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## **Regulatory Guide**

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# **Certification of Reactor Operators and Senior Reactor Operators at Nuclear Facilities (FANR-RG-017)**

## **Version 2**

**2022**

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## Basic Principle of Regulatory Guides

Regulatory guides are issued to describe methods and/or criteria acceptable to the Authority for meeting and implementing specific requirements contained in the Authority's regulations. Regulatory guides are not substitutes for regulations, and compliance with them is not required. Methods of complying with the requirements in regulations different from the guidance set forth by the regulatory guide can be acceptable if the alternatives provide assurance that the requirements are met.

## Definitions

### Article (1)

Capitalised terms used but not defined herein shall have the meaning ascribed to them in Article 1 of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy (the Law) and in Article 1 of FANR regulation for the Certification of Operating Personnel at Nuclear Facilities (FANR-REG-17). For the purposes of this regulatory guide, the following terms have the meanings set forth below:

<b>Active RO/SRO</b>	A Reactor Operator or Senior Reactor Operator with a valid Certificate onto whom the Nuclear Facility Licensee has assigned the duties of a Reactor Operator or Senior Reactor Operator.
<b>Candidate</b>	An individual who the Nuclear Facility Licensee has determined that s/he meets the conditions for Certification as a Reactor Operator or a Senior Reactor Operator at a Nuclear Facility and is being proposed by the Nuclear Facility Licensee to be Certified by the Authority.
<b>Certification/ Certified</b>	The approval by the Authority of an individual to perform the functions of a Reactor Operator or a Senior Reactor Operator.
<b>Competent Health Authority</b>	A Physician competent in the use of a specific standard (e.g. ANSI/ANS-3.4-1996) to evaluate medical fitness of the Operating Personnel.
<b>Controls</b>	The apparatus and mechanisms that, when manipulated, directly affect the reactivity or power level of the reactor.
<b>Equipment Operator (EO)</b>	An Operator who works in a Nuclear Facility, normally outside the control room, under the direction of Reactor Operators and Senior Reactor Operators.
<b>Operating Personnel</b>	The Senior Reactor Operators, the Reactor Operators, or the Equipment Operators at a Nuclear Facility.
<b>Physician</b>	An individual licensed by the State Authority or an Authority of the Emirate of Abu Dhabi to practice medicine.
<b>Qualified Trainee</b>	A trainee who may manipulate Nuclear Facility Controls under the direct supervision of an Active RO/SRO
<b>Reactor Operator (RO)</b>	A control room Operator who normally manipulates the Nuclear Facility Controls, particularly the Controls affecting reactor reactivity.

**Representative Simulator**

A full-scale replica training simulator whose behaviour corresponds well to the plant's behaviour under normal operational, transient, and accident conditions.

**Senior Reactor Operator (SRO)**

A senior control room Operator who oversees and directs the activities of Reactor Operators and Equipment Operators.

**Objective**

**Article (2)**

The objective of this regulatory guide is to provide guidance for implementation of the requirements set forth in FANR Regulation for the Certification of Operating Personnel at Nuclear Facilities (FANR-REG-17).

**Purpose and Scope**

**Article (3)**

1. This regulatory guide describes the means deemed acceptable for meeting the Authority's requirements for the programme that the Nuclear Facility Licensee shall implement for the selection, qualification, training and evaluation of the RO and SRO personnel leading to Certification and re-Certification by the Authority. This regulatory guide does not apply to Equipment Operators.
2. The Authority shall decide whether to certify RO and SRO Candidates based on the information provided confirming that the Candidate has successfully completed the Authority-approved Licensee's training and qualification plan as described in Article 3 and Article 4 of FANR regulation for the Certification of Operating Personnel at Nuclear Facilities (FANR-REG-17) and passed the required Licensee's written examination and operating test (see Appendix 3) or, alternatively, the additional specific information for Certification required by Article 6(3) of FANR-REG-17.

**Training Plan**

**Article (4)**

This article applies to Article 3 of FANR-REG 17

1. The Licensee's training plan approved by the Authority shall be used by the Licensee for all initial Certification training and continuing re-Certification training of Candidates. The approved training plan represents the current revision of the plan in use by the Licensee.
2. Implementing procedures, individual lesson plans, etc. are not required to be submitted to the Authority for approval. Such documents, procedures, processes and the means by which they are developed, controlled and changed should, however, be described in the training plan and shall be made available upon request to the Authority for review.
3. The Nuclear Facility Licensee should apply a process for reviewing all changes to the training plan and determine whether prior Authority approval is required as specified in Article 3(4) of FANR-REG-17.
4. The training plan for the ROs and the SROs should describe the following:
  - a) The minimum power plant and nuclear power plant experience that is required, including the positions held at other Nuclear Facilities, operating status of the Nuclear Facility, and how equivalent experience may be relevant,
  - b) The minimum educational qualifications,
  - c) The method to be used to assess an individual's Safety focus,
  - d) Description of the performance and attendance requirements for completion of the initial and continuing programmes as it applies to Candidates or Certified ROs and SROs,

- e) The details as to how the requirements of Article (11) of FANR-REG-17 will be implemented. This description should be consistent with the Licensee's Management System, and
- f) The means to be used by the Licensee to demonstrate that the ROs and the SROs will meet the medical requirements of Article 4(5) of FANR-REG-17. This should include identification of the standards used by Physicians for medical assessment to demonstrate the ROs and SROs fitness for duty.

## **Reactor and Senior Reactor Operator Medical, Education and Experience Guidelines**

### **Article (5)**

This article applies to Article 6(1) and Article 4(5) of FANR-REG-17

1. The Licensee should have a systematic process for the selection of Operating Personnel. The selection criteria should include requirements for education, previous work experience, general physical and mental health and other suitability considerations. An assessment of Safety attitude should be included in the process.
2. The Licensee should choose an appropriate standard (e.g. ANSI/ANS-3.4-1996) for establishing medical fitness of the Operators and select Physicians competent in the use of these standards. The Licensee should obtain written justification from those Physicians or from the Competent Health Authority demonstrating their competence in the use of the selected standard.
3. The Licensee should maintain records of all the Physicians and their contact information. such records should be maintained for at least five (5) years following the period during which their services were used for evaluating the ROs and the SROs.
4. A Candidate who does not meet all requirements of the relevant medical standard (e.g. ANSI/ANS-3.4-1996) may request conditional Certification. A request for conditional Certification should state the wording of the condition and provide the justification of the conditional acceptance.
5. All the RO and the SRO applicants should have a high school diploma and a minimum work experience of three years in nuclear-related work before beginning the RO or the SRO training. SRO applicants should have two years of plant experience as RO, or an alternative equivalent as described in the Korean Regulatory Guide 17.6 "Qualification of Workers of Nuclear Power Plant". Each case will be handled on its own merit, but it is the Licensee's responsibility to ensure that all Candidate ROs and SROs have sufficient experience to be certified. Criteria on the education and experience for application for the RO and SRO training programs are respectively described in Appendix 1 and Appendix 2. Exceptions for minimum work experience requirements for initial startup and Operation following plant construction are described in paragraph 6 below.
6. Guidelines for initial startup and Operation following plant construction (Cold Certification)
  - a) Cold Certification of Operators allows personnel to acquire the knowledge and experience required for the RO and the SRO duties during the unique conditions of plant construction and initial Operation. The cold Certification process will terminate after completion of the first refueling outage at the unit for which the Certificate is applied.
  - b) The RO applicant should be a holder of a high school diploma or an equivalent certificate. No prior power plant experience is required for entry into the RO training.
  - c) The SRO applicant should possess a high school diploma or an equivalent certificate, and should meet at least one of the following conditions prior to entry into the SRO training:
    - i. Previous status as an Active RO or SRO taking into full consideration the definitions of this regulatory guide,
    - ii. University degree in science or engineering.

- d) Additional training is to be completed as shown below:
  - i. Taking a site-specific Equipment Operator on-the-job training programme for selected Equipment Operator tasks. Such selected tasks shall be the ones that are important to plant Operation with regards to Nuclear Safety and defense-in-depth or those that are risk significant.
  - ii. Completion of practical and meaningful work assignments, including documented participation in pre-operational testing.

### **Initial Training of Reactor Operators and Senior Reactor Operators**

#### **Article (6)**

This article applies to Article 4 and Article 5 of FANR-REG-17

1. The Licensee should implement a training programme for initial training for ROs and SROs based on a systematic approach to training (SAT) that includes the following:
  - a) Conducting analysis at the job and task levels to be followed by selection of tasks for instruction,
  - b) Setting learning objectives to accomplish the tasks and order them in a proper instructional setting,
  - c) Developing relevant training materials and schedules,
  - d) Selection of qualified instructors to provide the training,
  - e) Evaluating the overall training programme,
  - f) The Licensee may refer to other international nuclear training standards/methods, including knowledge skills and abilities catalogues.
2. The RO and SRO trainees should be trained in the structure, functions and Operation of the Nuclear Facility and its systems. The obligation to operate the Nuclear Facility in accordance with the Operational Limits and Conditions (OLC) and procedures should be included in the training. In preparation for the various Nuclear Facility operational conditions, as well as transients and accidents, the trainee ROs and SROs should assimilate knowledge and skills pertaining to nuclear power plant behaviour, observation of plant conditions, and performance of control operations. RO and SRO training should also include consideration of good teamwork skills and readiness for the administrative control and supervision of work done at the Nuclear Facility. SRO and RO trainees should be given training and demonstrate competence in clear communications and language skills sufficient to report plant status and direct operations in both the control room and the field. The SRO trainees should be given training in the skills needed to perform oversight and provide direction to the ROs and Equipment Operators.
3. The initial training of the ROs and SROs should include training on a Representative Simulator.
4. Simulator training should include normal, transient, and accident Operation of the Nuclear Facility and its systems using up-to-date controlled procedures. The initial training for the ROs and the SROs should include the duties required for implementing the Nuclear Facility Emergency Plan.
5. As part of the initial training, trainees should participate in on-the-job training to demonstrate familiarity with and competence for the position to which they will be assigned. An on-the-job training plan should be prepared and the achievement of learning objectives and tasks performed during the training should be recorded as part of the training record for the trainee. The on-the-job training should include tasks in the main control room or simulator and in the Nuclear Facility. For Nuclear Facilities under construction, simulation of equipment operation and response may have to be used; however, maximum benefit of opportunities for equipment operation should be managed during commissioning activities. The training programme should reflect actual conditions of the Nuclear Facility and the main control room.



## **Initial Qualification of Reactor Operators and Senior Reactor Operators**

### **Article (7)**

This article applies to Article 6 of FANR-REG-17

1. The competence of RO and SRO Candidates to achieve initial Certification should be verified through a written examination process and the demonstration of professional skills during an operating test. The tests should require the trainee ROs and SROs to function at the level required during the performance of their duties.

### **Written Examinations**

2. The purpose of a written examination is to ensure that the trainee RO or SRO has learned the subject matter of initial training. The written examination should be given in two parts: a generic fundamentals examination, and a site specific examination. Guidelines on the content of such written examinations are provided in Appendix 3.
3. The generic fundamentals examination can be given to trainees at an early stage of their initial training to ensure that they understand the bases for the Operation and design of the Nuclear Facility and the applicable scientific principles. The Licensee may choose to provide a bank of generic fundamentals examination questions to the Authority in order to streamline the review process. Questions from this questions bank can then be used on a random basis to formulate the generic fundamentals examination. Care should be taken to ensure that the content of the examination is sufficiently modified from the previous examinations so that the integrity of the examination is not compromised. NUREG-1021 Rev. 11 describes acceptable methods with regards to formulation of written examinations. If a trainee previously passed a generic fundamental examination in an Operating training programme under the oversight of another national nuclear regulator, the trainee will not have to take another generic fundamental examination unless:
  - (a) He or she is transferring from a Nuclear Facility of another reactor type (i.e. going from a BWR to a PWR), or
  - (b) the trainee discontinued, for a period exceeding 2 years (24 months), participation in an Operator training programme that maintains proficiency in the generic fundamental examination topics, under the oversight of a national nuclear regulator.
4. A new site specific examination should be generated each time it is administered with no more than a 25% repetition of questions from the last two examinations. A typical site specific examination should contain at least 75 questions for an RO with an additional 25 questions for an SRO, preferably of the multiple choice variety. If the SRO trainee is currently Certified as an RO, the trainee need only take the 25 question SRO portion of the site specific examination. The 25 questions specific to the SRO duties should be limited to the tasks unique to that position.
5. Both the generic fundamentals examination and the site specific examination should be administered in a continuously monitored environment to provide assurance of the integrity of the examination results. Guidelines on the content of these site specific examinations are provided in Appendix 3.
6. The passing grade for all written examinations should be 80%. If the trainee fails to pass either of the written examinations, he/she should be re-trained in the areas in which they exhibited deficiencies prior to re-taking the examination.

## Operating Test

7. Trainees should successfully complete a performance based operating test consisting of two parts. The first part is the simulator examination following the guidelines provided in Appendix 3. The trainee should be familiar with the subject matter and the documents made available in the control room for use by the ROs and SROs, the location of the Controls and displays in the control room and be able to demonstrate, on the basis of the operating procedures, the actions required by them during normal Operation, transients, and accidents. The RO trainee should complete participation in a minimum of two simulator scenarios. If the Nuclear Facility operating structure has more than one specific role for the RO, then the RO trainees should be evaluated in all roles.
8. A new SRO trainee who has not held an RO position at the Nuclear Facility must complete the requisite number of scenarios to qualify as an RO and then complete an additional scenario in the SRO position to qualify as an SRO. Existing ROs who are qualifying as SROs must complete one scenario in the SRO position. If a trainee participates in more than the minimum number of scenarios, the total number of scenarios will be considered in the evaluation. Substitute personnel (e.g. surrogates) may be used to complete minimum crew staffing. In such cases, such substitutes must be fully capable of fulfilling their designated roles (e.g. RO/SRO).
9. The demonstration of professional skills in a Reference Simulator should be used to ensure that the ROs and SROs can exhibit teamwork and apply plant knowledge in a working environment. The trainee ROs and SROs should have the skills necessary to function as members of their team(s) so that the shift team can manage normal operational conditions of the nuclear power plant and perform the actions necessary during transients and accidents. The results of the simulator examination should be evaluated on a pass/fail basis. The simulator scenarios should be designed such that each trainee has the opportunity to conduct a variety of tasks. Description of the minimum number of normal plant evolutions, power changes, instrument failures, equipment malfunctions, abnormal events, and Emergency events that each trainee will have to address and how the individual's performance will be assessed should be included in the training programme.
10. The second part of the operating test is to complete a series of job performance measures (JPMs) following the guidelines in Appendix 3. The trainee should be familiar with the subject matter, the documents available for use by the operating shift personnel, the location of the Controls and displays in the control room and in the plant, and be able to demonstrate, on the basis of the operating procedures, the actions required in normal Operation, transients, and accidents. The passing grade for the job performance measures portion of the operating test should be 80%.
11. Upon receiving a request to Certify a Candidate (i.e. Certification application), the Authority will notify both the Nuclear Facility Licensee and the RO/SRO of the decision to grant or deny Certification approximately thirty (30) days after receipt of the request. Appendix 4 provides an example of the application form for requesting initial Certification.

## Continuing training and qualification of Reactor Operators and Senior Reactor Operators

### Article (8)

This article applies to Article 6 and Article 4 of FANR-REG-17

1. Pursuant to Article 4(1) of FANR-REG-17, the Licensee shall implement a programme for continuing training and qualification of Certified ROs and SROs in accordance with its approved training plan. Based on such programme, each Certified RO and SRO should be continuously trained and re-evaluated in all the positions that are permitted by his or her Certification over a period not to exceed 2 years.



### Continuous qualification

2. Certified ROs and SROs must successfully complete one written examination on a biennial basis. This examination should contain 10% of questions that are based on the generic fundamentals examination with the rest being site specific examination questions, consistent with the guidance provided in Appendix 3. The number of questions for continuous qualification written examinations may be less than that prescribed for initial qualification written examinations. Each operating crew should be given a separate written examination, as necessary, to conform to the training schedule. Each written examination should be at least 25% different from the prior two examinations given in that biennial cycle.
3. Certified ROs and SROs should also complete an operating test on a biennial basis, consistent with the guidance provided in Appendix 3. The simulator examination should be taken on a crew basis with focus on both overall crew performance and individual performance. The results of the simulator examination should be evaluated on a pass/fail basis. The job performance measure portion of the test should be evaluated on an individual basis.

### Continuing training

4. In addition to the written examination and operating tests, the Licensee's programme for continuing training of Certified ROs and SROs should also specify minimum attendance requirements at the continuing training sessions and provisions for makeup for missed lectures and on-the-job training activities. The training programme and the lectures, on job training, and examinations/tests that ensure its delivery should be structured into discernable and topical segments.
5. Ongoing competence for Certified ROs and SROs can be demonstrated by actively performing the functions of the job position and routine attendance at continuing training. The minimum periodicity for attending continuing training sessions and still maintaining qualifications should also be specified in the Licensee's training plan

### A. Lectures

6. The programme for continuing training and qualification should include preplanned lectures on a regular and continuing basis. Consideration for the content of such lectures should be developed from those areas where RO/SRO written examinations and nuclear power plant operating experience indicate that emphasis in scope and depth of coverage is needed. Below are some examples of general topics addressed by the lectures that are based on a SAT for the RO and SRO positions:
  - a) Theory and principles of Operation,
  - b) General and specific plant operating characteristics,
  - c) Plant instrumentation and control systems,
  - d) Plant protection systems,
  - e) Engineered safety systems,
  - f) Normal, abnormal, and Emergency operating procedures,
  - g) Emergency Preparedness and Response arrangements,
  - h) Radiation control and Safety,
  - i) Interface between nuclear safety and nuclear security,
  - j) Operating Limits and Conditions,
  - k) Applicable provisions of the Federal Law by Decree No. 6 of 2009 and Authority Regulations,
  - l) Plant modifications and their significance,

- m) Response to severe accidents,
- n) Plant events,
- o) Industry events,
- p) Design changes,
- q) Procedural changes.

## B. On-The-Job Training

7. The Licensee's programme for continuing training and qualification of Certified ROs and SROs should include on-the-job training. The on-the-job training should include training in the simulator as well as in the nuclear power plant and should be designed in accordance with the RO and SRO SAT based training programme. For Certified ROs and SROs, manipulations should be consistent with the below activities (Controls manipulations and plant evolutions). The use of the Operational Limits and Conditions should be emphasized during the on-the-job training. Certified SROs may be credited with these activities if they direct control manipulations either in the nuclear power plant or in the simulator.
8. The following Controls manipulations should be performed annually in accordance with the Certified RO and SRO SAT based continuing training programme:
  - a) Plant or reactor startups to include a range that reactivity feedback from nuclear heat addition is noticeable and heat-up rate is established,
  - b) Plant shutdown,
  - c) Manual control of steam generators or feed water or both during startup and shutdown,
  - d) Boration or dilution during power Operation,
  - e) Significant ( $\geq 10$  percent) power changes in manual rod control,
  - f) Reactor power change of 10% or greater where load change is performed with load limit control,
  - g) Loss of coolant, including;
    - i. Significant steam generator leaks
    - ii. Leaks inside and outside containment
    - iii. Large and small, including leak-rate determination
  - h) Loss of instrument air,
  - i) Loss of electrical power or degraded power sources,
  - j) Loss of core coolant flow and use of natural circulation,
  - k) Loss of feed water,
  - l) Loss of service water.
9. The following Control manipulations should be performed at least once every 2 years in accordance with the RO and SRO SAT based continuing training programme:
  - a) Loss of shutdown cooling,
  - b) Loss of component cooling system or cooling to an individual component,
  - c) Loss of condenser vacuum,
  - d) Loss of a protective system channel,
  - e) Mis-positioned control rod or rods (or rod drops),
  - f) Inability to drive control rods,
  - g) Fuel cladding failure or high activity in reactor coolant or off-gas,
  - h) Turbine or generator trip,
  - i) Malfunction of an automatic control system that affects reactivity,
  - j) Malfunction of chemical and volume control system,

- k) Reactor trip,
- l) Main steam line break (inside or outside containment),
- m) Nuclear instrumentation failure,
- n) For continuous qualification purposes it should be sufficient for an Operator to manipulate the Controls for one small loss of coolant and one large loss of coolant accident during the 2 year continuing training cycle.

## **Evaluation Techniques**

### **Article (9)**

This article applies to Article 6(8) of FANR-REG-17

1. The Licensee should provide evaluators to conduct evaluations, throughout the RO and SRO initial and continuing training programmes, who are competent in the necessary aspects of plant theory, design, and Operation in order to adequately assess the performance of the Certified ROs and SROs, and trainees, to support safe Operation. The individuals evaluating the examinations should have a high degree of skill and experience, at the same level or higher, of RO and SRO Certification, in order to perform this function. In all cases, evaluators should be familiar with the requirements for implementation of a SAT based RO and SRO training programme.

### **Operating Test**

2. The simulator portion of the operating test for initial qualification should be evaluated by the same number of evaluators as the positions being evaluated. For continuing qualification, the number of evaluators can be less than the number of positions being evaluated provided the evaluation objectives can be effectively achieved. For both initial and continuous qualification tests, one evaluator should be designated as the lead . If the evaluation scenario does not proceed in accordance with the preplanned event sequence, the lead evaluator will determine whether the scenario should continue, be terminated, or some alternate sequence be inserted.
3. After each scenario, each evaluator may ask follow up questions to clarify actions taken by the individual being evaluated. This questioning should be done in a manner which does not signal to the individual who may have made a mistake and therefore potentially jeopardize the individual's performance in later scenarios.
4. During the job performance measure portion of the operating test, each evaluator will examine the individual being evaluated one on one. Each job performance measure should consist of a task. Additional clarifying questions may be asked. For Operations being simulated as part of the job performance measures, the evaluator should provide all the audible and visual clues that the plant equipment would have provided for the given situation.

## **Maintaining Validity of Certificates**

### **Article (10)**

This article applies to Article 9 of FANR-REG-17

1. The Licensee should have a process to ensure continued demonstration of compliance with all requirements to maintain a valid certificate as listed in Article 9 of FANR-REG-17, and the other conditions documented in the Certificate, and providing for the relevant documentation. Only individuals with valid Certificates can be Active ROs/SROs.
2. The Licensee should immediately remove an RO/SRO from duties as an Active RO/SRO when any RO/SRO Certificate becomes invalid. In accordance with Article 9 of FANR-REG-17, Certificates for the ROs and SROs become invalid in case of failure to meet any of the following conditions:

- a) Failure to complete make-up training for missed continuing training lectures/on-the-job-training within one training segment (i.e. 5 weeks) subsequent to the end of the segment for which the make-up training is required.
  - b) Failure to pass the initial administration of a continuing training segment examination or biennial continuous qualification written examination or operating test.
  - c) Failure to pass the administration of continuing training segment retake examination or biennial continuous qualification written or operating retake examination subsequent to completing remediation for failure of a previous examination.
  - d) Failure to meet provisions in the Licensee's fitness for duty programme.
  - e) Failure to meet the competent health authority medical fitness for duty requirements.
  - f) Failure to complete the on-shift watch standing requirements in Article 9(7) of FANR-REG-17.
- Note:** To maintain the validity of an SRO Certificate, an SRO must stand at least **one** complete watch (8- or 12-hour shift) per calendar quarter in the position of a shift supervisor or shift manager. The remainder of complete watches (to meet the required minimum of seven 8-hour or five 12-hour shifts per calendar quarter) may be performed in either the shift supervisor, shift manager, or RO position. A Certified SRO may stand all of his or her required watches as shift supervisor or shift manager and the RO portion of the Certificate will still be considered valid. The on-shift watch standing requirement becomes applicable in the calendar quarter subsequent to the calendar quarter in which the initial certification was issued.
3. An invalid Certificate should be reported to the Authority within three (3) days of occurrence. Invalidation of Certificates due to condition (b) under paragraph 2 above can be reported to the Authority in accordance with Article 12(3).
  4. If a Certificate is invalidated due to meeting condition (b) under paragraph 2 above, while the Certified RO or SRO maintains medical and fitness for duty requirements, the Certificate can be made valid by completing the Licensee remediation programme and passing the administration of a respective retake examination.
  5. If a Certificate is invalidated due to not meeting conditions (a) or (c) under paragraph 2 above, while the Certified RO or SRO maintains medical and fitness for duty requirements, the Certificate can be made valid by completing all re-validation actions under paragraph 9 below.
  6. If a Certificate is invalidated due to not meeting conditions (d) or (e) under paragraph 2 above, while the Certified RO or SRO continues to meet all requirements of the Licensee continuing training programme, the Certificate can be made valid by first complying with medical and fitness for duty requirements and in addition completing re-validation actions (e) and (f) under paragraph 9 below.
  7. If a Certificate is invalidated due to not meeting condition (f) under paragraph 2 above, while the Certified RO or SRO continues to meet all the requirements of the Licensee continuing training programme, and maintains medical and fitness for duty requirements, the Certificate can be made valid by completing re-validation actions (e) and (f) under paragraph 9 below.
  8. If a Certificate is invalidated due to not meeting condition (f) under paragraph 2 above, and the Certified RO or SRO fails to meet all requirements of the Licensee continuing training programme, the Certificate can be made valid by completing all re-validation actions under paragraph 9 below.
  9. The following are the actions required for Certified ROs and SROs to re-validate a Certificate, as applicable:
    - a) **Completion of update training which should consist of:**
      - i. Changes to Nuclear Facility systems,
      - ii. Changes to Licensee and Nuclear Facility policies, standards and procedures,
      - iii. Changes to the regulatory requirements,
      - iv. Changes to the Nuclear Facility Licence or to documents referenced in the Licence, and to

Nuclear Facility and industry experience and operating events.

Note that the intent of update training should be to address the changes and relevant operating experience that have taken place during the time the Certificate was invalid.

- b) Completion of refresher training** which covers topics from the initial training programme. The selection of topics by the Licensee should be based on a documented assessment of the impact of the absence while the Certificate was invalid. The refresher training should include formal written and performance based examinations that confirm that, at the completion of the training, the Certified RO or SRO has the required knowledge and skills to re-validate the Certificate.
  - c) Completion of simulator training**, including examinations that cover a sufficient number of varied situations that challenge the diagnostic and decision making abilities of the Certified RO or SRO to ensure that the person has the required knowledge and skills to re-validate the Certificate. The selection of topics by the Licensee should be based on a documented assessment of the impact of the absence while the Certificate was invalid.
  - d) Successful completion of written and operating continuous qualification exams** equivalent in the type and number to those that the Certified RO or SRO would have had to take during the period that the Certificate was invalid.
  - e) Performance of Certified duties under the supervision** of a valid Certified incumbent of the position for the number of shifts that the Licensee considers necessary to confirm and document that the Certified RO or SRO can perform such duties competently and safely.
  - f) Completion of an interview administered by Licensee Operations management** that confirms and documents the Certified RO or SRO's competence to perform Certified duties. The interview should be conducted after completion of actions a) to e) above, as applicable.
10. Only Active ROs and SROs, or Qualified Trainees, are allowed to manipulate Controls. The Licensee should retain records demonstrating that Active RO/SROs meet all requirements of Article 9 of FANR-REG-17. The records should be maintained for at least five (5) years following the period from which the RO/SRO initially became Active.

### **Re-Certification Article (11)**

1. A documented request to re-certify a Certified RO/SRO should be provided to the Authority at least sixty (60) days before the 5<sup>th</sup> anniversary of Certification to ensure the continuity of qualification. The Authority will notify both the Licensee and the RO/SRO of the decision to grant or deny re-Certification approximately thirty (30) days after receiving a documented request to re-certify. Appendix 5 provides an example of an application form for requesting re-Certification.

### **Notifications Article (12)**

1. The Authority should be notified sixty (60) days in advance of all examinations and operating tests for initial Certification and biennial qualification. The notification should include a copy of the examination or test, the names of the trainees to be tested and the planned schedule for the testing. The Authority shall notify the Licensee with requested changes to the written examination or test and of dates of any planned observations or inspections within thirty (30) days of the scheduled start of the examinations or tests.



2. The Licensee should notify the Authority of any decision to temporarily or permanently invalidate the Certificate of an RO/SRO. This notification should be communicated in writing to the Director of Nuclear Safety and should identify the individual and reasons for invalidation or removal from Active status. Such communication should appropriately protect personal or medical information of individuals. The Authority shall take appropriate actions to monitor the validity of Certificates and, when deemed necessary, decertify individuals in accordance with Article 8 of FANR-REG-17.
3. The Licensee should submit a report to the Authority every six (6) months summarizing the activities carried out under the currently approved training plan including any changes in the validity of Certificates and any changes made to the currently approved training plan.

### **Representative Simulator Article (13)**

This article applies to Article 5(2) of FANR-REG-17

1. The Licensee should have a documented programme for maintaining a Representative Simulator for all simulator based training performed for the ROs and SROs. This may be documented as part of the overall training programme and should address the major elements of simulator design, testing, performance and configuration criteria.
2. The Licensee should adopt guidance equivalent to or exceeding the guidance provided in ANSI/ANS-3.5-1998 “Nuclear Power Plant Simulators for Use in Operator Training and Examination”, for addressing the minimum design, testing, performance, and configuration criteria for a plant specific simulator.

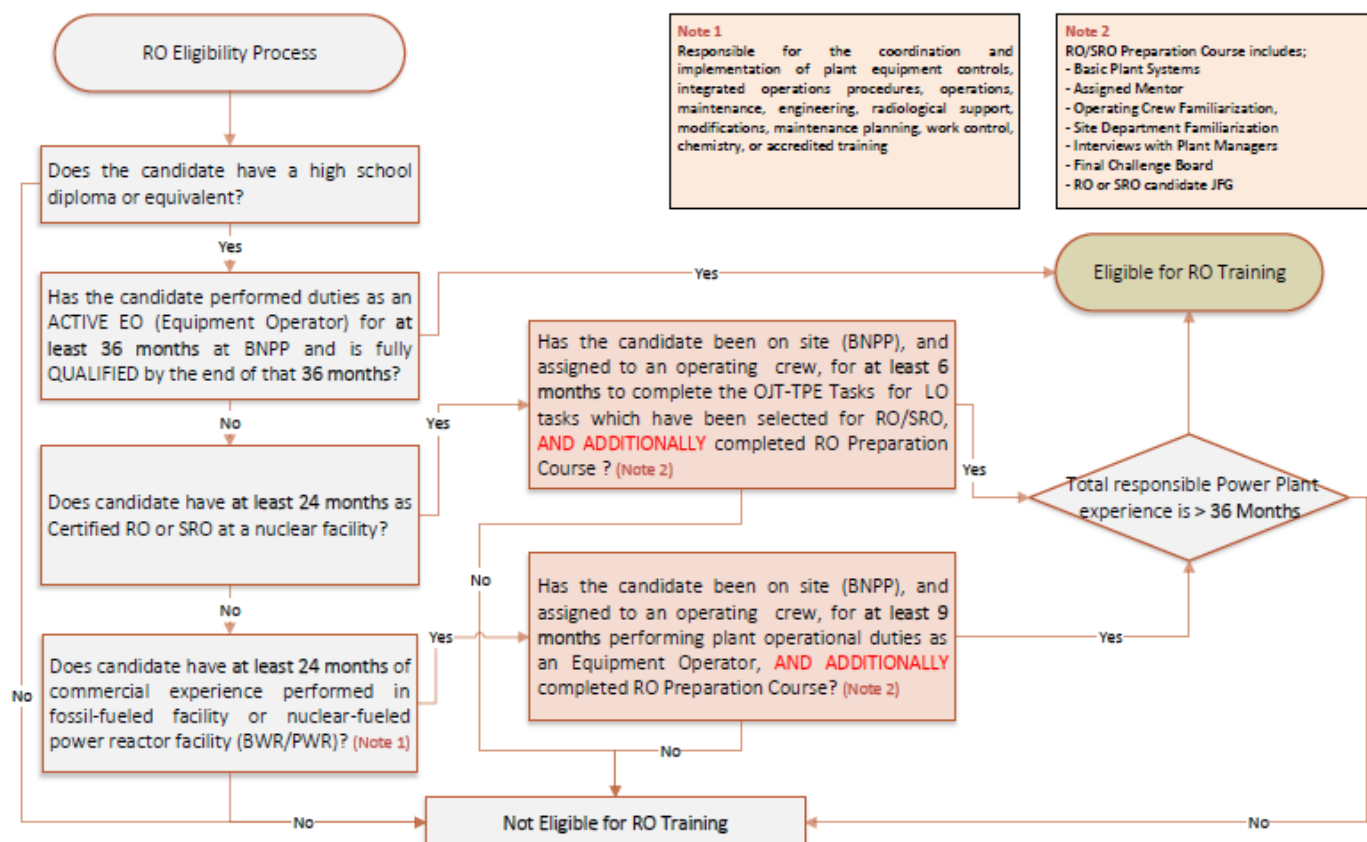
### **References Article (14)**

The following documents should serve as a reference for the Licensee when implementing the requirements of FANR-REG-17 and following the guidance of this regulatory guide:

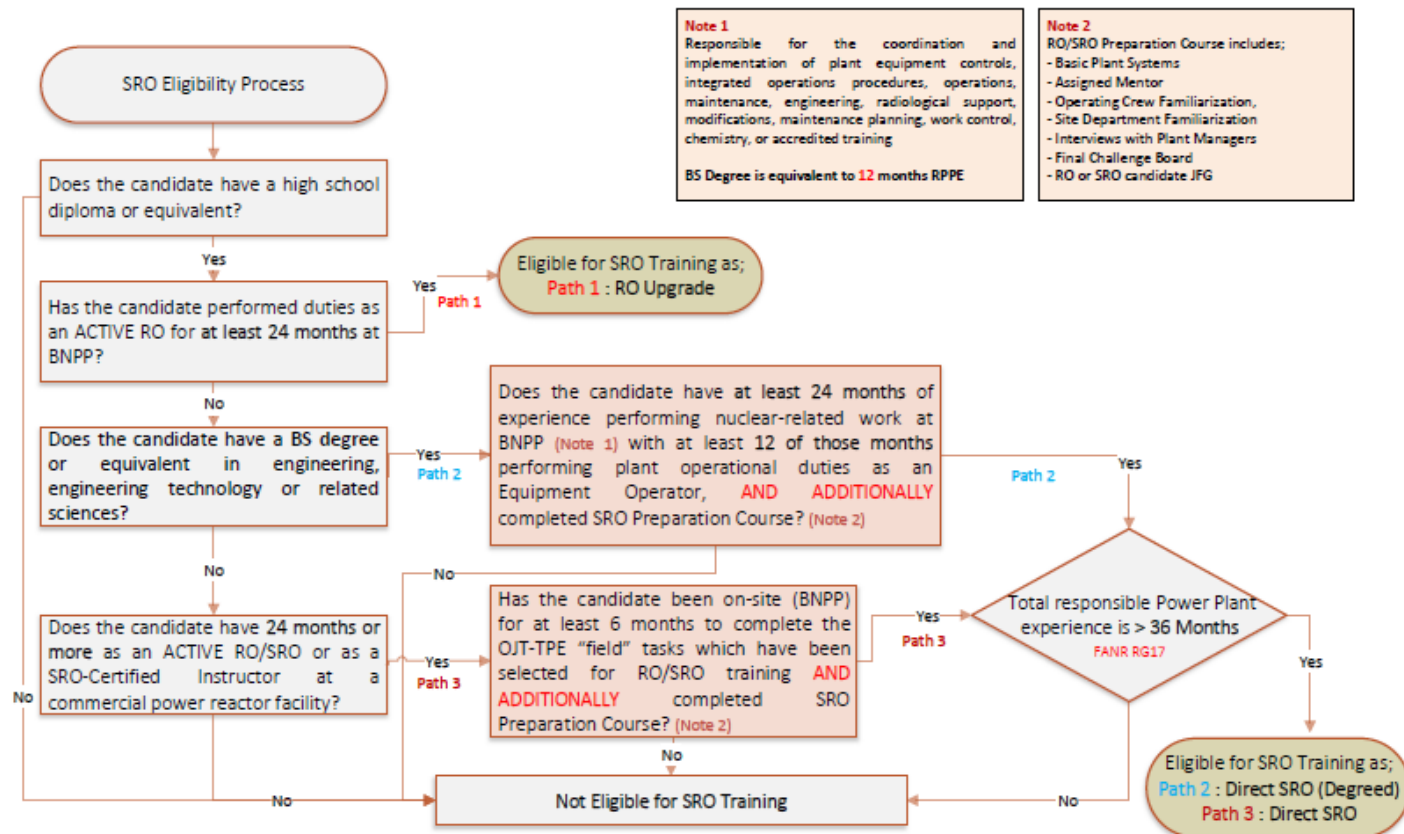
1. NUREG-1021, Operator Licensing Examination Standards for Power Reactors, Revision 11, February 2017, U.S. Nuclear Regulatory Commission.
2. YVL 1.6, Qualification of Control Room Operators for Nuclear Power Plants, 5 October 2006, STUK Safety Guide.
3. KINS Regulatory Guide 17.6 Qualification of Workers of Nuclear Power Plant, July 2011
4. ANSI/ANS-3.5-1998 “Nuclear Power Plant Simulators for Use in Operator Training and Examination
5. ANSI/ANS-3.4-1996 “Medical Certification and Monitoring of Personnel Requiring Operator Licences for Nuclear Power Plants.
6. IAEA-TECDOC-525 (Rev-1) “Guidebook on Training to Establish and Maintain the Qualification and Competence of Nuclear Power Plant Operations Personnel”
7. REGDOC-2.2.3, Personnel Certification, Volume III: Certification of Persons Working at Nuclear Power Plants, September 2019 , Canadian Nuclear Safety Commission



**APPENDIX 1 – Education and Experience Criteria for application for the RO Training Program  
 (Article 5 (5))**



## APPENDIX 2 – Education and Experience Criteria for application for the SRO Training Program (Article 5 (5))



### APPENDIX 3 - Guidelines for Examination Content

#### Generic Fundamentals Examination

1. The generic fundamentals examination should include the following elements, whether it is administered to RO or SRO trainees (see Article 7(3) of this regulatory guide): The content of such elements should be based on the RO and SRO SAT based training programme.
  - a) Fundamentals of reactor theory, including fission process, neutron multiplication, source effects, control rod effects, criticality indications, reactivity coefficients, and poison effects.
  - b) Principles of heat transfer thermodynamics and fluid mechanics.
  - c) Fundamentals of electrical components and instrumentation and Controls.
  - d) Fundamentals of mechanical components.

#### Site Specific Examination

1. The site specific examination should include the following elements when it is administered to trainee ROs and should comprise 75 questions: The content of these elements should be based on the RO SAT based training programme.
  - a) General design features of the core, including core structure, fuel elements, control rods, core instrumentation, and coolant flow;
  - b) Mechanical components and design features of the reactor primary system;
  - c) Secondary coolant and auxiliary systems that affect the Nuclear Facility;
  - d) Nuclear Facility operating characteristics during steady state and transient conditions, including coolant chemistry, causes and effects of temperature, pressure and reactivity changes, effects of load changes, and operating limitations and reasons for such operating characteristics;
  - e) Design, components, and functions of reactivity control mechanisms and instrumentation;
  - f) Design, components, and functions of control and safety systems, including instrumentation, signals, interlocks, failure modes, and automatic and manual features;
  - g) Components, capacity, and functions of Emergency systems;
  - h) Shielding, isolation, and containment design features, including access limitations;
  - i) Administrative, normal, abnormal, and Emergency operating procedures for the Nuclear Facility;
  - j) Radiological safety principles and procedures;
  - k) Purpose and operation of radiation monitoring systems, including alarms and survey equipment;
  - l) Procedures and equipment available for handling and disposal of Radioactive Materials and effluents.
2. In addition to the elements for the RO trainee examination, the site specific examination should contain the following elements when administered to SRO trainees and should comprise an additional 25 questions, as described in Article 7(4) of this regulatory guide; the content of these elements should be based on the SRO SAT based training programme:
  - a) Conditions and limitations in the Nuclear Facility Licence;
  - b) Nuclear Facility operating limitations in the Operational Limits and Conditions and their bases;
  - c) Nuclear Facility Licensee procedures required to obtain Authority approval for design and operating changes in the Facility;

- d) Radiation hazards that may arise during normal and abnormal situations, including Maintenance activities and various contamination conditions;
- e) Assessment of Nuclear Facility conditions and selection of appropriate procedures during normal, abnormal, and Emergency situations;
- f) Actions in accordance with the Emergency Plan;
- g) Action in accordance with the Nuclear Facility Physical Protection Plan (PPP);
- h) Interface between nuclear safety and nuclear security;
- i) Procedures and limitations involved in initial core loading, alterations in core configuration, control rod programming, and determination of various internal and external effects on core reactivity;
- j) Fuel handling facilities and procedures.

### **Operating Test**

1. The content of the operating test should be identified from learning objectives derived from a systematic analysis of RO/SRO duties. The operating test requires the RO/SRO to demonstrate understanding of and the ability to perform the actions necessary to accomplish the required and general items listed below. Such items can be addressed either during the simulator examination portion of the operating test or during performance of the job performance measures. Time-critical job performance measures must be completed within the allotted time. Failure to complete the item in the designated time would constitute failure of the job performance measure. Also, during the simulator portion of the operating test, evaluators should be assessing whether actions in response to events or in accordance with the Emergency Plan are completed in accordance with the timeframes specified in the Authority's regulations and Licence conditions, or the Emergency Plan.
2. Typically required items, the content of which should be based on the RO and SRO SAT based training programme:
  - a) Manipulating the Controls as required to operate the Nuclear Facility between shutdown and designated power levels,
  - b) Identifying announcements and condition-indicating signals and perform appropriate remedial actions,
  - c) Observing and safely control the operating behavior characteristics of the Nuclear Facility,
  - d) Performing control manipulations required to obtain desired operating results during normal, abnormal, and Emergency situations,
  - e) Safely operating the Nuclear Facility heat removal systems, including primary coolant, Emergency coolant, and decay heat removal systems, and identifying the relations of the proper Operation of such systems to the Operation of the Nuclear Facility,
  - f) Safely operating the Nuclear Facility auxiliary and Emergency systems, including Operation of the Controls associated with plant equipment that could affect reactivity or the release of Radioactive Materials to the environment,
  - g) Demonstrating knowledge of the Emergency Plan for the Nuclear Facility, including, as appropriate, the RO or SRO responsibility to decide whether the plan should be executed and the duties assigned under the plan,
  - h) Demonstrating the knowledge and ability, as appropriate, to the assigned position to assume the responsibilities associated with the safe Operation of the Nuclear Facility,
  - i) Demonstrating the trainee's ability to function within the control room team, as appropriate, to the assigned position, in such a way that the Licensee's procedures are adhered to and that the limitations in its Licence and amendments are not violated,

- j) Operating safe shutdown equipment outside of the main control room.
- 3. Recommended General Items, the content of which should be based on the RO and SRO SAT based training programme:
  - a) Preparation and startup for the reactor, including operating of the Controls associated with plant equipment that could affect reactivity,
  - b) Identifying the instrumentation systems and the significance of Nuclear Facility instrument readings,
  - c) Demonstrating or describing the use and function of the Nuclear Facility radiation monitoring systems, including fixed radiation monitors and alarms, portable survey instruments, and personnel monitoring equipment,
  - d) Demonstrating knowledge of significant radiation hazards, including permissible levels in excess of those normally authorized, and demonstrating the ability to perform other procedures to reduce excessive levels of radiation and to guard against personnel exposure.

**APPENDIX 4 – Application for Initial Certification**

**APPLICATION FOR INITIAL CERTIFICATION**

**NAME OF NUCLEAR FACILITY:** \_\_\_\_\_

**LICENCE NO.:** \_\_\_\_\_

**Type of Application:**

Reactor Operator (RO) ☐

Senior Reactor Operator (SRO) ☐

Certification by the Authority is hereby requested for the person identified below to perform the duties of Reactor Operator (RO) or Senior Reactor Operator (SRO) as described in the Nuclear Facility's Operational Limits and Conditions.

**PERSONAL QUALIFICATION - INFORMATION**

<b>Name :</b>		<b>Date:</b>	
<b>Citizenship/Country:</b>			
<b>Date of Birth:</b>			
<b>Education:</b>	High School or Equivalent <input type="checkbox"/>	Area of study:	<input type="checkbox"/>
	University/College <input type="checkbox"/>	Area of study:	<input type="checkbox"/>
	Advance Degree <input type="checkbox"/>	Area of study:	<input type="checkbox"/>
<b>This Candidate is medically fit</b> <input type="checkbox"/> Yes			
<b>The Candidate's trustworthiness and reliability has been checked</b> <input type="checkbox"/> Yes			

**POWER REACTOR OPERATOR TRAINING PROGRAMME**

1. Has the Candidate completed the Reactor Operator/Senior Operator Training Programme and successfully passed the Licensee's appropriate written examinations and operating test?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
2. Has the Candidate been trained on a full scale/ Nuclear Facility – Reference Simulator?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

**TRAINING**

CLASSROOM:	MONTH/YEAR		Number of Weeks
	Start	Completion	
Nuclear Power Plant Fundamentals			
Plant System			
Plant Procedures			
Normal Plant Operations			
Abnormal Plant Operations			
Accidents (including Severe Accident Management)			

Note 1: Examination results and medical certificates are available for review at the Licensee Facility.

Note 2: If the Candidates did not complete the approved training programme then include the additional information required by Article 6 of FANR-REG-17, as supporting document along with the application.





## APPLICATION FOR INITIAL CERTIFICATION

### TRAINING PROGRAMME

**On the Job Training:**

Number of weeks completed (start/end dates) \_\_\_\_\_

### SIMULATOR / PLANT MANIPULATION

PLANT/FACILITY SIMULATOR OPERATING EXPERIENCE:		MONTH/YEAR		Number of Weeks
		FROM	TO	
Normal Plant Operations (including start-up and shut-down Operations)				
Abnormal Plant Operations				
Accidents (including Severe Accident Management)				
Extra Person in training on Shift as a Qualified Trainee performing Facility manipulations under the supervision of an RO/SRO				
POWER PLANT EXPERIENCE (details):				
POSITION TITLE	FACILITY	FROM	TO	DUTIES

I am certifying hereby that the information contained in this application form as well as the supporting documents are true and complete:

**Signature – Candidate:**

Date:

Name of Authorised Nuclear Facility Licensee Representative:

**Signature of Authorised Nuclear Facility Licensee Representative:**

Any false statement or omission in this document, including attachments, may be subject to civil or criminal sanctions

Date:

**APPENDIX 5 – Application for Re-Certification**

**APPLICATION FOR RE-CERTIFICATION**

**NAME OF NUCLEAR FACILITY:** \_\_\_\_\_

**LICENCE NO.:** \_\_\_\_\_

Re-Certification by the Authority is hereby requested for the persons identified below to perform the duties of Senior Reactor Operators (SROs) or Reactor Operators (ROs) as described in the Nuclear Facility Operational Limits and Conditions.

The individual(s) is / are medically fit ☐ Yes

The below listed individual(s) trustworthiness and reliability has been checked ☐ Yes

Date: \_\_\_\_\_

FULL NAME OF SENIOR REACTOR OPERATOR / REACTOR OPERATOR & CERTIFICATION NUMBER	Please tick as appropriate		DATE of LAST CERTIFICATION	DATE of LAST CONTINUOUS QUALIFICATION WRITTEN EXAMINATION	DATE OF LAST CONTINUOUS QUALIFICATION OPERATING TEST
	RO	SRO			

Examination results and medical certificates are available for review at the Nuclear Facility. Any false statement or omission in this document, including attachments, may be subject to civil or criminal sanctions

**Name and Signature - Authorised Nuclear Facility Licensee Representative:** \_\_\_\_\_

## APPENDIX 6 – Maintaining Validity of Certificates (Supplement to Article (10))

