other degradation mechanisms of the containment (e.g. due to interactions between molten corium and structures as well as localised high temperatures).
  - The Level 2 PRA shall present at least the following:
    - interface between Levels 1 and 2: a description of the plant damage states used at Level 2, distribution of Level 1 minimal cut sets to Level 2 plant damage states, and dependencies of Level 2 modelled systems and functions on the Level 1 model
    - containment event trees
    - an estimate of the amount of radionuclides escaping from nuclear fuel to containment and of escape timing, spreading and retention in the containment
      - an estimate of the interactions between containment phenomena and safety systems during the accident progression
      - containment structural analyses of severe accident loading situations
      - reliability analysis of the systems intended for severe accident management taking into account the conditions prevailing during an accident and also human action
      - justifications for expert assessments.
- 407.** In applications for exemption from the Operational Limits and Conditions in accordance with Guide YVL A.6, in safety assessments of operational events in accordance with Guide YVL A.10 and in other case-specific PRA analyses supporting decision-making, at least the following shall be given:
- analysis input data and assumptions
  - description of potential model changes and separate computations
  - impact on the main results of the PRA
  - assessment of factors affecting the results most (e.g. completed with importance measures)
  - qualitative assessment of analysis uncertainties
  - identification data for the computerised PRA model and the computation programme used in the analysis
  - summary of the results and their evaluation with conclusions.
- 408.** The computerised PRA model for case-specific risk computation shall describe the event under consideration well enough for the intended purpose of use. The licensee shall submit to STUK all data essential for computation traceability.
- 409.** The general requirements set forth for the PRA shall apply to any major plant modifications.

## 5 Regulatory oversight by the Radiation and Nuclear Safety Authority

501. STUK oversees the licensee's risk management by reviewing the associated documents, models, analyses, guidelines and applications and by performing verification analyses. STUK makes inspection visits to nuclear power plants and organisations involved in the implementation of the PRA. STUK may commission work supporting the review of the PRA from external expert organisations.

502. In the selection of the control and inspection targets and in setting safety requirements STUK uses the PRA with the objective of developing the related procedures. The aim is also to ensure that the power utility has in place appropriate procedures with guidelines for risk identification, analysis and, where necessary, risk reduction.

503. STUK assesses in connection with the review of the decision-in-principle the licence applicant's ability to submit Probabilistic Risk Assessments that fulfil the requirements of this Guide.

504. STUK reviews the design phase PRA and its applications and assesses their acceptability before giving a statement about the construction licence application.

505. STUK reviews the PRA, which has been complemented during the construction phase, and its applications and also assesses their acceptability before giving a statement about the operating licence application.

506. STUK reviews in the extent necessary the updates to the PRA and its applications submitted for information during the nuclear power plant's operation and, where necessary, makes a decision on them. Always in connection with a periodic safety review, STUK performs an extensive review of the adequacy of the PRA and its applications.

507. STUK makes an inspection report on the review of the PRA and its applications.

508. In reviewing the PRA and its applications, STUK qualitatively and quantitatively assesses the adequacy of the quality and scope of the power utility's PRA and its applications.

- The qualitative review assesses whether the data, methods and their results are justified and acceptable and checks the modelling of i.a. initiating events, safety systems, auxiliary systems and operator actions.
- The quantitative review assesses the most important numerical results, the computation of accident sequences and the associated uncertainty and sensitivity analyses.

## Definitions

### Initiating event

Initiating event shall refer to an identified event that leads to anticipated operational occurrences or accidents.

### Minimal cut set

Minimal cut set shall, in a level 1 PRA, refer to the smallest combination of an initiating event, failures or errors which can result in core damage.

### Probabilistic risk assessment

Probabilistic risk assessment (PRA) shall refer to a quantitative assessment of hazards, probabilities of event sequences and adverse effects influencing the safety of a nuclear power plant. (Government decree 717/2013)

### Auxiliary system

Auxiliary system shall refer to a system required to actuate, control, cool or operate a system executing a safety function, or otherwise maintain the conditions required by the operational prerequisites of the safety function.

**Safety system**

Safety system shall refer to a system that has been designed to execute safety functions.

**Safety functions**

Safety functions shall refer to functions important from the point of view of safety, the purpose of which is to control disturbances or prevent the generation or propagation of accidents or to mitigate the consequences of accidents. (Government decree 717/2013)

**Common cause failure in PRA**

In PRA common cause failure shall refer to a scenario where the following three conditions are met: 1) Two or more individual systems, components or structures have failed or degraded so that they are no longer operable when necessary. 2) The failures overlap temporally so that the fulfilment of the success criteria in a random demand is uncertain. 3) The failures are caused by a common cause or mechanism, but they are not consequential failures.

**References**

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6. Government Decree on the Safety of Disposal of Nuclear Waste (736/2008).
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14. Probabilistic Safety Assessment, Safety Series No. 75-INSAG-6, IAEA, 1992.
15. Basic Safety Principles for Nuclear Power Plants, Safety Series No. 75-INSAG-3 Rev.1, INSAG-12, IAEA 1999.
16. A Framework for Integrated Risk-informed Decision Making Process, INSAG-25, IAEA, 2011.
17. Periodic Safety Review for Nuclear Power Plants, SSG-25, IAEA, 2013.
18. Safety Classification of Structures, Systems and Components in Nuclear Power Plants, DS367, April 2013.

## Appendix Documentation to be submitted to STUK

A01. The tables of the appendix sum up the risk-management related documentation and information that the licensee shall submit to STUK for regulatory control.

### A02. General

| Requirement | Documentation  | Submitted to STUK   |
|-------------|--|---|
| 303         | The licensee guidelines defining the responsibilities and procedures associated with the development, improvement, maintenance and utilisation of the PRA. | For information.  |
| 308         | The PRA peer review report and a description of how the results of the review have been or are intended to be taken into account in the PRA.               | For information with the construction and operating licence applications. |

### A03. During design and with the construction licence application

| Requirement | Documentation  | Submitted to STUK   |
|-------------|--|---|
| 311         | The design phase Level 1 and Level 2 Probabilistic Risk Assessments, including the computerised PRA model.   | For approval with the construction licence application.   |
| 312         | The development principles of the risk-informed in-service inspection programme and the preliminary methodology description and input documentation for the risk-informed selection process. | For information with the construction licence application.  |
| 313         | The PRA application for the determination of the safety classification of structures, systems and components.  | For information with the safety classification document.  |
| 336         | The risk assessment relating to the decommissioning phase of the nuclear power plant.  | The risk assessment shall be submitted for information during the construction licence application phase. |

### A04. During construction and with the operating licence application

| Requirement | Documentation  | Submitted to STUK  |
|-------------|--|--|
| 314         | The Level 1 and Level 2 Probabilistic Risk Assessments, including the computerised PRA model.  | For information during construction and for approval with the operating licence application.   |
|             | The PRA peer review report and a description of how the results of the review have been or are intended to be taken into account in the PRA. | For information with the operating licence application.  |
| 315         | The Level 1 and Level 2 computerised PRA models, PRA documentation and justifications for modifications.                                     | For information during construction at least once a year and for approval with the operating licence application.                              |
| 316         | The PRA application for the determination of the safety classification of structures, systems and components.                                | For information during construction in connection with significant modifications and with the submittal of the safety classification document. |
| 317         | The methodology description and application for the risk-informed development of the Operational Limits and Conditions.                      | The methodology description for approval during construction and the application for information with the operating licence application.       |

| Requirement | Documentation  | Submitted to STUK  |
|-------------|--|--|
| 318         | The methodology description and application for the risk-informed development of the testing procedures for systems and components important to safety.                        | The methodology description for approval during construction and the application for information with the submittal of the Operational Limits and Conditions document at the latest. |
| 319         | The methodology description and application for the risk-informed development of the on-line preventive maintenance programmes for systems and components important to safety. | The methodology description for approval during construction and the application for information with the delivery of the Operational Limits and Conditions document at the latest.  |
| 320         | The methodology description and application for the risk-informed development of the piping pre-service and in-service inspection programmes.                                  | The methodology descriptions of the inspection programmes and the applications are submitted in accordance with Guide YVL E.5.   |

**A05. During operation**

| Requirement | Documentation   | Submitted to STUK  |
|-------------|---|--|
| 327         | The risk assessment of the safety significance of a plant modification.   | As part of the pre-inspection documentation of a plant modification.   |
| 328         | The assessment of safety classification when significant modifications are made to the plant or the computerised PRA model during operation.  | For information.   |
| 329         | The use of the PRA for risk management of maintenance outages, nuclear refuelling outages and the associated operational states as well as the transfers between them.                                  | For information.   |
| 330         | The use of the PRA in the assessment of the Operational Limits and Conditions and in connection with applications for OLC exemptions.   | For information as part of an application for a modification or exemption.   |
| 331         | The use of the PRA in the development of the in-service inspection, testing and preventive maintenance programmes for systems and components and in the development of the ageing management programme. | The methodology descriptions and their updates for approval and the applications for information.  |
| 332         | The use of the PRA in the development of the abnormal and emergency operating procedures as well as in the planning of training relating to them.   | The methodology description for information.   |
| 334         | The updated PRA documentation and computerised model.   | For information in one go at least once a year. For approval for the operating licence review and for the periodic safety review required for the operating licence. |
|             | The computerised PRA model and the documentation of the changes made to the computerised model and the input data as well as their causes and impact on the results of the PRA.                         | For information after significant modifications.   |

**A06. Before decommissioning**

| Requirement | Documentation                                      | Submitted to STUK   |
|-------------|--|---|
| 336         | The risk assessment for the decommissioning phase. | For approval in good time before power operation ends at the plant. |