

## **Regulatory Guide**

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

## **Version 0**

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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 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)

For the purposes of this regulatory guide, the following terms have the meanings set forth below. Other 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):

<b>Candidate</b>	An individual who the Facility Licensee has determined meets the conditions for Certification as a Reactor Operator or Senior Reactor Operator at a Nuclear Facility and is being proposed by the Facility Licensee to be Certified by the Authority.
<b>Certification/ Certified</b>	The approval by the Authority for a Reactor Operator or Senior Reactor Operator to manipulate or supervise the manipulation of the Controls of a Nuclear Facility.
<b>Competent Health Authority</b>	A Physician competent in the use of a specific standard (e.g. ANSI/ANS-3.4-1996) used to evaluate medical suitability of 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 Abu Dhabi Authority to practice medicine.
<b>Active RO/SRO</b>	A Certified Reactor Operator or Certified Senior Reactor Operator onto whom the Facility Licensee has assigned the duties of a Reactor Operator or Senior Reactor Operator.
<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.
<b>Representative Simulator</b>	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 guide is to provide guidance for implementation of the requirements in FANR-REG-17, Regulation for the Certification of Operating Personnel at Nuclear Facilities.

### **Purpose and Scope**

#### **Article (3)**

1. This guide describes an acceptable means of meeting the requirements of the Authority for the programme that the Facility Licensee should implement for the selection, qualification, and training of RO and SRO personnel. For ROs and SROs it describes an acceptable means for the training and evaluation of these personnel leading to Certification and re-Certification. This guide does not apply to Equipment Operators (EO).
2. The Authority will make a determination whether to certify ROs and SROs Candidates after sufficient information has been provided that the Candidate has successfully completed the Authority approved Facility training plan and passed the requisite Facility Licensee examinations; both the written examination and operating test (see Appendix 1) or alternatively the additional specific information for Certification required by FANR-REG-17 Article (6), Item 3.

### **Training Plan**

#### **Article (4)**

This article applies to FANR-REG 17 Article (3)

1. The currently approved training plan must be used by the Facility Licensee for all initial training and re-Certification training of Candidates submitted for Certification to the Authority.
2. Implementing procedures, individual lesson plans, etc. are not part of the training plan and 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 be described in the training plan.
3. The 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 FANR-REG-17 Article (3), Item 4.
4. The training plan for ROs and SROs should describe the following:
  - a. the minimum power plant and nuclear power plant experience that is required, including positions held at other Facilities, operating status of the Facility, and how equivalent experience may be justified;
  - b. minimum educational qualifications;
  - c. the method to be used to assess an individual's safety focus;
  - d. a description of the performance and attendance requirements for completion of the requalification programme as it applies to Certified ROs and SROs;
  - e. the details as to how the requirements of FANR-REG-17 Article (11) Records will be accomplished. This description should be consistent with the Facility Licensee's Management System; and

- f. the means the Facility Licensee will use to demonstrate that ROs and SROs will meet the medical requirements of FANR-REG-17 Article (4). This should include identification of which standards have been used by Physicians for medical assessment.

### **Active Reactor Operator and Senior Reactor Operator**

#### **Article (5)**

This article applies to FANR-REG 17 Article (3) Item 3

1. The Facility Licensee should have a process documenting that Active RO/SROs are in compliance with all legal and regulatory requirements and certificate conditions.
2. The Facility Licensee should immediately remove an RO/SRO from duties as an Active RO/SRO when any RO/SRO does not meet any legal or regulatory requirement or certificate condition. The Facility Licensee may re-instate an individual to Active status so long as any individual's Certification remains valid.
3. Only Active ROs and SROs, or Qualified Trainees, are allowed to manipulate Controls.
4. The Facility Licensee should retain records demonstrating that Active RO/SROs meet all requirements of the FANR REG 17 Article (11). The records should be maintained for at least 5 years following the period which an RO/SRO was Active.

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

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

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

1. The Facility 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 Facility Licensee should choose an appropriate standard (e.g. ANSI/ANS-3.4-1996) for establishing the medical fitness of Operators and select Physicians competent in the use of these standards. The Facility Licensee should obtain written justification from these Physicians (Competent Health Authority) demonstrating their competence in the use of the selected standard.
3. The Facility Licensee should maintain records of all Competent Health Authorities and their contact information. These records should be maintained for at least 5 years following the period which their services were used for evaluating ROs/SROs.
4. A Candidate who does not meet all requirements of the relevant medical standard (ANSI/ANS-3.4-1996) may request conditional Certification approval. A request for conditional approval should state the wording of the condition and provide the justification of the conditional acceptance.
5. All potential RO and SRO Candidates should have a high school diploma and a minimum work experience of 3 years in nuclear related work before beginning RO/SRO training. SRO trainees should have two years of plant experience as a RO, or alternative equivalent, such 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 potential ROs and SROs have sufficient experience to be Certified. Exceptions for minimum work experience requirements for initial Operation following plant construction are described in item 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 RO/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 license is applied.
- b) The RO applicant should possess a high school diploma or an equivalency certificate. No prior power plant experience is required for entry into Reactor Operator training.
- c) The SRO applicant should possess a high school diploma or an equivalency certificate and should meet at least one of the following conditions prior to entry into Senior Reactor Operator training:
  - Previously Active status as an RO or SRO consistent with the definitions of this regulatory guide
  - University degree in science or engineering
- d) Additional training to be completed as follows:
  - Integral with training, complete a site-specific Equipment Operator on-the-job training programme for selected Equipment Operator tasks. The selected tasks are those that are important to plant Operation with regard to Nuclear Safety and defense-in-depth or those that are risk significant.
  - Practical and meaningful work assignments include documented participation in preoperational testing.

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

### **Article (7)**

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

1. The Facility Licensee should implement training programmes for both initial and refresher training for ROs and SROs based on a systematic approach to training (SAT). The SAT should include: Analysis at the job and task levels and then selection of tasks for instruction; design of learning objectives to accomplish the tasks and sequence these in the proper instructional setting; develop training materials and schedules; implement the training with qualified instructors; and then evaluate the training. The Facility Licensee may make reference to other International nuclear training standards/methods including knowledge skills and abilities catalogues.
2. RO and SRO Candidates 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 and procedures should be included in the training. In preparation for the various Nuclear Facility operational conditions as well as transients and accidents, the 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 include consideration of good teamwork skills and readiness for the administrative control and supervision of work done at the nuclear power plant. SRO and RO trainees should be given training in and demonstrate competency in clear communications and language skills sufficient to communicate plant status and direct Operations in the control room and in the balance of plant. SROs should be given training in skills needed to perform oversight and provide direction to ROs and Equipment Operators.
3. The initial training of 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 training for ROs and SROs should include the duties required for implementing the Nuclear Facility Emergency Plan.
5. As part of the initial training, applicants should participate in on-the-job training to demonstrate familiarity 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 applicant. For ROs and SROs, this on-the-job training should include tasks in the main control room or simulator and in the plant. For plants 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 (8)**

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

- 1 The assurance of the competence of Candidates for RO and SRO 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 ROs and SROs to function at the level required during the performance of their duties.
- 2 A request to Certify should be provided to the Authority at least 60 days in advance of the conduct of the initial Certification examinations for RO's and SRO's. The Authority will notify both the Facility Licensee and RO/SRO of the decision to grant or deny Certification approximately 30 days after completion of the last operating test. Appendix 2 provides an acceptable application form for requesting initial Certification.

### **Written Examinations**

1. The purpose of a written examination is to ensure that the Operator applicant 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 these written examinations are provided in Appendix 1.
2. The generic fundamentals examination can be given to applicants at an early stage of their initial training to ensure that they understand the bases for the Operation and design of the Facility and the applicable principles. The Facility Licensee may elect to provide a bank of generic fundamentals examination questions to the Authority in order to streamline the review process. Questions from this question 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 describes acceptable method with regard to formulation of written exam. If an applicant previously passed a generic fundamental examination in an Operating training programme under the oversight of another National Nuclear Regulator, the applicant will not have to take another GFE unless:
  - a. He or she is transferring from a Facility of another reactor type (i.e. going from a BWR to a PWR); or
  - b. the applicant discontinued, for a period exceeding 2 years (24 months), participation in an Operator training programme that maintains proficiency in the GFE topics, under the oversight of a National Nuclear Regulator.

3. 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 applicant is currently Certified as an RO, the applicant 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 those tasks unique to that position. 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.
4. The passing grade for all written examinations should be 80%. If the applicant fails to pass either of the written examinations, he/she should be re-trained in those areas in which they exhibited deficiencies prior to re-taking the examination.

### **Operating Test**

1. Applicants 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 1. The applicant 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 Operations, transients, and accidents. An RO applicant 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 applicants should be evaluated in all roles.
2. A new SRO Candidate who has not held a 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 a SRO. Existing RO's that are qualifying as SRO's must complete one scenario in the SRO position. If any Candidate participates in more than the minimum number of scenarios, the total number of scenarios will be considered in the evaluation. Substitute personnel may be used to complete minimum crew staffing. In such cases, these substitutes must be fully capable of fulfilling their designated roles (e.g. RO/SRO).
3. The demonstration of professional skills in a Nuclear Power Plant Reference Simulator should be used to ensure that the ROs and SROs can exhibit teamwork and apply plant knowledge in a working environment. The ROs and SROs should have the skills necessary to function as a member of his/her team 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 applicant has the opportunity to conduct a variety of tasks. A description of the minimum number of normal plant evolutions, power changes, instrument failures, equipment malfunctions, abnormal events, and Emergency events that each Candidate will have to address and how the individual's performance will be assessed should be included in the training programme.
4. The second part of the operating test is to complete a series of job performance measures (JPMs) following the guidelines in Appendix 1. The Candidate 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 Operations, transients, and accidents. The passing grade for the JPM portion of the operating test should be 80%.



## **Requalification of Reactor Operators and Senior Reactor Operators**

### **Article (9)**

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

1. The Facility Licensee should implement a requalification programme for Certified ROs and SROs in accordance with its approved training plan. The requalification programme should be completed over a period not to exceed 2 years. Each individual should be trained and evaluated in all positions that are permitted in terms of his/her Certification.
2. Certified ROs and SROs must successfully complete a written requalification examination on a biennial basis. Only one written examination is required for requalification. This examination should contain 10% of questions that are based on generic fundamentals examination questions with the rest being site specific examination questions, consistent with the guidance provided in Appendix 1. 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 exams given in that biennial cycle.
3. Certified ROs and SROs participating in the requalification programme should complete an operating test on a biennial basis consistent with the guidance provided in Appendix 1. 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.
4. The Facility Licensee's requalification programme for Certified ROs and SROs should specify minimum attendance requirements at requalification training sessions and provisions for makeup for missed lectures and on-the job training activities.
5. Ongoing competence for Certified RO's and SRO's can be demonstrated by actively performing the functions of the job position and routine attendance at requalification training. The minimum periodicity for attending requalification sessions and still maintaining qualifications should also be specified in the Facility Licensee's training plan.
6. A documented request to re-Certify should be provided to the Authority at least 60 days before the 5 year anniversary of Certification to ensure the continuity of qualification. The Authority will notify both the Facility Licensee and the RO/SRO of the decision to grant or deny Certification approximately 30 days after receiving a documented request to re-Certify. Appendix 3 provides an acceptable application form for requesting re-Certification.

### **Requalification Lectures**

1. The requalification programme should include preplanned lectures on a regular and continuing basis. Consideration for the content of these 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 in requalification programmes 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) Radiation control and safety
  - h) Operating Limits and Conditions

- i) Applicable portions of the Federal Law by Decree No. 6 of 2009 and Authority Regulations
- j) Plant modifications and their significance
- k) Response to severe accidents
- l) Plant events
- m) Industry events
- n) Design changes
- o) Procedural changes

### **On-The-Job Training**

1. The Certified RO and SRO requalification programme should include on-the-job training (OJT). The OJT 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 RO's and SRO's, manipulations should consist of the following activities (control manipulations and plant evolutions). The use of the Operational Limits and Conditions should be emphasized during the OJT. Certified SROs may be credited with these activities if they direct control manipulations either in the nuclear power plant or in the simulator.

### **Control Manipulations that should be performed annually in accordance with the RO and SRO SAT based 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 feedwater 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 percent or greater where load change is performed with load limit control
- g) Loss of coolant, including;
  - a. Significant steam generator leaks
  - b. Leaks inside and outside containment
  - c. 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 feedwater
- l) Loss of service water

### **Control Manipulations that should be performed at least once every 2 years in accordance with the RO and SRO SAT based 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 offgas
- 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) A nuclear instrumentation failure
- n) For requalification 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 requalification training cycle.

## **Evaluation Techniques**

### **Article (10)**

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

1. The Facility Licensee should provide evaluators to conduct evaluations, throughout the RO and SRO 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 applicants, 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**

1. The simulator portion of the operating test should be evaluated by the same number of evaluators as the positions being evaluated, with one evaluator 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.
2. After each scenario, each evaluator may ask follow up questions to clarify actions taken by the Operator being evaluated. This questioning should be done in a manner which does not signal to the Operator that they may have made a mistake and therefore potentially jeopardize the Operator's performance in later scenarios.
3. During the job performance measure portion of the operating test, each evaluator will examine their Operator 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.

## **Notification**

### **Article (11)**

1. The Authority should be notified 60 days in advance of all examinations and operating tests for initial Certification and biennial requalification. The notification should include a copy of the examination or test, the names of the applicants to be tested and the planned schedule for the testing. The Authority should notify the Facility Licensee with requested changes to the written examination or test and of dates of any planned observations or inspections within 30 days of the scheduled start of the examinations or tests.
2. The Facility Licensee should notify the Authority of a decision to permanently remove an RO/SRO from Active status or a decision to remove an Active RO/SRO from Active status for an indeterminate period of time. This notification should be by letter to the Director of Nuclear Safety and should identify the individual and reasons for removal from Active status. Such a letter should appropriately protect personal or medical information of individuals.

## **Representative Simulator**

### **Article (12)**

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

1. The Facility Licensee should have a documented programme for maintaining a Representative Simulator for all simulator based training performed for 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 Facility 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 minimum design, testing, performance, and configuration criteria for a plant specific simulator.

### **References**

#### **Article (13)**

1. NUREG1021, Operator Licensing Examination Standards for Power Reactors, Revision 9, July 2004, 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
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 licenses 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"

## APPENDIX 1 - Guidelines for Examination Content

### Generic Fundamentals Examination

1. The generic fundamentals examination should include the following elements, whether this examination is administered to RO or SRO applicants (see Article (8) Written Examinations Item 2 of this Guide): The content of these 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 this examination is administered to applicant 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 Facility
  - d) 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 these 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 power plant (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 applicant examination, the site specific examination should contain the following elements when administered to SRO applicants and should comprise an additional 25 questions, as described in Article (8) item 3 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 License
  - b) 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 Plant Protection Plan (PPP)
- h) 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
- i) 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 Operator to demonstrate an understanding of and the ability to perform the actions necessary to accomplish the required and general items listed below. These items can be addressed either during the simulator examination portion of the operating exam or during performance of the job performance measures. Time-critical job performance measure 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 Authority Regulations, the FSAR or the Emergency Plan.
2. Typically required Items: The content of these items should be based on the RO and SRO SAT based training programme.
  - a) Manipulate the Controls as required to operate the nuclear power plant between shutdown and designated power levels
  - b) Identify annunciators and condition-indicating signals and perform appropriate remedial actions
  - c) Observe and safely control the operating behavior characteristics of the Nuclear power plant Facility
  - d) Perform control manipulations required to obtain desired operating results during normal, abnormal, and Emergency situations
  - e) Safely operate the nuclear power plant heat removal systems, including primary coolant, Emergency coolant, and decay heat removal systems, and identify the relations of the proper Operation of these systems to the Operation of the Facility
  - f) Safely operate the nuclear power plant auxiliary and Emergency systems, including Operation of those Controls associated with plant equipment that could affect reactivity or the release of Radioactive Materials to the environment
  - g) Demonstrate knowledge of the Emergency Plan for the Nuclear power plant, including, as appropriate, the Operator's or senior Operator's responsibility to decide whether the plan should be executed and the duties under the plan assigned
  - h) Demonstrate the knowledge and ability as appropriate to the assigned position to assume the responsibilities associated with the safe Operation of the nuclear power plant
  - i) Demonstrate the applicant's ability to function within the control room team as appropriate to the assigned position, in such a way that the Nuclear power plant Facility Licensee's procedures are adhered to and that the limitations in its License and amendments are not violated

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

**APPENDIX 2 – Application for Initial Certification**

**APPLICATION FOR INITIAL CERTIFICATION**

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

<b>Type of Application:</b>	
Reactor Operator (RO)	<input type="checkbox"/>
Senior Reactor Operator (SRO)	<input type="checkbox"/>

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 Facilities Operational Limits and Conditions. This applicant is medically qualified, the Licensee has high confidence in the person's trustworthiness, reliability and competence, that the Licensee has a need for a person to perform the duties of RO or SRO and that the person has successfully passed the Licensee's RO or SRO training and qualification programme. This Certification request is based on a need for the applicant to perform the duties of SRO or RO at the above Nuclear Facility.

**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"/>
	University/College	<input type="checkbox"/>
	Advance Degree	<input type="checkbox"/>

**POWER REACTOR OPERATOR TRAINING PROGRAMME**

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

**TRAINING**

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

- continues to next page -

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 FANR-REG-17, Article (6).



**APPENDIX 2 (CONTINUED)**

**TRAINING PROGRAMME**

**On the Job Training:**

Number of weeks completed \_\_\_\_\_

**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 a RO/SRO

**POWER PLANT EXPERIENCE (details):**

POSITION TITLE

FACILITY

FROM

TO

DUTIES

Signature – Candidate:

Date:

Name of Authorised Nuclear Facility Representative:

Date:

Signature of Authorised Nuclear Facility Representative:

Date:

**APPENDIX 3 – Application for Re-Certification**

**APPLICATION FOR RE-CERTIFICATION**

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

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. These applicants are medically qualified and have satisfactorily completed the Nuclear Facility requalification training programme as described in the Nuclear Facility training plan to continue to serve as SRO or RO.

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

FULL NAME OF SENIOR REACTOR OPERATOR / REACTOR OPERATOR	RO/SRO (Check-Box)		DATE OF LAST CERTIFICATION	DATE OF LAST RE-QUALIFICATION WRITTEN EXAM	DATE OF LAST RE-QUALIFICATION OPERATING TEST

Examination results and medical certificates are available for review at the Nuclear Facility.

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