FINNISH CENTRE FOR RADIATION AND NUCLEAR SAFETY
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Translation

Nuclear power plant operator licensing

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1 General

Pursuant to Section 20 of the Nuclear Energy Act, an application for an operating license for a nuclear facility can be granted if i.a. the applicant has available sufficient expertise and if the competence of the operating personnel and the operating organization of the nuclear facility are appropriate. In accordance with Section 55 of the Nuclear Energy Act, the Finnish Centre for Radiation and Nuclear Safety (STUK) shall establish the qualification requirements of the individuals involved in the use of nuclear energy and shall control the meeting of these requirements.

According to Section 119 of the Nuclear Energy Decree, STUK sees to it that the licensee's organization is appropriate and adequate, that the individuals participating in the use of nuclear energy meet the qualification requirements set and that appropriate training has been offered to them. Pursuant to Section 128 of the Nuclear Energy Act, only an individual approved by STUK for this specific purpose may operate the reactor and plant systems in the main control room of a nuclear facility.

This guide describes the licensing procedure for nuclear power plant operators. In Guide YVL 1.7, Qualifications of nuclear power plant personnel /1/ requirements for basic education, work experience and special training of nuclear power plant operating personnel are provided.

According to Guide YVL 1.0, Safety criteria for design of nuclear power plants /2/, in designing a nuclear power plant attention shall be paid to requirements and limitations by which safe plant operation is ensured. On their basis, the Technical Specifications are drawn up which are complied with in operating the nuclear power plant. In the Technical Specifications, the minimum number of operators licensed according to this guide is defined whose presence is required in the main control room and on site during each plant operational state.

The documents required under this guide are made available to STUK in accordance with Guide YVL 1.2, Formal requirements for the documents to be submitted to the Institute of Radiation Protection /3/.

2 Scope

This guide applies to the nuclear power plant operator licensing procedure referred to in Section 128 of the Nuclear Energy Decree. The operator licensing procedure for other nuclear facilities is decided case-by-case. Licensing according to this guide is required for the shift supervisor of a nuclear power plant unit and for at least two operators subordinate to him. It is required that the operations engineer who is the immediate superior of the shift supervisors of a nuclear power plant unit has been licensed to perform the functions of a shift supervisor according to this guide. Nuclear power plant controls located in the main control room may be independently manipulated only by shift supervisors and operators licensed according to this guide.

Theoretical knowledge required of the shift supervisor in examinations administered in compliance with this guide is also required of the head of the organizational unit (office of operations) responsible for the operation of the nuclear power plant, personnel on duty who provide backup capability to the shift supervisor as well as the head of simulator training. The nuclear power plant licensee shall see to it that this level of knowledge is ensured and maintained. If these individuals are to be licensed to perform the functions of a shift supervisor, procedures according to this guide shall be taken.

3 Principles of licensing

Responsibility for the safe operation of a nuclear power plant rests with the licensee of the nuclear power plant who has primary responsibility for conducting nuclear power plant shift supervisor and operator examinations as part of the licensing procedure prescribed in this guide. The licensee shall also otherwise control the competence of the shift supervisors and operators to discharge their responsibilities.

Before the licensee files an application for STUK's approval of an applicant as a shift supervisor or an operator, the licensee shall find assurance of the applicant's competence to discharge his responsibilities considering his medical fitness and personal attributes, the results of tests relating to the training period and the applicant's activities during training. Before filing an application for license renewal the licensee shall likewise find assurance of the maintenance of the shift supervisor's or operator's competence considering the medical fitness, participation in periodic requalification and additional training

programmes as well as performance in the job setting of the individual in question.

The licensee shall file an application with STUK for a license for a nuclear power plant shift supervisor or operator. In the license approval STUK authorizes the shift supervisor or operator to perform the functions set out in the ordinance for facility administration. If operator functions have been clearly defined in job descriptions, separate licenses for reactor operators and turbine operators can be issued. This shall be taken into account when drawing up staffing requirements for the Technical Specifications concerning operators. The license granted for a shift supervisor and an operator is plant unit specific. A licensed shift supervisor can also perform the functions of an operator at the plant unit in question.

Subparagraphs 4.1 and 4.2 of this guide describe the procedure of licensing a nuclear power plant shift supervisor or operator for the first time. In subparagraph 4.3 the procedure is set out which is applied when renewing a license for an individual in possession of a valid or expired license.

4 Licensing

4.1 New nuclear power plants

At a new nuclear power plant, there shall be a sufficient number of shift supervisors and operators licensed in compliance with this guide before fuel loading to the reactor may commence.

In addition to the requirements presented in Guide YVL 1.7/1/, the requirements for the shift supervisor's or operator's license comprise medical examination, written examination, oral examination and demonstration of professional skill as well as appropriate verification of trustworthiness.

The licensee shall recruit the individuals who will be licensed shift supervisors or operators early enough to provide time for adequate training and to facilitate familiarization with the facility and its operation during the trial run.

Licensing of shift supervisors and operators for a new nuclear power plant is initiated by the oral examination as prescribed in subparagraph 5.2 of this guide. STUK's approval of the examination is sought. At the same time, the applicant's basic education, work experience and special training are accounted for to assess the need for any additional training.

The oral examination in compliance with subparagraph 5.3 of this guide can be arranged on the applicant's passing of the written examination.

After an approved oral examination, an application can be filed for a shift supervisor's or an operator's license for the applicant. In the application, a reference shall be made to the decision by which the written examination was approved, the record of the oral examination, a certificate of medical examination and information relating to the demonstration of professional skill during simulator training and during trial run.

Approval can be granted conditionally and in part without the demonstration of professional skill for the purpose of loading the reactor and commissioning the facility. Demonstration of professional skill during power ascension tests and making available to STUK of the report relating to the demonstration are a precondition for license renewal after the completion of tests required in the facility's trial run programme.

4.2 Nuclear power plants in operation

In addition to the requirements presented in Guide YVL 1.7/1/, the requirements for the approval of a shift supervisor's or an operator's license include also medical examination, written examination, on-the-job training and associated demonstration of professional skill and oral examination as well as appropriate verification of trustworthiness.

In addition to the above, a requirement for approval as shift supervisor is that the individual has, at least for six months, performed the functions of a nuclear power plant operator or a reactor operator provided that operators' duties have been divided as mentioned in subparagraph 3. If the individual has no earlier operating experience and is intended to be trained to perform the functions of a shift supervisor, a shift supervisor's written examination can be arranged already in connection with the examination for an operator's license.

Licensing of shift supervisors and operators to an operating nuclear power plant is initiated by the written examination in compliance with subparagraph 5.2 of this guide. STUK's approval of the examination is requested. At the same time a certificate of medical examination, information on the applicant's basic education, work experience and special training are presented to assess the need for any additional training and a request

is made for approval of the applicant as a trainee in his potential duty assignment.

The trainee is entitled to manipulate the controls in the main control room under the supervision of a licensed shift supervisor or an operator.

When the applicant has performed control room functions as a trainee for at least three months and an opportunity has been provided for him of demonstrating his professional skill, an oral examination can be administered.

On the trainee's passing the oral examination, an application can be filed for the issuance of the shift supervisor's or operator's license. In the application reference shall be made to approval of the written examination, description of training and demonstration of professional skill as well as record of the oral examination.

4.3 Renewal of a license

A shift supervisor's or an operator's license issued by STUK is valid for three years at most at a time. To renew a valid license decision an oral examination is arranged in accordance with subparagraph 5.3 of this guide.

On approval of the oral examination an application can be filed for extension of a shift supervisor's or an operator's license by three years. For license approval medical examination, regular performance of control room functions, regular participation in requalification training, oral examination and appropriate verification of trustworthiness are required. In the application for a license a reference to a previous license, a certificate of medical examination, information on the control room functions performed, information on the requalification programmes taken and the record of the oral examination shall be presented. E.g. the following functions are considered control room functions or functions comparable with them: operations engineer, shift supervisor and operator as well as simulator trainer. For licensed shift supervisors and operators who perform functions comparable with control room functions, from time to time, opportunities of performing control room functions for appropriate periods, shall be arranged.

The oral examination shall be arranged so that applications for license renewal can be filed with STUK not later than two weeks prior to the expiration of the validity of the licenses.

A valid license may expire if the shift supervisor's or operator's physical condition changes, if he has not been actively engaged as operator for over six months or if he has, in discharging his responsibilities, grossly or repeatedly violated safety requirements. In such cases the licensee shall make a proposal to STUK for a revocation of the license. The license will also expire if the shift supervisor or operator does not pass the oral examination conducted to extend the license.

After revocation of a valid license the requirements for its renewal are defined case-by-case. The licensee shall make a proposal to STUK of the measures required. The minimum requirement comprises the organizing of a requalification programme and the passing of the oral examination. The applicant whose application for a license has been denied because of a failure to pass the oral examination may file a new application for a license in three months' time at the earliest after the examination in which the denial took place.

4.4 Transfer to a parallel plant unit

In case a licensed shift supervisor or an operator is transferred to a parallel plant unit, he shall be given the necessary training and an oral examination shall be arranged in which differences between the plant units are elaborated upon. The application for a license is filed after the oral examination. A transfer to a parallel unit may not cause an extended lapse of time between medical examinations.

Transfer to a parallel plant unit does not bring about revocation of an earlier license. In case the shift supervisor or operator is in possession of a license which entitles him to discharge the same responsibilities at two plant units, a simultaneous renewal of both licenses shall be aimed at.

5 Phases of licensing

5.1 Medical examination

For the shift supervisor's or operator's license, a certificate of medical examination is required. The examination is performed by a licensed medical practitioner.

A licensed shift supervisor's or an operator's physical condition shall be such that he is able to discharge his responsibilities under normal operating conditions, during abnormal occur-

rences and emergencies. The examining physician shall be aware of the responsibilities of the individual in question at the nuclear power plant. It shall be indicated in the certificate of medical examination that the examination was arranged for the licensing of a shift supervisor or an operator.

A certificate of medical examination may not be older than three months. The licensee shall see to it that, in addition to the above medical examination, appropriate health control is provided for the individuals in question.

5.2 Written examination

The written examination is always administered when a shift supervisor or operator is licensed for the first time. The written examination is administered at discretion in cases where a license has been revoked.

In the written examination, the applicant is required to demonstrate an understanding of

- nuclear power plant's basic safety principles
- radiological safety requirements
- reactor's thermal and physical properties
- reactor design and operating principles
- main features of behaviour of the nuclear power plant unit during abnormal occurrences and under accident conditions
- design and functions of the nuclear power plant unit's primary and secondary circuits, safety systems and important auxiliary systems
- design and functions of the nuclear power plant unit's protection systems and main control systems
- design and functions of the nuclear power plant unit's electricity supply systems
- fire fighting principles for the nuclear power plant unit
- the most important administrative rules applicable to the plant unit.

The questions administered to the applicants for the shift supervisor's license are more exacting than those made to the applicants for the operator's license. In deciding about the questions also a possible definition of operators' responsibilities (reactor operators and turbine operators) is taken into account. Examples illustrating the degree of difficulty and nature of the written examination can be found in Appendix E of Reference /4/ and in Reference /5/. The questions are defined more in detail plant-by-plant on the basis of the licensee's proposal.

For arranging the written examination, the licensee shall present STUK with a proposal for the questions to be administered not later than two weeks prior to the intended examination date. STUK assesses the degree of difficulty of the questions and discusses any question changes with the licensee, where necessary. STUK will add some questions of its own. The minimum extent of the examination is ten questions and the maximum duration six hours. The examination can be organized in two parts to allow for a lunch break.

STUK's representative brings the questions to the examination and supervises the examination arrangements. The licensee shall provide at least one supervisor for the complete duration of the examination. Copies of the applicants' answers will be handed over to STUK's representative without delay after the examination.

The licensee shall evaluate the replies question -by-question. Evaluation by a scale from 0 to 5 is recommended. Based on this evaluation the licensee shall request the approval of the written examination. In connection with the application, information referred to in subparagraphs 4.1 and 4.2 shall be given.

STUK decides on the approval of the written examination on the basis of the licensee's proposal and own assessment. The bases for approval by STUK comprise a sufficient number of points and the fact that in the information concerning the applicant no significant deficiencies have been exhibited in issues vital for the safety of the nuclear power plant.

In case the applicant fails to pass the written examination, re-examination can be arranged in three months' time at the earliest from the date of denial.

5.3 Oral examination

Oral examination is in all cases a prerequisite for the licensing of a shift supervisor or an operator.

The oral examination is arranged in the main control room or in a closely associated room as well as on site for one individual at a time. Plant rounds which are part of the examination can be given to two applicants at the same time. The examination shall cover the following three areas:

- plant unit's administrative rules and regulations as well as the Technical Specifications
- operation of the plant unit and its system functions during normal operation

- operation of the plant unit and its system functions during abnormal occurrences and under accident conditions.

In the examination the applicant is not required to have memorized all details by heart but shall be able to answer questions fluently by making use of the documents located in the control room. The applicant shall be familiar with the documents made available for shift supervisors or operators. He shall know the location of the display and control equipment in the control room and shall be able to demonstrate, on the basis of operating procedures, the actions necessary during an abnormal occurrence or an accident. The applicant shall also be able to demonstrate in practice the carrying out of these actions in the main control room or on site. The questions presented to the applicants of a shift supervisor's license are more exacting than those presented to the applicants of an operator's license. In deciding upon the subjects of the questions also a possible definition of operators' responsibilities (reactor operators and turbine operators) is taken into account.

When licensing an operator applicant for the first time, a plant round is always made in connection with the oral examination the function of which is to find assurance that the applicant has an insight into the plant and into the components layout at the plant and that he is able to manipulate controls external to the control room, if necessary. Less extensive plant rounds are made at discretion during other oral examinations.

The licensee shall appoint at least two examiners to the oral examination, one of whom keeps a record of the examination. The head of the office of operations or an operations engineer shall be among the licensee's representatives. At least one power company examiner shall have competence corresponding with at least the examination in question. STUK usually sends two examiners to the examination. Examinations on STUK's behalf can be administered by designated individuals. A list stating STUK's examiners is given to the licensee.

Two or three questions are made concerning each area mentioned above so that a minimum of six questions will be made during the examination. The questions and the answers therein shall be prepared in advance. Prior to the commencement of the examination, the licensee and STUK's representatives agree on the questions to be presented. The majority of the questions are posed by the licensee. To ensure unbiased treatment of all those examined, sufficient time shall be reserved for review of the questions, for the examination and for its assessment.

Replies to all questions will be evaluated separately. Evaluation by a scale from 0 to 5 is recommended. Requirements for the approval of the examination comprise a sufficient total number of points and a sufficient number of points in each area.

When licensing a shift supervisor or an operator for the first time, the shift supervisor or operator can be either approved or denied in the oral examination. Re-examination can be arranged in three months' time at the earliest.

In the oral examination administered to renew a license the shift supervisor or operator can be approved, denied or he may be required to take additional training. This alternative is possible if he has not obtained a sufficient number of points in the whole examination or in some area and if deficiencies in his knowledge and competence have no bearing on plant safety. In such a case, validity of a license will be extended by three months during which time a completely new examination or a re-examination of a particular area shall have to be administered. Performance in such a re-examination can only be approved or denied.

All examiners shall confirm the evaluation of the examination with their signatures. In case of dissenting views individual evaluations will be entered in the record.

5.4 Demonstration of professional skill

When licensing a shift supervisor or an operator for the first time for a new or an operating nuclear power plant, a special demonstration of professional skill is required.

For demonstration of professional skill, the licensee shall provide the applicant with an opportunity of discharging various operator responsibilities. These shall include at least plant start-up (heat-up and passing criticality), power ascension, power decrease, plant shutdown (subcriticality and cooling), functioning of auxiliary systems and periodic tests of systems and components. Demonstration of professional skill shall, to the extent possible, be arranged at the power plant and the rest of it on a training simulator which sufficiently well simulates behaviour of the plant unit in question /6/.

Demonstration of professional skill includes also practising abnormal occurrences and accident conditions characteristic of the plant in question on a training simulator.

A detailed clarification of the demonstration of professional skill shall be attached to the application for a license.

6 Operator training

Adequate basic education and special training as well as requalification programmes are among the requirements set for shift supervisor and operator licensing and renewal of licenses. Information on training shall be indicated in the application as prescribed in subparagraphs 4.1 and 4.2.

Basic and special training programmes specific of responsibilities and facilities shall be drawn up for shift supervisors and operators. Also, regular requalification programmes shall be drawn up. Issues which have bearing on the safety of the nuclear power plant shall be reviewed at least at three years' intervals. The requalification programme shall include rehearsal of abnormal occurrences and emergencies on a training simulator. Deficiencies which emerge during the oral examination as well as operating experience gained at both domestic and foreign facilities shall be taken into account in requalification programmes.

The requalification programme for shift supervisors shall in the main also apply to personnel groups referred to in paragraph two of this guide of whom theoretical knowledge necessary for the shift supervisor is required.

Requirements concerning the training programmes are explained in more detail in Ref /1/.

7 Bibliography

1 YVL 1.7, Qualifications of the operators of nuclear power plants
2 YVL 1.0, Safety criteria for design of nuclear power plants
3 YVL 1.2, Formal requirements for the documents to be submitted to the Institute of Radiation Protection
4 NRC-NUREG-0094,NRC Operator Licensing Guide
5 GRS, Translations-Safety Codes and Guides, 1/79, Guideline Relating to the Content of the Examination of the Technical Qualification of Responsible Shift Personnel at Nuclear Power Plants
6 ANSI/ANS 3.5-1985,Nuclear Power Plant Simulators for Use in Operator Training
7 IAEA, Technical Reports Series No. 242, Qualification of Nuclear Power Plant Operations Personnel
8 IAEA, Safety Series No. 50-SG-01. Safety Guides. Staffing of Nuclear Power Plants and the Recruitment, Training and Authorization of Operating Personnel
9 ANSI/ANS-3.4-1983, Medical Certification and Monitoring of Personnel Requiring Operator Licenses for Nuclear Power Plants
10 NRC, Regulatory Guide 1.149, Nuclear Power Plant Simulation Facilities for Use in Operator License Examination

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