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In the event of any differences in interpretation of this guide, the Finnish version shall take prescedence over this translation

QUALIFICATIONS OF NUCLEAR POWER PLANT PERSONNEL

1 GENERAL

A prerequisite for issuance and continued validity of an operating license for a nuclear power plant is that the following statutory requirements set for the plant personnel are fulfilled:

1) The general requirement of necessary expertise at the disposal of the applicant for operating license, Chapter 4 of Atomic Energy Act (356/57) and Chapter 12 of Atomic Energy Statute (75/58)

2) Requirement for an ordinance for plant administration defining the duties, authority and responsibilities of the personnel, Chapter 17 of Atomic Energy Statute.

3) Requirements for a responsible plant manager and his substitute, Chapters 14, 16 and 17 of Atomic Energy Statue and Chapter 5 of the Act on Radiation Protection (328/57).

4) Requirements for a supervisor of pressure vessel operation and his substitute, Chapters 14, 25 and 26 of the Statute on Pressure Vessels.

The purpose of this guide is to expound the position taken by the Institute of Radiation Protection on interpretation of the above requirement 1 in particular

Since nuclear power plants, like companies which own them, differ from one another, the structure of the operating organization as well as the outlines for personnel requirement and training must be drawn up on a plant-by-plant basis. Therefore, this guide is not meant to be binding on every detail; rather, it exemplifies the overall level of requirement and can be used as a frame of reference in setting plant-specific requirements for personnel. The IRP will comment on the details when reviewing the proposals put forward by the power company.

This guide is not applicable to individuals whose main duties are economic or administrative, or who are responsible for buildings maintenance or work as security guards on a nuclear power plant. Furthermore,

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this guide does not deal with requirements set for the personnel on the basis of other than Atomic Energy, Radiation Protection or Pressure Vessel legislation.

Section 2 of the guide defines various responsibilities, proposing equivalent job titles. The definition of duties is made with such accuracy as to render the requirements associated with each job title as set forth in section 3 and 4 intellegible. Section 5 gives a presentation of how the IRP supervises the competence of the personnel.

2 ASSIGNMENT OF RESPONSIBILITIES

The activities related to the operation of a nuclear power plant can be divided into three main areas of responsibility: operation, maintenance and technical support activities. For each area of responsibility, there shall be a responsible person who works at the facility on a day-to-day basis.
These individuals, together with the responsible plant manager, make up the plant management. Each manager with a specified area of responsibility shall be provided with a sufficient number of subordinates to carry out the duties assigned to his department.

An example of how to organize the work related to plant operation and to assign the duties to various organizational units and individuals is given below. Different job titles may be used and the duties assigned in some other way, provided that the requirements set forth in this guide with respect to the total number of personnel and resources needed for execution of any specific task are met.

2.1 Plant Management

2.1.1 Responsible Plant Manager

The responsible plant manager is reguired to assure that

- the operation of the plant complies with existing legislation and applicable international agreements
- the plant is operated according to plant design and in compliance with orders given by the authorities
- the confirmed quality assurance programme is observed
- the plant personnel is sufficiently competent and has access to necessary instructions
- radioactive wastes are properly handled
- supervision of nuclear material on the plant is effected in compliance with the confirmed accounting and control programme.

- sufficient preparedness for coping with emergencies is maintained
- the confirmed industrial security plan is observed in plant operation and fuel handling

Duties:

- to act as the responsible plant manager referred to in the Atomic Energy Statute and Radiation Protection Statute
- to direct and supervise the work of the personnel specified in this guide as well as all other activities related to the operation and maintenance of the plant

2.1.2
Operations Manager

Duties:

- to direct and supervise the work of operating personnel
- to prepare and inspect the facility operating programme
- to assure that the operating instructions are appropriate for safe operation and complied with
- to inspect reports on plant operation
- to assure that sufficient operating personnel resources are maintained

2.1.3
Maintenance Manager

Duties:

- to direct and supervise the work of maintenance personnel
- to assure that the instructions on maintenance and inspection of plant components are appropriate and complied with
- to supervise procurement, control and storage of replacement and spare parts necessary for plant maintenance
- to assure that sufficient maintenance personnel recources are maintained

2.1.4
Technical Manager

Duties:

- to direct and supervise the work of technical personnel
- to assure that the instructions on technical support activities are appropriate and complied with
- to inspect technical analyses, action plans and reports of potential abnormal occurrances

- to assure that sufficient tehcnical personnel resources are maintained.

2.2
Operating Personnel

2.2.1
Operations Engineer

An operations engineer is not necessarily required on a nuclear power plant with only one operating unit. However, if there are several operating units, an operations engineer shall be assigned to each one of them.

Duties:

- to act as an immediate superior to shift leaders on the unit
- to prepare the operating programme and supervise compliance
- to assure that personnel are available on the unit in sufficient numbers as required by each operating condition

2.2.2
Operations Co-ordinator

There shall be as many operations co-ordinators as there are operating units.

Duties:

- to plan and report on component tests required by the Technical Specifications
- to assist the operations manager and engineer in drawing up the operating programme for the plant and planning related support activities (liquid and gas treatment)
- to participate in preparation, inspection and development of operating instructions

2.2.3
Shift Leader

On each unit, there shall be a sufficient number of shifts to ensure that the plant is continuously manned, taking into account the working hours laid down in the labour contract and the time required for re-qualification training. Each shift must have a shift leader.

Duties:

- to direct and supervise the work of the shift crew
- to check the work orders for maintenance work affecting plant operation and to give permission to begin the work
- to keep an operation log

- to assure that the plant conforms in every respect to the Technical Specifications
- to investigate without delay abnormal readings on some operating parameter

2.2.4
Operator

There has to be at least two operators to each shift.

Duties:
- to manipulate plant controls in accordance with operating instructions and orders given by the shift leader
- to report to the shift leader on abnormal reading on operating parameters

2.2.5
Assistant Operator

There shall be one or several assistant operators to each shift, depending on the structure and degree of automation of the plant.

Duties:
- to manipulate, according to given orders, those auxiliary plant systems that are not controlled from the main control room
- to control the functioning of components and instrument readings outside the main control room and to report to the shift leader on observations made

2.3
Maintenance Personnel

2.3.1
Chief Work Co-ordinator

Duties:
- to direct work planning and scheduled maintenance
- to prepare and examine maintenance instructions
- to inspect work plans

2.3.2
Work Co-ordinator

The number of work co-ordinators shall be equal to operating units.

Duties:
- to plan maintenance operations in accordance with procedures, instructions and orders given
- to mark clearly on work orders the special instructions and permissions required for the work involved

2.3.3
Mechanical Maintenance Foreman

Duties:

- to act as the supervisor of pressure vessel operation at a nuclear power plant referred to in the Statute on Pressure Vessels
- to direct mechanical equipment maintenance at a a nuclear power plant
- to participate in preparation, inspection and development of mechanical equipment maintenance instructions

2.3.4
Electrical Maintenance Foreman

Duties:

- to direct electrical equipment maintenance at a nuclear power plant
- to participate in preparation, inspection and development of electrical equipment maintenance instructions

2.3.5
Instrumentation and Controls Maintenance Foreman

Duties:

- to direct instrumentation and control equipment maintenance at a nuclear power plant
- to participate in preparation, inspection and development of instrumentation and control equipment maintenance instructions

2.3.6
Buildings Maintenance Foreman

Duties:

- to direct buildings maintenance at a nuclear power plant
- to act as a fire brigade chief for the plant and to assure that fire protection prescripts are complied with and necessary preparedness maintained

2.3.7
Foreman

A sufficient number of foreman shall be employed for each segment of maintenance.

Duties:

- to direct given maintenance tasks
- to perform more demanding maintenance operations in accordance with given instructions

2.3.8
Mechanics

Mechanics shall be sufficient in number to make sure that normal maintenance operations can be performed by the plant's own personnel.

Duties:

- to perform maintenance operations according to given instructions

2.4
Technical Personnel

2.4.1
Safety Engineer

Duties:

- to check work orders on maintenance of components important to safety
- to inspect plans for abnormal operating procedures and their safety effect
- to examine action plans and reports of abnormal occurences affecting safety
- to plan and supervise actions related to industrial security
- to assure that emergency preparedness is maintained

2.4.2
Reactor Engineer

Duties:

- to observe and analyze reactor power distribution, thermal margins, burn-up and reactivity balance
- to supervise the use of fuel
- to plan and supervise activity related to handling and storage of fuel
- to have responsibility for accounting and control of nuclear material

2.4.3
Radiation Protection Engineer

Duties:

- to direct and supervise the work of radiation technicians and assistants
- to prepare reports on dose monitoring and radiation surveillance
- to issue permits for work involving exposure to radiation

2.4.4
Radiation Protection Technician

Each plant unit is required to have at least one radiation protection technician.

Duties:

- to control the condition of radiation protection equipment and to instruct other personnel how to use it
- to execute monitoring and control duties according to instructions given by the radiation protection engineer
- to instruct plant personnel and visitors in radiation protection and to assure compliance with regulations

2.4.5
Radiation Protection Assistant

The number of radiation protection assistants shall be sufficient to ensure that radiation protection tasks related to plant operation or maintenance can be performed.

Duties:

- to perform monitoring and control duties as instructed

2.4.6
Chemist

Duties:

- to direct and supervise work in the chemical laboratory
- to screen and control the chemical parameters of processes as well as actions affecting chemical conditions

2.4.7
Laboratory Assistant

Each plant is required to have one or several laboratory assistants, depending on the structure and degree of automation of the plant.

Duties:

- to perform chemical analyses as instructed

2.5
Training Personnel

2.5.1
Training Co-ordinator

Duties:

- to establish an introductory and requalification training programme for plant personnel
- to be responsible for arranging training courses and recruiting instructors
- to inform the instructors on the objectives of training
- to supervise courses and the contents and quality of instruction

- to check that the trainees have assimilated, to a sufficient degree, the instructional material incorporated in each training period
- to keep a training register

3 REQUIREMENTS FOR BASIC TRAINING AND WORKING EXPERIENCE

Requirements for the basic training and working experience of individuals listed in section 2 are presented in table 3.1. Since the assignment of duties varies from plant to plant, these requirements shall be confirmed in the ordinance for plant administration so that they are in harmony with the requirements set forth as examples in table 3.1.

In table 3.1., basic training requirements are denoted by abbreviations MSc, E, T, VT, or -. They stand for following degrees or training requirements:

MSc	Master of Science in Engineering or a corresponding degree
E	Engineer or corresponding technical training
T	Technician or corresponding technical training
VT	Vocational training related to the field
-	no specified vocational training

If several alternatives are marked in the basic training column, the working experience reuirement for each alternative given in the same order in the experience column.

Working experience is defined as experience gained after basic training. The working experience shall be such in nature as to give knowlegde and skills necessary for execution of assigned duties at a nuclear power plant.

position	Basic Training	Total Working Experience (years)	Nuclear Power Plant Experience (years)
Responsible Plant Manager	MSc	10	2
Operations Manager	MSc, E	5, 10	2, 5
Maintenance Manager	MSc, E	5, 10	2, 5
Technical Manager	MSc	7	3
Operations Engineer	E	7	2
Operations Co-ordinator	-(*)	-(*)	-(*)
Shift Leader	E, T	3, 7	1, 3
Operator	T	2	1
Assistant Operator	-(*)	-(*)	-(*)
Chief Work Co-ordinator	E	5	1
Work Co-ordinator	-(*)	-(*)	-(*)
Mechanical Maintenance Foreman	E, T	5, 7	1, 3
Electrical Maintenance Foreman	E, T	5, 7	1, 3
Instrumentation and Controls Maintenance Foreman	E	5	1
Buildings Maintenance Foreman	T	5	-
Foreman	T, -	-, 10	-, 3
Mechanic	VT,-	-, 2	-, -
Safety Engineer	MSc, E	3, 7	3
Reactor Engineer	MSc	3	3
Radiation Protection Engineer	MSc, E	3, 7	3
Radiation Protection Technician	T, -	-, 2	-, 2
- " - - " - Assistant	-	-	-
Chemist	MSc, E	3, 5	1, 3
Laboratory Assistant	VT, -	-, 2	-, -
Training Co-ordinator	MSc, E	2, 5	1

(*) Requirements depend on responsibilities and will be specified on a plant-by-plant basis.

Table 3.1 Education and experience requirement for personnel

Nuclear power plant experience means experience gained in design, construction, test operation and operation of a nuclear power plant. Work at a research reactor or laboratory and work related to research and inspection of nuclear power plants can also qualify as nuclear experience. Furthermore, the time the individual is employed by the power company and undergoing training in preparation for his future duties may be acceptable as qualifying experience.

At a new nuclear power plant units, the personnel shall meet the experience requirements by the time of core loading. At units already in operation, the applicant must have acquired the necessary experience prior to appointment.

4 SPECIAL TRAINING REQUIREMENTS

Special training means training provided by the owner of the nuclear power plant in order to assure that the employees acquire and maintain the skills needed in execution of specific duties. Special training includes introductory training, given before an individual accepts responsibility for certain duties, and requalification training to be given later on a regular basis.

Special training shall be supervised and the number of subjects based on individual study kept to a minimum. Regular examinations are to be held during the training period to ensure that the trainees have assimilated the study material to required extent.

4.1 Introductory Training

Table 4.1 gives a presentation of what kind of training the IRP deems necessary for each of the individuals mentioned in section 2. The courses and training listed in the table are dealt with in detail below. A more concise version of most courses can be made, including selected parts from a full-length course. A course can be held as continous or as divided into several shorter periods and it may include, depending on the subject matter and participants, lectures, seminars, individual study, on-the-job training and exercises. The prescribed duration of a course means the total time used for the study of each subject.

Fundamentals of Nuclear Technology

The course is equivalent in contents to the nuclear power training package prepared by AB Kärnkraftutbildning and edited into Finnish by Imatran Voima Oy.

Appr. three months shall be reserved for a full-length course and appr. one month for a concise course.

Features of Facility Design

All systems and their main components of the nuclear power plant involved are dealt with on the course. The functions, structure, operating conditions and maintenance requirements of each system are presented

About 4 months shall be reserved for a full-lenght course and 1 month for a concise course.

Special Courses on Facility Parts

The courses are limited to those parts of the plant that the participants have to deal with in course of their work. Separate courses on mechanical components, process systems, electrical systems and equipment, and instrumentation systems and equipment are held for maintenance personnel. Assistant operators, radiation and laboratory assistants shall attend courses of their own.

About 4 months shall be reserved for courses for employees at the functional level of foreman, and 2 to 4 weeks for concise courses for workers.

Radiation Protection

The course deals with the effect of ionizing radiation on the organism, measure units and methods of measurement, methods of protection and radiation protection legislation. About 1 week shall reserved for a full-lenght course and 2 days for a concise course.

Fire Protection

The course deals with fire prevention regulations, fire detection and alarm, built-in extinction systems, manual extinquishers, protectice equipment used in fire fingting, passageways and action during potential fires. In addition, the fire protection organization of the facility is presented, and drills are conducted within the framework of the organisation.

About 1 week shall be reserved for a full-length course and accompanying drills and 1 to 2 days for a concise course.

Abnormal and Emergency Conditions

The course deals with abnormal occurrences and emergencies used as design bases and analyzed in the Safety Analysis Reports. Actions to be taken in each situation are practiced in accordance with relevant instructions.

About 2 weeks shall be reserved for a full-length course and associated practice, and about 2 days for a concise course.

Administrative Training

The course deals with
- acts, statutes and license conditions bearing upon nuclear power plants
- Technical Specifications and their bases
- Quality Assurance Programme
- facility organization including authoritative hierarchy and work routines (work orders and permits)
- structure and outlines of facility regulations
- principles of reporting and storage of records (archives)
- general principles of security arrangements (control of passage, quarding, cards, keys etc.)

About 2 weeks shall be reserved for a full-length course and 1 to 2 days for a concise course

Course-type Practical Training

The course-type practical training shall be conducted at an operating nuclear power plant or in a simulator reproducing real operating characteristics.

At least two months shall be reserved for course-type practical training.

On-The-Job Training

As for the original personnel, participation in supervision of installation and commissioning of the facility qualifies as required training. The figures determining the duration of on-the-job training given in table 4.1 applies to complementary personnel.

On-the-job training shall be conducted under immediate supervision of a senior employee, with special emphasis placed on relevat regulations.

4.2
Requalification Training

Requalification training shall be given to all the personnel in radiation and fire protection as well as abnormal occurrences and emergecies. Furthermore, shift leaders and operators are required to repeat the fundamentals of nuclear technology, features of facility design and the Technical Specifications. Subjects included in the introductory training shall be taken up in requalification training to the extent they do not come up in day-to-day work. A requalification programme is to be established for the purpose of repetition. All subjects shall be covered on a regular basis within two years.

position	Fundamentals of Nuclear Technology	Features of Facility Design	Special Courses on Facility Components	Radiation Protection	Fire Protection	Abnormal Occurrences and Emergencies	Administrative Training	Course-type Practical Training	On-the-job Training
Responsible Plant Manager	K	K		K	M	M	K		
Operations Manager	K	K		K	M	K	K	C	
Maintenance Manager	K	K		K	K	M	K		
Technical Manager	K	K		K	M	K	K		
Operations Engineer	F	F		F	F	F	F	F	
Operations Co-ordinator	K	K		K	C	M	F		
Shift Leader	F	F		F	F	F	F	F	4 mo
Operator	F	F		F	F	F	F	F	2 mo
Assistant Operator	C	C	C	F	F	C	C		2 mo
Chief Work Co-ordinator	C	C		C	C	C	F		
Work Co-ordinator	C	C		C	C	C	F		
Mechanical Maintenance Foreman	C	C	F	C	C	C	F		
Electrical Maintenance Foreman	C	C	F	C	C	C	F		
Instrumentation and Controls Maintenance Foreman	C	C	F	C	C	C	F		
Building Maintenance Foreman	C	C	F	C	K	C	F		
[illegible]eman	C	C	F	F	F,C	C	C		2 mo
Mechanic			C	C	F,C		C		2 mo
Safety Engineer	K	K		K	F	K	K		
Reactor Engineer	K	M		K	M	M	K		
Radiation Protection Engineer	K	M		K	M	M	K		
- " - - " - Technician	C	C	C	F	F	F	C		2 mo
- " - - " - Assistant	C	C	C	F	F	C	C		2 mo
Chemist	K	M		K	M	M	K		2 mo
Laboratory Assistant			C	C	C		C		2 mo
Training Co-ordinator	K	K		K	F	K	K		

F = a full-length course required
C = a concise course required
K = required to possess the knowlegde contained in a full-length course or to acquire it through course attendance or some other way
M = familiarity with the main points of subject dealt with on a full-length course required

Table 4.1 Introductory Training Requirements for Personnel

In case the training of complementary personnel is administered through senior employees acting as instructors and supervisors, they will be exempted from requalification training in the subject they instruct in.

5
TRAINING REGISTER

A training register is kept on all persons with responsibilities presented in section 2 of this guide. The training register shall include information on basic training and working experience as well as all special training programmes in which the employees have participated.

6
INDIVIDUAL LICENSES

The Atomic Energy Statute requires that the responsible plant manager and his substitute are licensed by the Ministry of Trade and Industry. A member of the permanent staff who satisfies the requirements laid down in Chapter 16 of the Statute can be proposed as a substitute; in other words, he shall hold a university degree and be familiar with nuclear technology.

The Statute on Pressure Vessels requires that for each registered pressure vessel, a supervisor of operation and his substitute or substitutes are appointed. An approval of the supervisor and his substitute is granted by the IRP.

The Institute of Radiation Protection deems it necessary that operations engineers (or where there is none, the operations manager), shift leaders, and operators be licensed as facility operators following the procedure precribed in Guide YVL 1.6.

7
SUPERVISION OF PERSONNEL

The Institute of Radiation Protection supervises the competence of the personnel

- by checking the information on personnel provided in the Preliminary and Final Safety Analysis Reports and in the supplements to the application for operating license
- by examining the ordinance for facility administration
- by supervising training through visits on which the quality and methods of instruction and study material is controlled
- by issuing individual licenses to operations engineers, shift leaders, operators and supervisors of pressure vessel operation.

The Preliminary Safety Analysis Report shall include

- a diagram of facility organisation showing all proposed positions
- a proposal for a schedule for filling the vacancies
- a brief account of responsibilities associated with each position
- the preliminary basic training and working experience requirements related to each position
- a preliminary training programme describing courses included in introductory training and arrangements for practical training, and specifying the duration,participants and organisation responsible for each training period

The same items in their final form as well as the requalification programme is presented in the Final Safety Analysis Report.

Information on the basic training and working experience of those persons whose positions require a MSc or Engineer's degree is provided in the supplements enclosed with the application for an operating license (Chapter 11 of the Atomic Energy Statute 75/58)

The duties, authority and responsibility associated with all positions corresponding with the job titles listed in section 2 shall be defined in the ordinance for plant administration.

The IRP shall be notified of training activities in order to enable supervision of training on a regular basis.

The licensing procedure for shift leaders and operators is presented in Guide YVL 1.6 and for the supervisor of pressure vessel operation in Guide YVL 3.0.