GOVERNMENT OF INDIA

AERB SAFETY GUIDE

STAFFING, RECRUITMENT, TRAINING, QUALIFICATION AND CERTIFICATION OF OPERATING PERSONNEL OF NUCLEAR POWER PLANTS

ATOMIC ENERGY REGULATORY BOARD

AERB SAFETY GUIDE NO. AERB/SG/O-1

STAFFING, RECRUITMENT, TRAINING, QUALIFICATION AND CERTIFICATION OF OPERATING PERSONNEL OF NUCLEAR POWER PLANTS

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FOREWORD

Safety of public, occupational workers and the protection of environment should be assured while activities for economic and social progress are pursued. These activities include the establishment and utilisation of nuclear facilities and the use of radioactive sources. They have to be carried out in accordance with relevant provisions of the Atomic Energy Act 1962 (33 of 1962).

Assuring high safety standards has been of prime importance since the inception of the nuclear power programme in the country. Recognising this aspect, the Government of India constituted the Atomic Energy Regulatory Board (AERB) in November 1983 vide standing order No. 4772 notified in the Gazette of India dated December 31, 1983. The Board has been entrusted with the responsibility to lay down safety standards and to frame rules and regulations in respect of regulatory and safety functions envisaged under the Atomic Energy Act of 1962. Under its programme of developing safety codes and guides, AERB has issued four codes of practice covering the following topics:

Safety in Nuclear Power Plant Siting

Safety in Nuclear Power Plant Design

Safety in Nuclear Power Plant Operation

Quality Assurance for Safety in Nuclear Power Plants

Safety guides are issued to describe and make available methods to implement specific parts of the relevant codes of practice as acceptable to AERB. Methods and solutions other than those set out in the guides may be acceptable if they provide at least comparable assurance that the nuclear power plants can be operated without undue risk to the health and safety of the plant personnel, general public and environment.

The codes and safety guides may be revised as and when necessary in the light of experience as well as relevant developments in the field. The annexure, footnotes, bibliography are not considered an integral part of the document but included to provide information that might be of help to the user.

The emphasis in the codes and guides is on protection of site personnel and public from undue radiological hazard. However, for aspects not covered in the codes and guides, applicable and acceptable national and international codes and standards shall be followed. Industrial safety shall be assured through good engineering

practices and compliance with the Factories Act 1948 as amended in 1987 and the Atomic Energy (Factories) Rules, 1996.

This safety guide provides guidance on the aspects of staffing, recruitment, training, qualification and certification of operating personnel of nuclear power plants.

The Safety Guide has been prepared by the staff of AERB and other professionals. In drafting this guide, they have used extensively the relevant documents of the International Atomic Energy Agency (IAEA) developed under the Nuclear Safety Standards(NUSS) programme, specially the IAEA Safety Guide on Staffing of Nuclear Power Plants and Recruitment, Training and Authorisation of Operating Personnel (50-SG-01, Rev.1).

Experts have reviewed the guide and AERB Advisory Committees have vetted it before issue. AERB wishes to thank all individuals and organisations who reviewed the draft and finalised the guide. The list of persons, who have participated in the committee meetings, along with their affiliations is included for information.

(P.Rama Rao)
Chairman, AERB

DEFINITIONS

Acceptable Limits

Limits acceptable to the Regulatory Body.

Accident Conditions[1]

Substantial deviations from Operational States which could lead to release of unacceptable quantities of radioactive materials. They are more severe than anticipated operational occurrences and include Design Basis Accidents and severe accidents.

Anticipated Operational Occurrences[2]

All operational processes deviating from normal operation which may occur during the operating life of the plant and which, in view of appropriate design provisions, neither cause any significant damage to Items Important to Safety nor lead to Accident Conditions.

Approval

A formal consent issued by the Regulatory Body to a proposal.

Atomic Energy Regulatory Board (AERB)

An authority designated by the Government of India to enforce the rules promulgated under the relevant sections of the Atomic Energy Act 1962, for the control of radioactive substances (section 16), special provisions to safety (section 17) and administration of the Factories Act 1948 (section 23).

Audit[3]

A documented activity performed to determine by investigation, examination and evaluation of objective evidence the adequacy of, and adherence to, codes, standards, specifications, established procedures, instructions, administrative or operational programmes and other applicable documents and the effectiveness of their implementation.

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1 Substantial deviation may be a major fuel failure, a Loss of Coolant Accident (LOCA) etc. Examples of Engineered Safety Features are: an Emergency ˜Core Cooling System (ECCS), and containment.

2 Examples of Anticipated Operational Occurrences are loss of normal electric power and faults such as turbine trip, malfunction of individual items of control equipment, loss of power to main coolant pump.

3 The definitions refer to Quality Assurance activity as discussed in Quality Assurance code and guides.

Authorisation

See ' Regulatory Consent'.

Commencement of Operation[4]

The specific activity/activities in the commissioning phase of a Nuclear Power Plant towards first approach to criticality.

Commissioning[5]

The process during which structures, systems and components of a facility, having been constructed, are made operational and verified to be in accordance with design specifications and to have met the performance criteria.

Competent Authority

An officer or authority appointed or approved by the Government by notification for the purposes of the rules promulgated under the Atomic Energy Act 1962.

Construction[5]

The process of manufacturing, testing and assembling the components of a facility, the erection of civil works and structures and the installation of components and equipment.

Decommissioning[5]

The process by which a facility is finally taken out of operation in a manner that provides adequate protection to the health and safety of the workers, the public and of the environment.

Documentation[3]

Recorded or pictorial information describing, defining, specifying, reporting or certifying activities, requirements, procedures and results.

Emergency Situation

A situation which endangers or is likely to endanger safety of the NPP, site personnel or the environment and the public.

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4 e.g. Fuel loading in case of Light Water Reactors and in case of Pressurised Heavy Water Reactors, heavy water addition with fuel already loaded.

5 The terms Siting, Construction, Commissioning, Operation and Decommissioning are used to delineate the five major stages of the authorisation process. Several of the stages may coexist; e.g. construction and commissioning, or commissioning and operation.

Examination[3]

An element of Inspection consisting of investigation of materials, components, supplies or services, to determine conformance with those specified requirements which can be determined by such investigation.

Inspection[3]

Quality Control actions which, by means of examination, observation or measurement, determine the conformance of materials, parts, components, systems, structures as well as processes and procedures with pre-determined quality requirements.

Items Important to Safety

The items which comprise:

(1) those structures, systems, equipment and components whose malfunction or failure could lead to undue radiological consequences at Plant or outside the Plant;[6]

(2) those structures, systems and components which prevent Anticipated Operational Occurrences from leading to Accident Conditions;

(3) those features which are provided to mitigate the consequences of malfunction or failure of structures, systems or components.

License

It is a type of regulatory consent, granted by the Regulatory Body for all sources, practices and uses for nuclear facilities involving the nuclear fuel cycle and certain categories of radiation facilities.

Licensed Person

A person who has been licensed to hold certain Licensed Position of a NPP after due authorised procedure of certification by the AERB.

Licensed Position

A position, which can be held only by persons Certified by AERB or a body designated by it. e.g. Shift Charge Engineer, Assistant Shift Charge Engineer, Control Engineer, Assistant Shift Charge Engineer (Fuel Handling Unit) and Control Engineer (Fuel Handling Unit).

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6 This includes successive barriers set up against the release of radioactivity from nuclear facilities.

Normal Operation

Operation of a Plant or equipment within specified operational limits and conditions. In case of nuclear power plant this includes, start-up, power operation, shutting down, shutdown state, maintenance, testing and refuelling.

Nuclear Power Plant

A thermal neutron reactor or reactors together with all structures, systems and components necessary for safety and for the production of power, i.e., electricity.

Nuclear Safety

Protection of all persons from undue radiological hazards.

Objective Evidence

Term used in context of Quality Assurance, qualitative or quantitative information, record or statement of fact, pertaining to quality of an item or service, which is based on observation, measurement or test and which can be verified.

Operating Organisation[7]

The organisation so designated by responsible organisation and authorised by Regulatory Body to operate the facility.

Operating Personnel

Those members of Site Personnel who are involved in the operation of the NPP.

Operation[5]

All activities following commissioning and before decommissioning performed to achieve in a safe manner the purpose for which an installation was constructed, including maintenance.

Operational Limits and Conditions (OLC)

(See also technical specification)

Limits on plant parameters and a set of rules on the functional capability and the performance level of equipment and personnel, approved by the Regulatory Body, for the safe operation of the facility.

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7 Organisation structure and not individual names.

Operational Records

Documents such as instrument charts, certificates, log books, computer print outs and magnetic tapes, made to keep objective history of the NPP operation.

Operational States

The states defined under Normal Operation and Anticipated Operational Occurrences.

Plant Management

The members of Site Personnel who have been officially delegated responsibility and authority by the Operating Organisation for directing the operation of the plant.

Prescribed Limits

Limits established or accepted by the Regulatory Body for specific activities or circumstances that must not be exceeded.

Qualified Person

A person who having complied with specific requirement and met certain conditions, has been officially designated to discharge specific duties and responsibilities. [For example, Reactor Physicist, Station Chemist, and Maintenance Person of a Nuclear Power Plant are qualified persons]

Quality Assurance

Planned and systematic actions necessary to provide adequate confidence that an item or facility will perform satisfactorily in service as per design specifications.

Records

Documents which furnish objective evidence of the quality of items and activities affecting quality. It also includes logging of events and other measurements.

Regulatory Body

See 'Atomic Energy Regulatory Board' (AERB).

Regulatory Consent

It is a written permission issued by the Regulatory Body to perform the specified activities related to the facility. The types of consent are 'Licence', 'Authorisation', 'Registration', and 'Approval', and will apply depending upon the category of the facility, the particular activity and radiation sources involved.

Reliability

It is the probability that a structure, system, component or facility will perform its intended (specified) function satisfactorily for a specified period under specified conditions.

Responsible Organisation[8]

The organisation having overall responsibility for siting, design, construction, commissioning, operation and decommissioning of a facility.

Safety

See 'Nuclear Safety'.

Safety Limits

Limits upon process variables within which the operation of the facility has been shown to be safe.

Safety Report

A document provided by the applicant or licensee to the Regulatory Body containing information concerning the facility, its design, accident analysis and provisions to minimise the risk to the public and to the site personnel.

Safety Critical Systems (Safety Systems)

Systems important to safety, provided to assure, under anticipated operational occurrences and accident conditions, the safe shutdown of the reactor (Shutdown System) and the heat removal from the core (Emergency Core Cooling System), and containment of any released reactivity (Containment Isolation System).

Severe Accidents

Nuclear Power Plant conditions beyond those of the Design Basis Accidents causing significant core degradation.

Site

The area containing the facility defined by a boundary and under effective control of facility management.

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8 In the present context the Nuclear Power Corporation of India Limited (NPCIL) is the Responsible Organisation for Nuclear Power Plants in India.

Site Personnel

All persons working on the site, either permanently or temporarily.

Siting

The process of selecting a suitable site for a facility including appropriate assessment and definition of the related design bases.

Specification

A written statement of requirements to be satisfied by a product, a service, a material or process indicating the procedure by means of which it may be determined whether specified requirements are satisfied.

Surveillance[9]

All planned activities namely monitoring, verifying, checking including in-service inspection, functional testing, calibration and performance testing performed to ensure compliance with specifications established in a facility.

Technical Specifications for Operation

A document submitted on behalf of or by the responsible organisation covering operational limits and conditions, surveillance and administrative control requirements for the safe operation of the facility and approved by Regulatory Body.

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9. This includes activities performed to assure that provisions made in the design for safe operation of the NPP continue to exist during the life of the plant.

CONTENTS

ANNEXURES

1. INTRODUCTION

1.1 General

1.1.1 This Safety Guide has been prepared as part of the Atomic Energy Regulatory Board's (AERB) Programme for establishing Codes of Practice and Safety Guides relating to Nuclear Power Plants (NPPs). It supplements the Code of Practice on Safety in Operation of NPPs (AERB/SC/O). The provisional list of Safety Guides on Operation is given at the end of this publication.

1.1.2 Safe operation of nuclear power plants requires a clearly defined organisational structure for the Plant Management. Essential features of staffing of the organisational structure shall be competent managers and personnel carefully selected and trained, qualified and authorised as applicable.

The above managers and personnel should have proper awareness of the technical and administrative requirements for safety and the motivation to adopt a positive attitude for developing and maintaining adequate mental alertness in day-to-day activities. This should go beyond mere implementation of the best and accurate procedure and provisions.

1.1.3 There must be a pervasive safety commitment on the part of those concerned with operation, maintenance, training and all related activities. Comprehensive safety approach is a key element in safety culture.

1.2 Objectives

1.2.1 The main objectives of this Safety Guide are as follows:

(i) To focus on the need for ensuring a carefully planned organisational structure of plant management to cater to efficient performance of the various functions for safe operation of the plant.

(ii) To highlight the different factors to be considered in staffing the organisational structure to ensure sufficient number of personnel well qualified with skill and expertise for the complex and highly technical requirements of plant operation.

(iii) To provide guidelines on the selection of personnel during recruitment as well as subsequent training, qualifications and authorising to promote a well equipped and competent team for plant operation.

1.3 Scope

1.3.1 This safety guide briefly covers, in particular, those functions that are generally performed by the distinct groups of site personnel under the authority of Plant Management.

1.3.2 It includes the detailed requirements of educational qualification, experience for various members of Plant Management and initial as well as continuing training programmes, qualifying tests and authorisation procedures for persons whose duties have an immediate bearing on safety of the plant personnel and the public.

1.3.3 It also provides guidelines in respect of various categories of operating personnel such as professionals, operators, maintainers, technicians and tradesmen for their training to equip them with general as well as specific knowledge and skills to discharge their duties for all operational states and accident conditions of the plant.

2. STAFFING OF PLANT MANAGEMENT

2.1 General

2.1.1 The site organisation i.e. the Plant Management (see Annexure-II) has the immediate responsibility to meet the requirements for the safe and reliable operation of the plant. The Station Director reports to the Executive Director, Operations (Operating Organisation).

2.1.2 The Plant Management shall identify the functions to be carried out at the site to meet the above stated objectives. The Operating Organisation should decide functions to be performed at site, off-site within operating organisation and off-site by agencies outside the operating organisation.

2.1.3 On the basis of these decisions and of all applicable regulatory requirements, the operating organisation shall establish an organisational plan for plant management indicating general policies, lines of responsibilities and authority, lines of communication and number of persons needed along with their qualifications. These should be documented in approved formats and maintained according to approved procedures.

2.1.4 The organisation plan shall be established well in advance (about 3 to 4 years) of the nuclear power plant commissioning and operation, since it is the basis for subsequent recruitment and training.

2.2 Bases of Organisation

2.2.1 Functions important for safe operation of NPP are performed both on-site and off-site. Typical on-site functions include personnel administration, procurement of materials or services, design of plant modifications and special technical support.

2.2.2 Functions performed off-site may have a bearing on safety and therefore programmes of specific training for such personnel involved shall be established along with quality assurance requirements.

2.2.3 The different approaches to problem solving adopted by operating organisations have a significant bearing on the size of the site organisation. The selected organisation structure should be described in detail in a document with clear emphasis on responsibilities, authority, interface and lines of communication.

2.2.4 The following considerations may influence the determination of the positions and the number of persons in the organisational structure:

(i) The number of persons in each shift shall be sufficient to deal safely at any time with all operational states and accident conditions, with consideration given to the possibility of keeping some persons on call and adequate relief duty and to the time needed for such persons to reach the site. The possibility of abnormal events occurring at odd hours shall be considered.

(ii) The shift crew personnel should be provided with facilities for training and re-training. The number of shift teams is generally subject to national and local regulations and agreements; however, off-shift time for continuing training purposes should also be provided.

(iii) The organisational structure shall be such as to permit the performance of the duties assigned to the site personnel in the emergency plan, with consideration given to the possibility of keeping some persons on-call and to the time needed for such persons to reach the site.

(iv) The location of the plant relative to the off-site support organisation shall be taken into account.

(v) The number of persons assigned for any given activity important to safety (e.g. instrument technicians) shall be determined allowing for absence due to continuing training, sickness, vacation etc., and the minimum requirements to meet the plant needs.

(vi) The expected turnover rate and time to recruit, train and qualify replacement personnel as well as staff requirements for expansion programmes.

(vii) The availability of obtaining off-site personnel for planned or unplanned replacement or reinforcement shall be considered (e.g. increased maintenance staff during annual or capital shutdown).

2.3 **Functions of Plant Management**

2.3.1 The following are the main functions of plant management:

(1) Operation

(2) Maintenance

(3) Technical support

(4) Quality assurance

(5) Training

(6) Industrial safety including fire safety

(7) Health physics

(8) Radioactive and other effluent management

(9) Physical protection

(10) Emergency response preparedness

(11) Personnel management

(12) Materials management

(13) Financial management (accounts)

2.3.2 The functions are categorised as :

(1) Direct operating functions

(2) Support functions

(3) Service functions

2.3.3 Direct Operating Functions

Those functions which affect the operational states of the plant (such as control room and field operations).

2.3.4 Support Functions

2.3.4.1 The supporting category includes the following functions:

i) Systems review, performance checks, analysis and modifications

ii) Health physics and radiological protection

iii) Fuel handling

iv) Mechanical maintenance

v) Electrical and instrument maintenance

vi) Quality assurance

vii) Reactor physics and fuel management

viii) Chemistry

ix) Planning and scheduling

x) Spent fuel storage

xi) Training

xii) Security

xiii) Industrial and fire safety

xiv) In-service inspection

xv) Waste and effluent management

xvi) Environmental radiological laboratory (ERL) (support function and independent of plant management)

xvii) Civil/services maintenance

xviii) Heavy water management and handling

xix) Interface with Regulatory Body, grid and state authorities

2.3.5 Service Functions

2.3.5.1 Service functions are those that cater to the requirements of site personnel (employees) and the establishment. Such functions include administration, accounts, transport, security, medical, etc.

2.4 Organisational Structure

2.4.1 When the various functions are divided into different divisions for ease of performance and organisational efficiency, an organisational structure results. The structure clearly assigns responsibility to various specific groups to perform the respective functions.

2.4.2 A typical organisational structure of plant management is given in Annexure-II.

2.5 Staffing

2.5.1 Staffing comprises details of personnel required to carry out the various functions in line with the organisational structure.

2.5.2 Typical Minimum Staffing

Typically the minimum number of operating personnel required in plant operation shift depends upon plant complexity, plant layout, degree of automation, and the number of auxiliary plants etc. The minimum staff required and available all the time for operating shift shall be prescribed in the Technical Specifications for the specific plant (see Annexure-IV).

2.5.3 Station Director

The Station Director of the plant has the overall responsibility for safe and reliable operation of the plant. In discharging this responsibility he is responsible for the overall coordination of technical support functions, whether performed by site personnel or off-site personnel or external organisations. He is also responsible for the qualification (including adequate initial and continuing training) of the operating personnel.

The Station Director is responsible for ensuring that the relevant requirements of both the operating organisation and the regulatory body are complied with. In addition he is involved in public information activities and in maintaining relationships with local authorities.

2.5.4 Operations

2.5.4.1 The function of operations is to ensure safe and reliable operation of the plant, in accordance with operational limits and conditions, established procedures and good practices.

It must be remembered that the operations personnel are of the 'direct operator' type, in the sense that their activity has a direct impact on the behaviour of the reactor and its associated systems and the consequences are immediate. This aspect shall be considered in the selection, training, continuing training and authorisation of personnel concerned.

The group consists essentially of shift teams. The number of shift teams shall be determined in accordance with local conditions. The structure of

each team varies according to the type of the plant, the number of units, the regulatory requirements and the provisions of the emergency plan.

Broadly speaking there are three levels: Head of Operations, Shift Charge Engineer and Control Engineers.

2.5.4.2 Operations Superintendent

The Operations Superintendent (head of operations) is responsible for the direct operation of the plant in accordance with the operational limits and conditions. He ensures compliance with the regulatory requirements such as the safety and radiation protection rules, QA manual and other instructions and procedures issued by the operating organisation to ensure safety. He is responsible for assessing the adequacy of training of the personnel in his group. He is also responsible for reporting to the persons responsible for training, any proposal for improvement or corrective actions.

2.5.4.3 Shift Charge Engineer

The Shift Charge Engineer is responsible for the supervision of his shift and for the direct operational control of the plant in accordance with operational limits and conditions and with authorised instructions and procedures set out in appropriate documents.

The shift charge engineer is responsible for the initial assessment of the nature and extent of any unusual occurrence, including any which might result in radioactive release, and subsequently for taking the first steps necessary to minimise the consequences, to ensure safety of personnel and to initiate the actions required by the emergency plan.

The shift charge engineer shall be capable of directing or assuming the duties of the Control Room Operator to ensure the safe operation of the plant if he considers such actions necessary.

He is also responsible for the authorisation within established instructions and procedures to remove from service or restore to service plant systems and/or components, and for the issue of the associated permits to carry out work or test on such items. In the absence of the shift engineer from the control room, the assistant shift engineer should be able to take over his duties and responsibilities.

2.5.4.4 Control Engineers

Under the authority of Shift Charge Engineer, Control Engineers are responsible for the manipulation of controls in the control room in accordance with relevant operating instructions and procedures. Other operators are responsible for the control of operational activities outside the control room under the general direction of the Control Engineers and in accordance with the relevant operating instructions and procedures.

2.5.4.5 Operators

The number of operators in each shift and their responsibilities should be determined on the basis of complexity of the plant and degree of automation.

2.5.5 Maintenance

The maintenance functions (for detailed guidance see Safety Guide AERB/ SG-O7) cover all activities related to maintenance, repair and modifications of the plant. They include:

(1) Preparing a preventive maintenance programme;

(2) Preparing maintenance procedures and instructions;

(3) Execution of maintenance work;

(4) Keeping records of and evaluating performance data of maintenance activities;

(5) Planning the work, and scheduling and requisitioning tools, materials and spare parts for the maintenance, repair and modifications of the plant.

The Head of Maintenance (Maintenance Superintendent) is responsible for ensuring that all maintenance activities are performed in accordance with operational limits and conditions, established procedures, and good practices. He is responsible for assessing the adequacy of training of personnel in his group and for reporting to those responsible for training, any proposal for improvement and corrective actions.

Maintenance is normally subdivided into subgroups such as fuel handling unit, mechanical, electrical, instruments and controls, maintenance preparation and planning. The heads of these subgroups are responsible to the Head of Maintenance.

2.5.6 Technical Support Functions

The structure provided to perform the technical support functions varies among different operating organisations. In some cases, each of these functions is covered by a separate and dedicated group while in other cases two or more functions are grouped. In what follows, each function is summarised separately.

2.5.6.1 Reactor Physics and Core Management

The reactor physics and core management functions involve actions necessary to ensure safe and economical use of the fuel in the reactor. This includes prediction and monitoring of the fuel and core components during the fuel cycle, the preparation of refueling programmes and plans and the performance of tests and experiments. Assistance to Operations during normal operation and abnormal occurrences is also included. For detailed guidance see Safety Guide AERB/SG/O-10.

2.5.6.2 Chemistry

The chemistry function provides necessary chemical and radiochemical assistance to ensure safe operation, the long term integrity of systems and components, as well as control and reduction of radiation levels in working areas. The function includes monitoring, analyses, instruction to operations about chemical processes and evaluation of results.

2.5.6.3 Radiation Protection

The aim of radiation protection function is to ensure implementation of the radiation protection programme, as described in Safety Guide AERB/ SG/O-5, and to advise the plant management on all related aspects. This requires

(a) assessment of radiological status in different plant areas, provision of appropriate personal monitoring devices, maintenance of appropriate radiological data records and monitoring the radiological aspects of work implementation for conformity with relevant requirements of the regulatory body.

(b) that the head of radiation protection function (Station Health Physicist) shall be empowered to interact directly with the Station Director.

2.5.6.4 Surveillance and Testing

Surveillance and testing covers all activities involved in in-service inspection, surveillance and testing contained in Safety Guides AERB/SG/ O-2 and AERB/SG/O-8, monitoring plant parameters and system status, checking and calibrating instruments, testing and inspecting structures, systems, components and evaluating the results of these actions.

2.5.6.5 Planning

Planning covers both long-term and day-to-day planning and co-ordination of the on-site operation and maintenance activities, and in particular those important for safety. Its aim is to achieve maximum availability of systems and components important for safety, especially during complex activities such as refuelling, general overhaul and significant plant modifications and plant outages.

2.5.6.6 Performance and Plant Engineering

The performance and plant engineering group ensures that all systems and components continue to meet design requirements for safe and reliable operation. It includes:

(i) monitoring performance;

(ii) identifying causes of poor performance;

(iii) analysis of root causes/repetitive problems and review of incidents;

(iv) recommending and designing modifications;

(v) assessing proposed modifications;

(vi) reviewing the operating experience of other plants to assess its applicability;

(vii) providing feedback of experience (see Safety Guide AERB/SG/O-9)

The performance and plant engineering staff are sometimes subdivided into groups with responsibilities for systems such as containment, shutdown, power control, heat removal, and emergency power supply etc.. Other systems such as electrical supply, electrical output and secondary cooling may be included.

2.5.6.7 Safety Analysis and Review

This group has the following functions:

(i) review and audit of safety related aspects of plant operation;

(ii) review of malfunctions, failures and precursors to assess their importance to safety and suggest measures for both correct adverse situations and improve safety;

(iii) review proposals for modification (see the Code AERB/SC/O) to ascertain that they promote safety;

(iv) review submissions to the regulatory body to ensure their consistency with safety policy of the operating organisation;

(v) suggest corrective actions and/or modifications;

(vi) reliability analysis/probabilistic safety assessment (PSA); and

(vii) ageing management

A Station Operations Review Committee (SORC) should be established at each nuclear power plant to monitor and review safety related aspects of the plant.

2.5.6.8 Emergency Preparedness

In order to cope with on-site and off-site emergency situations, an emergency plan is prepared and put in force. The operating organisation has many duties related to the implementation of such a plan (for details see Safety Guide AERB/SG/O-6), in particular to maintain and ensure the preparedness to intervene at any time.

The function of ensuring emergency preparedness need to be performed in accordance with approved on-site and off-site emergency preparedness plans. The staff strength and training requirement should be adequate for the above purpose.

2.5.6.9 Records Administration and Documentation

Administration and documentation of records ensures appropriate maintenance of documents that are relevant to the safe and reliable operation of the plant, including documents relating to design, commissioning, operational history of the plant, as well as general and specific procedures. Particular care shall be exercised to ensure that correct and up-to-date versions are available to the site personnel for day-

to-day activity. However, all versions of each document should be appropriately filed and preserved as reference. For detailed guidance see Safety Guides AERB/SG/QA-5 and IAEA-50-SG-QA2.

2.5.6.10 Industrial and Fire Safety

The fire safety function is designed to establish a fire protection programme based on defence in-depth approach which addresses to direct effects of flame, radiant heat and explosion and the potential for release of hazardous combustion products in the event of fire and the potential for release of water and other fire fighting media contaminated during fire fighting.

The industrial safety function is to advise and assist the plant management in the fulfillment of its obligations, statutory or otherwise, concerning prevention of personal injuries and maintaining a safe working environment.

2.5.7 Categories of Personnel

2.5.7.1 This Guide deals with those aspects of training and qualifications that are important for safe operation of nuclear power plants. It also includes the other qualification (managerial capabilities, financial, personnel management, etc.) that may be required to fully implement the functions of each position.

2.5.7.2 The following broad categories are involved: professionals, operators, technicians and tradesman.

2.5.7.3 Professionals

(i) This category includes personnel to fill the management positions such as station director, chief superintendent and the operational line down to control engineer. It shall also include the heads, and their senior assistants, of the supporting functions such as reactor physics, health physics, maintenance, technical services, industrial safety, and training. Persons in this category shall be graduates/diploma holders in engineering or science as applicable.

(ii) Persons in this category for certified positions such as station director, chief superintendent, technical services superintendent, operations superintendent, maintenance superintendent, training superintendent,

shift charge engineer, assistant shift charge engineer, shall be graduates in engineering. Other professionals such as health physicists, reactor physicist, chemists should be post-graduates in science with special training in respective fields. Industrial Safety Officer shall possess qualifications as laid down in Rule 43(5) of the Atomic Energy (Factories) Rules, 1996.

(iii) These persons shall have adequate practical experience in keeping with the duties and responsibilities to be assigned to them. For the senior operational, maintenance, QA and technical positions and for the senior reactor physics and health physics positions, it is essential that they have relevant experience in appropriate nuclear power plants. If persons with such experience are not available, staff members with suitable qualifications and experience may be recruited from industrial plants, design groups and nuclear research establishments and be given appropriate extensive training and practical experience in nuclear power plants.

2.5.7.4 Operators

This category includes persons who will carry out field duties, operations in reactor, fuel handling, turbine and service systems. He shall have minimum schooling of 12 years (higher secondary school certificate) or of 10 years (secondary school certificate) followed by Industrial Training Institute Certificate for courses of not less than 2 years duration, with specified experience.

2.5.7.5 Technicians

This category includes senior operators, instrument technicians, radiation control technicians, chemical laboratory technicians, mechanical, electrical and electronic technicians, and other such skilled/specialised personnel.

Such persons shall have schooling appropriate to what is required of them in the performance of their duties at a specific power plant, normally they shall have not less than ten years of formal schooling, or have the equivalent knowledge through experience and training. Recruits for the senior positions in this category shall have adequate experience.

2.5.7.6 Tradesman

This category includes welders, fitters, mechanics, electricians, machinists and other skilled craftsmen. Such persons shall have schooling and training appropriate to their skills. Recruits for the senior positions in this category should have adequate experience.

3. RECRUITMENT

3.1 General

Recruitment shall commence well before the commissioning of the nuclear power plant, to allow for adequate training and familiarisation with the plant. The decisions as to when each position or group of related positions is to be staffed is largely dependent on the training required and the duties which the individuals are required to carry out prior to being assigned responsibility for operation. In particular, the following factors should be taken into account:

(a) the time needed to train a person after his recruitment in order to gain the qualifications and experience required for his duties;

(b) the time taken for the training of any person who is involved in the training of other personnel;

(c) the training of any person in relation to supplier activities; for example, attachment to suppliers involved in pre-shipment testing or assembly of plant items; and

(d) the duties the person is required to perform prior to the date of initial fuel loading. Many of these duties may need to be performed several years before this date, and could include the following:

(i) assistance in the recruitment of other staff;

(ii) preparation of commissioning procedures;

(iii) pre-operational tests;

(iv) preparation of operating and maintenance manuals;

(v) preparation of radiological protection procedures;

(vi) specification and selection of equipment for chemical and health physics laboratories, maintenance and instrumentation shops, radiological protection, spare parts, stores and other supplies;

(vii) commissioning and operation of auxiliary systems;

(viii) preparation of in-service inspection programme; and

(ix) desirability of deploying recruited operation and maintenance personnel in participating in design, construction/ commissioning activity as appropriate.

3.2 Schedule of Recruitment and Training

The Operating Organisation should prepare a schedule showing how recruitment and training will be planned. The period covered by this schedule, in the case of the first plant, will be about 6 years. As additional plants are constructed and operated, this period may be reduced as experienced and qualified personnel would be available. The general features of this schedule for the first plant should be along the lines given in the following paragraphs.

3.3 Professionals

A few senior experienced professionals for management and specialists shall be recruited at the beginning of the recruitment period as a core group, since one of their first duties is to plan and carry out further recruitment and training. This group should increase in size with the ongoing training and other pre-operational activities. Recruitment of experienced professionals from other operating plants may also be considered. Industrial and fire safety professionals should be recruited before construction.

3.4 Senior Operators and Maintainers

Relatively early recruitment of operators and maintainers is advisable as some of their duties start before the commencement of commissioning and time will also be needed for training. The initial recruitment of these personnel may start about a year later than the recruitment of persons in the professional category, especially if operators and technicians with substantial previous experience are recruited. As junior staff are appointed, they shall be placed in training groups and be given pre-operational duties. The increase in personnel shall be brought about in steps so as to facilitate organised training.

An important aspect of training for some of these persons could be work performed with the construction organisation in the checking and initial calibration of instruments and controls and in initial operating of equipment prior to fuel loading. Some individuals may thus be located at the site well before the commencement of operation, and others may be sent to suppliers' plants to acquire experience with new and complex equipment.

3.5 Skilled Tradesmen

The initial recruitment of experienced and fresh tradesmen should also be sufficiently early as in the case of senior operators and maintainers. They may receive specialised training at suppliers' plants during the assembly and pre-shipment testing of special equipment, for example diesel or gas turbine sets or large pumps or fuel handling equipment. Personnel should continue to be recruited at a rate commensurate with the length of training they require, and also with the opportunities available to place them into the construction and commissioning work, to provide experience with installed equipment and systems.

3.6 Unskilled Workers

To ensure observance of safety measures properly, it is advisable to recruit only literates who can read and understand the instructions displayed in the plant.

3.7 Medical Examination

Each member of the operating personnel whose duties have an immediate bearing on safety should be examined at the time of recruitment and at appropriate times thereafter to ensure that he is medically fit to carry out duties and responsibilities assigned to him. The radiation protection manual should include detailed requirements of medical examination and its frequency should conform to the statutory requirements listed in the Atomic Energy (Factories) Rules, 1996.

The use of aptitudinal and psychological tests as appropriate to check the mental stability of staff to stand vigours of dynamic plant situations and their ability to handle plant controls with calmness and dexterity may be included.

4. TRAINING AND QUALIFICATION

4.1 General

4.1.1 The operating organisation is responsible for recruitment and training of staff and for the definition of qualifications and competence levels. Only qualified personnel shall be entrusted with functions important to safety. These functions, duties and responsibilities shall be clearly indicated.

4.1.2 It is a normal practice to recognise functional qualification levels of duties and responsibilities for different categories of personnel like professionals, operators, maintainers/tradesmen, etc. These levels are numbered I to V, I being the top level. See Annexure-II.

At each of these levels, it is important that an individual is appropriately qualified in terms of:

(i) basic educational level;

(ii) previous experience;

(iii) training and continuing training;

(iv) medical fitness, and

(v) qualification/authorisation as applicable.

4.1.3 The responsibility to ensure that individuals are appropriately qualified and remain so rests with the plant management. A formal authorisation issued by the Regulatory Body shall be required before a person is assigned to a designated position as described in Section 5.

4.1.4 For each of the positions in the operating organisation having importance to safety, a series of requirements for training and continuing training should be prepared. These requirements vary according to individual positions, level of responsibility, and specific levels of competence required and should be prepared by persons having specific competence in power plant operation and experience in training activities.

4.1.5 It is the responsibility of plant management, with reference to each position having importance to safety, to ensure that:

(i) appropriate qualification requirements are established and approved by the Regulatory Body as applicable;

(ii) training needs are analysed and an overall training programme developed;

(iii) proficiency of the trainee at various stages of the training is reviewed and verified;

(iv) effectiveness of the training is reviewed and verified;

(v) competence acquired is not lost after the final qualification; and

(vi) competence of the persons occupying each position is periodically reviewed and continuing training is provided on a regular basis.

4.2 Training System

4.2.1 A systematic approach is recommended for the analysis, design, development, implementation and evaluation of both initial and continuing training to ensure that all job competence requirements are established and achieved.

4.2.2 A separate initial and continuing training programme should be defined and implemented for each group. A job specific training and a qualification programme should be developed to provide and enhance the knowledge, skills and attitudes necessary for efficient performance of assigned tasks and functions under all conditions.

4.2.3 The training programme for most nuclear power plant positions should include on-the-job training to ensure that the trainees obtain the required job-related knowledge and skills in the actual work environment. Formal on-the-job training provides hands-on experience and allows the trainee to become familiar with plant routines. However, on-the-job training does not merely mean working in the job/position under the supervision of the qualified individual but also involves the use of learning objectives, qualification guidelines and trainee assessment. This training should be conducted and evaluated in the work environment by qualified, designated individuals.

4.2.4 A performance-based training programme based on an analysis of the responsibilities and tasks of a job should be designed, developed and implemented for each major station working group. The programme should include the following elements:

(i) identification of all tasks for each work group;

(ii) analysis of these tasks in terms of knowledge, skills and attitudes required to adequately perform the tasks;

(iii) written compilation of learning objectives;

(iv) definition of the basic educational and experience requirements and selection of trainees;

(v) specification and design of training programme;

(vi) development of training material and equipment;

(vii) planning, scheduling and holding of classroom, simulator, special workshop and on-the-job training in a structured manner;

(viii) verification of learning results; and

(ix) validation and improvement of the programmes.

4.2.5 The first step is to conduct job and task analysis or job competency analysis for safety related jobs/positions and then to identify the training needs. The analysis should identify the knowledge, skills and attitudes required and the results should be used to ensure that personnel are made competent to perform all anticipated tasks and to avoid incorrect operation. In addition to training in plant processes and systems, training in industrial safety, fire fighting, and first aid should be included. For some positions training in public relations should also be included.

4.2.6 In the development of a training programme, clear objectives should be compiled stating the anticipated performance, conditions and standards. Training activities and methods are specified below.

4.2.7 The following training methods are widely used:

(i) Classroom instruction is the most widely adopted training method. Its effectiveness is enhanced by the use of training media such as written material, transparencies, audio, video and computing devices and plant scale models and part task simulators.

(ii) On-the-job training should be conducted in accordance with prescribed guidelines by incumbents who have been trained to deliver this form of training. Progress should be monitored and assessment carried out by an independent assessor.

(iii) Initial and continuing simulator-based training for the control room

shift team personnel should be conducted on a simulator which is representative of the power plant control room and which has software of sufficient scope to cover normal operation, anticipated operational occurrences, and a range of accident conditions.

(iv) Laboratory/workshop training is needed to ensure safe working practices. Training mock-ups and models should be provided for activities that need to be carried out quickly and skillfully especially when such activities cannot be practised with actual equipment. Training mock-ups should be full-scale to the extent possible.

(v) Self-study training can be undertaken at home and at the work place. In all cases the trainees require support from a designated expert.

4.2.8 In general, the training shall consist of periods of formal training in the classroom intermixed with intervals of simulator or laboratory/workshop training as well as practical training in the plant.

4.2.9 Even if off-site training facilities are to be used, a training unit should still be included in the plant organisation. This unit should advise the plant management on questions related to training, co-ordinate training activities on site, ensure proper liaison with off-site training facilities and collect and maintain appropriate evidence as record of satisfactory completion of training and continuing training of individuals.

4.2.10 The existence of a full-time training staff does not relieve the plant line management from their responsibility to ensure that their staff are adequately trained and qualified. Each supervisor should recognise and provide for training needs of his subordinates. The responsibilities and authority of training personnel, as distinct from those of line management, should be clearly defined and understood.

4.2.11 Trainers in the on-site training unit should be properly trained, in particular on matters concerning the policies of the operating organisation, the safety and regulatory requirements and the quality assurance practices.

4.2.12 Training instructors should have sufficient technical knowledge in their assigned areas of responsibility. This means that they should be technically competent and have credibility with the students and other station personnel. In addition, the instructors should be familiar with the basics of adult educational skills. They should also be given sufficient time to maintain their technical and instructional competence through work experience by exposing them to on-the-job assignments and continuing training.

4.2.13 The progress of training shall be assessed and documented. Assessment of trainee performance includes written examinations, oral questioning and performance demonstrations.

4.2.14 A combination of written and oral techniques is most appropriate for demonstrating knowledge and performance. Assessment of simulator training should utilise prepared checklists to improve objectivity. Reassessment of individuals at regular intervals should be undertaken by instructors and their immediate supervisors.

4.2.15 The training programme and training facilities and material shall be periodically reviewed and modified if necessary. The review shall cover the adequacy and effectiveness of training, with due consideration given to the actual performance of persons in their jobs. It shall also examine training needs, training programmes and facilities, and the material necessary to deal with changes in regulations, changes in facility, and lessons from industry experience. Such a review should be undertaken by persons other than those directly responsible for training.

4.3 Training Programmes

4.3.1 General

4.3.1.1 All new employees starting work at nuclear power plants shall be introduced to their work environment in a systematic and consistent manner. General training programmes shall give the new employees a basic understanding of their responsibilities and of safe work practices.

4.3.1.2 The training programme for professionals, control room operators and senior technicians shall provide a thorough understanding of the basic principles of nuclear technology, nuclear safety and radiation protection, of the design intents and assumptions and of the theoretical basis of plant activities, together with the necessary on-the-job training. The programme for other operators, technicians and tradesmen should have a more practical orientation with explanations of the theoretical and safety related aspects.

4.3.1.3 All persons likely to be occupationally exposed to ionising radiations, shall receive suitable training in radiation risks and the technical and administrative means required to prevent undue exposure and implement the ALARA principle (see Safety Guide AERB/SG/O-5).

4.3.2 Training for Operations Personnel

4.3.2.1 Operators shall receive general employee training and overall operational training comparable to that given to those in the professional category.

4.3.2.2 Formal training of operators shall cover areas of technology to the levels necessary for the task to be performed. It shall develop a thorough theoretical and practical knowledge of plant systems, their function, layout, and operation. Participation in the pre-operational phase and plant startup provide a valuable opportunity for this training. Emphasis shall be placed on systems having safety significance. The training shall emphasise the importance of maintaining the plant within operating limits and conditions and the consequences of violation of these limits.

4.3.2.3 Control engineers should get extensive experience in plant diagnostics, control manipulations, team work and administrative tasks. Shift charge engineers should additionally be trained in supervisory techniques and communication skills. Their training should in general be more broadbased than that of other operators.

4.3.2.4 The training of control engineers should consist of classroom lectures and on-the-job training and simulator training. On-the-job training should be planned and controlled to ensure that necessary topics are completed during the training period. Simulator exercises should be structured and planned in detail to ensure adequate coverage of relevant topics. The exercises should include preliminary briefings and follow-up critiques.

4.3.2.5 Training at a representative full scope simulator facility is of paramount importance for operators who work in real-time situations with immediate consequences on the plant behaviour and who may be confronted with abnormal situations which have low probability of occurrence and which cannot therefore be enacted in real plant practice. Consideration shall be given to training control room staff as a unit to develop strength in interaction as members of a team.

4.3.2.6 Trainees shall learn routines for normal operation of the plant and the response of the plant to changes that could lead to abnormal situations if not counteracted. The programme shall improve the diagnostic skills of the trainees. Operating procedures for normal operation and anticipated operational occurrences as well as appropriate actions for design basis accidents and, as far as practicable, for severe accidents shall be included

in the programme and practised at the simulator, so that the trainees may recognise the consequences of errors and violations of procedures.

4.3.2.7 In addition to general employee training, field operators shall receive overall operational training commensurate with their duties and responsibilities. All personnel in this category shall have detailed knowledge of the operational features of the plant and hands-on experience. This knowledge should cover both the control room and the plant as a whole.

4.3.3 Training for Maintenance Personnel

4.3.3.1 Initial training of maintenance staff shall consist of knowledge about plant layout, the general features and purposes of plant systems, quality assurance, quality control, maintenance procedures, practices including surveillance, inspections, and special maintenance skills.

4.3.3.2 Training of maintenance staff shall emphasise the potential safety consequences of technical and procedural errors. Past experience of faults and hazards caused by such errors shall be reviewed.

4.3.3.3 Controls should be established to ensure that maintenance personnel are qualified on equipment to which they are assigned to work. This qualification could be based on training given by component manufacturer, training on equipment mock-ups and on-the -job training under the supervision of experienced staff. Maintenance personnel should have access to training mock-ups and models for training in maintenance activities that have to be carried out quickly and cannot be practised with actual equipment. Maintenance training may be undertaken anywhere, but its effectiveness remains the responsibility of the plant management. Evaluation of each individual's skills and knowledge in performing a given maintenance activity should normally precede his qualification.

4.3.4 Training for Technical Support Personnel

4.3.4.1 Personnel involved in chemistry, health physics, reactor physics, system performance review, or other functions should have qualifications and training appropriate to their jobs and responsibilities. Such training should be determined by a systematic approach as described above for operators and maintenance personnel.

4.3.4.2 Technicians may be assigned to carry out work on equipment similar to their own at other plants or with equipment suppliers. Emphasis shall be placed on the development of specific skills, with classroom training limited to essentials. In some cases, laboratories and part-scope simulators may have to be established to impart basic and specific skills.

4.3.4.3 Tradesmen shall receive general employee training and some overall plant training. The main objectives shall be to impart and develop the basic and specialised skills required for work on the installed equipment. Methods to achieve this objective could include attaching persons to suppliers of equipment and components and to construction groups. The basic skills could also be developed with the help of part-scope simulators as appropriate.

4.3.5 Training for Management Personnel

4.3.5.1 In addition to the training described above it is recognised that technicians and professionals may require additional technical knowledge and skills and also supervisory skills.

Managers should have mastered their own technical field through basic training and long experience in the nuclear field. They should have thorough understanding of relevant standards, rules and regulations. They should also have a good overall knowledge of the plant and its systems. Those occupying such positions should also be specially trained for duties in operational exigencies.

4.3.5.2 Since management personnel hold leading positions in plant organisation, it is important that they acquire skills for promoting among their subordinates, mainly by example, the conscious need to consider safety as a primary objective in all day-to-day activities.

4.3.5.3 There should be a management development programme to ensure that an adequate number of qualified persons are available to fill any management position, should a need suddenly arise. Training of managers and supervisors, and their potential successors, should include courses and seminars on management and supervisory skills.

4.3.6 Training for Emergency Management

4.3.6.1 General training shall be provided for all staff members who have

assignments under the emergency response preparedness plan. Supplementary training shall be provided to those staff members who perform specialised duties required in the event of an accident.

4.3.6.2 Training for accident response and management should be emphasised. Such topics as nuclear safety analysis, applicable codes, standards and regulations, information on evaluated safety margins of the plant, symptom-oriented procedures, and accident management measures should be covered. The principal results of any probabilistic safety assessment of the plant, showing the importance of plant systems in preventing damage or severe accidents, shall be covered by the training programme. Adequate understanding and familiarity with emergency preparedness manuals should be ensured by conducting drills at stipulated frequencies.

4.3.7 Continuing training

4.3.7.1 Continuing training is the training that is necessary to maintain and enhance the competence of nuclear power plant staff in terms of their knowledge, skills and attitudes. It can also include training to improve career development potential of selected individuals. Continuing training must therefore be regarded as an integral part of the operations of a nuclear power plant. Continuing training based on a systematic approach is essential to ensure that the levels of qualification and competence are maintained and upgraded when necessary.

4.3.7.2 Continuing training shall be carried out on a regular basis. An annual programme is recommended. Included in the programme should be all groups of personnel whose functions are important to the safe operation of a nuclear power plant.

All site personnel shall have continuing training in the performance of their duties in an emergency.

4.3.7.3 Persons likely to get occupationally exposed to ionizing radiations should receive periodic training and retraining in radiation protection.

4.3.7.4 Operators should undergo formal continuing training on a regular basis and the time needed for this should be taken into account when work schedules are established. Continuing training at a simulator facility is essential and simulator training exercises should be planned annually and systematically. Such exercises should reflect operating experience with emphasis on those

situations which do not occur frequently, for example startup, shutdown, special transients and accident conditions. In the case of maintenance group, refresher training should be given on infrequently performed maintenance activities.

4.3.8 Re-Training

4.3.8.1 Re-training shall be on a regular basis and is intended to maintain adequate competence, especially for those situations which do not occur frequently, as, for example, startup, shutdown, special transients, and accident conditions. The programme shall be reviewed periodically and re-training of individuals organised as required.

4.3.8.2 All site personnel shall be re-trained in the performance of their duties in an emergency.

4.3.9 Special Training

4.3.9.1 Persons manning certified positions, specially the control room operators, and fuelling machine operators should be trained in full scope plant simulators to give them confidence to handle normal operation as well as abnormal situations.

4.3.9.2 Personnel carrying out in-service inspection shall be trained and qualified in non-destructive testing techniques.

4.3.9.3 Maintenance personnel who have to work in radioactive inaccessible locations should be trained in mock-ups set up in a non-radioactive area.

4.3.10 Qualification

4.3.10.1 General

4.3.10.1.1 In addition to satisfactory completion of training programme and passing the qualifying examinations and other conditions laid down by the operating organization, the candidate should have a specified number of years of experience as a pre-requisite for getting a qualification at a specified level (e.g. L-I, L-II, L-III, L-IV). This permits the qualifying person to be officially designated to discharge specified duties and responsibilities (refer Annexure I and Section III.16.2 of Annexure III).

4.3.10.1.2 It is the responsibility of the operating organization to ensure the appropriate qualification of all members of site personnel (as well as off-site personnel) as applicable.

4.3.10.1.3 Some guidelines are given in the section on the qualification necessary for persons before assuming full duties and responsibilities for key positions. Although the qualifications indicated are in terms of years of experience, the total capabilities of a person may justify modifications to these figures. The period of experience given below are typical. Reference should be made to specific orders of competent authority (operating organization, Regulatory Body as applicable) for exact figures.

4.3.10.2 Professionals

4.3.10.2.1 The Station Director and Chief Superintendent should have about 10-15 years practical experience in positions of increasing responsibility, including operational experience at nuclear or conventional power plants, with a minimum of ten years at nuclear power plants.

4.3.10.2.2 The operations superintendent should have about 8-10 years of practical experience in positions of increasing responsibility, including operational experience at nuclear or conventional power plants, with a minimum of eight years at nuclear power plants.

4.3.10.2.3 Typically shift charge engineers should have about 4-6 years of practical experience. This shall include shift operational experience with nuclear or conventional power plants, of which a minimum of two years shall be at nuclear power plants. In addition, they should have obtained at least the qualification equivalent to control engineer.

4.3.10.2.4 The maintenance superintendent, technical superintendent and training officer should have about 8-10 years of practical experience in power plant with minimum two years operational experience in nuclear power plants. In addition, they should have obtained at least the qualifications equivalent to control engineer.

4.3.10.3 Operators

4.3.10.3.1 The senior members of this category should have about 4-6 years of practical experience. This shall include shift operational experience with

nuclear or conventional power plants, one year of which should be at nuclear power plants. The other operators shall have experience appropriate to their duties and responsibilities.

4.3.10.4 Technicians

4.3.10.4.1 The leading members of this category should have about 2-3 years of practical experience. The other technicians/tradesmen should have experience appropriate to their duties and responsibilities.

5. CERTIFICATION/QUALIFICATION

5.1 General

5.1.1 The operating organization of a nuclear power plant has to perform its functions for safe and reliable operation at a minimal risk to plant, plant personnel and the general public. The operating organization would be a multi-discipline and a multi-tier unit of well-trained personnel which includes the management. It shall establish procedures, norms and practices to ensure high quality of work execution in an orderly manner. All plant personnel should be trained, qualified and certified to achieve the quality of operational activities.

5.1.2 Certain functions require a rapid response. An erroneous response may lead to a major problem with its attendant consequences. Perhaps, there would also be no time to verify a response plan. The correctness of response would thus depend on the individual's perception, attentiveness and activeness.

To ensure a correct response:

(a) key positions involving such functions shall be designated as certified positions and persons meeting such requirements only should be allowed to perform such functions; and

(b) Each of them shall be covered by a retraining programme, minimum once in three years, to maintain proficiency in coping with anticipated operational occurrences and accident conditions and to minimize human errors and should then be recertified for the positions.

5.1.3 The operating organization shall have well established procedures for qualification and certification of all station personnel. The certification procedures for persons holding such positions shall be to the satisfaction of the Regulatory Body.

5.1.4 The certification of persons for the key certified positions will be done by the Regulatory Body or by a body approved by the Regulatory Body.

5.1.5 Adequate number of personnel required for normal operation should be certified for these certified positions before commencement of operation. These positions must be manned by certified personnel only.

5.1.6 Work on safety systems or safety related systems in the plant which has commenced operation should be carried out only after a written authorisation by a certified person.

5.2 Positions to be certified/licensed

5.2.1 The following positions shall be designated as certified positions:

(i) Control Engineer (main plant), CE(M) - who operates and controls main plant including the reactor.

(ii) Control Engineer (Fuel Handling), CE(FH) - who controls the refuelling operations.

(iii) Assistant Shift Charge Engineer (main plant) ASCE(M) - who assists Shift Charge Engineer to supervise and direct operations of the main plant.

(iv) Assistant Shift Charge Engineer (Fuel Handling), ASCE(FH) - who assists Shift Charge Engineer to supervise and direct operation of refuelling and fuel transfer;

(v) Shift Charge Engineer (SCE) - who takes charge of plant operation and supervises and directs all the operation activities in shift; and

(vi) Senior management positions i.e.

(a) Station Director (SD),

(b) Chief Superintendent (CS),

(c) Operations Superintendent (OS),

(d) Maintenance Superintendent (MS),

(e) Technical Services Superintendent (TSS), and

(f) Training Superintendent (TS)

5.2.2 The certified positions shall be manned by licensed/management qualified persons. Persons in certified positions Nos. (i) to (v) above shall hold a license to this effect and in Nos. (vi)a to (vi)f (inclusive) shall have appropriate qualifications. These certified positions are shown in a typical organization chart (Annexure-II).

5.2.3 The operating organisation has the responsibility to establish qualification requirements and procedures for all other operations and maintenance

personnel not covered above and also for contractor personnel who perform activities important to safety. Necessary assurance in this regard should be established before the contractor personnel are actively involved in safety-related activities.

5.2.4 Operating organisation should also ensure that health physics section of NPP is manned by persons duly qualified according to approved procedures.

5.3 Basis for Certification/Qualification

5.3.1 Certification procedure in the case of persons mentioned in para 5.2.1 shall be based on careful evaluation of individual's knowledge and capabilities as stated in 5.4 below, after considering his experience, education, training, and personal attributes. In the final evaluation process, a representative of the Regulatory Body should also be present and get satisfied before a person is certified.

5.3.2 Similarly plant organisation should qualify other plant personnel (wherever necessary) to meet other statutory requirements, skills and knowledge requirements to ensure quality of workmanship.

5.3.3 The operating organisation shall maintain all records pertaining to each licensed and qualified person regarding his experience, training, field skills, demonstration/simulation demonstration, and qualification/ certification for a stipulated period (ten years after a person ceased to be at particular position). These past records would be useful for certification/ qualification of a person.

5.4 Personnel Assessment

The personnel assessment for certification/licensing as well as qualification shall cover the following aspects:

(1) General Nuclear Plant Technology

(2) Specific plant knowledge

(3) Specific plant job skills and job capability

5.4.1 General Nuclear Plant Technology

5.4.1.1 The person would be tested for the overall principles and practices of nuclear plant operation as well as necessary technological fundamentals in the following broad areas:

(i) Reactor and its systems,

(ii) Conventional systems,

(iii) Nuclear safety and reactor protection,

(iv) Radiological protection, and

(vi) Power plant controls and dynamics.

5.4.1.2 The topics included in the above areas are outlined in sub-Section 4.3 and assessment conducted by the use of question paper examination or an interview.

5.4.2 Specific Plant Knowledge

5.4.2.1 The specific plant knowledge shall be assessed in detail for a particular plant with emphasis on safety aspects. These tests should include plant instructions and procedures, as applicable. The testing may be carried out by question papers on specific features of the plant.

5.4.2.2 The examinations should cover all relevant areas/systems for the position for which a person is being certified/qualified. However, these papers may be sub-grouped according to plant training plan so that skills and knowledge are acquired simultaneously as far as possible.

5.4.3 Specific plant job skill and capability

Specific plant job skills and capability would be assessed as follows:

5.4.3.1 On-the-job feedbacks and walk through including possible demonstration for all areas of relevance.

5.4.3.2 In addition demonstration on mock-ups or on plant simulators. (These job skills feedback/walk through may be sub-grouped according to 5.4.2.2).

5.5 Recertification/Requalification

The plant management shall have recertification/relicensing/ requalification programmes to maintain proficiency of the person for the respective position.

5.5.1 Recertification/relicensing of persons for certified positions shall be carried out once in three years by the Regulatory Body or by a body designated by it and would be similar to Sec. 5.1.4 to meet intent of secs. 5.1.1 & 5.1.2 covering topics given in Sec. 5.5.2.

5.5.2 Licensed persons as mentioned in 5.2.1 for positions (i) to (iv) should be reassessed to check capability for mitigating anticipated operational occurrences and design basis accident conditions. They should be checked for the knowledge of plant modifications, lessons learnt, good practices adopted and feedbacks received from incidents in-house as well as other NPPs.

5.5.3 Similar procedure shall be followed for licensing of a person who is absent from a certified position for more than a year.

5.5.4 In case a licensed person is absent from a certified position continuously for more than three months, the plant management shall assure itself of the adequacy of responses of the person to anticipated operational occurrences and design basis accidental conditions before allowing such person to resume the certified position. However, person absent from the position for more than one year shall be relicensed.

5.5.5 A licensed certified person from another similar plant shall undergo a familiarization course covering the differences between the two units of NPPs, get acquainted with site layout and equipment location, and be relicensed/requalified before he is allowed to assume certified position in the plant.

5.5.6 The operating organization shall prepare requalification procedures for others in the plant management and staff to ensure the capability of plant personnel.

6. RECORDS

6.1 The operating organization shall maintain adequate records of individual training plans, of the performance of the individual trainees and of the authorizations issued.

6.2 The main purpose of these records is:

(1) to provide evidence to the Regulatory Body of the qualifications of all persons whose duties have a bearing on safety and of the authorizations, when so required; and

(2) to provide information necessary for reviews of the training programme and for corrective actions if necessary.

6.3 The records shall be collected and kept in accordance with the applicable quality assurance requirements (refer section 9 of Safety Guide AERB/SG/ QA-5 on "QA During Commissioning and Operation of NPPs).

ANNEXURE-IA

TYPICAL SCHEDULE OF WRITTEN EXAMINATIONS AND SPECIFIC STIPULATIONS FOR EACH POSITION (FOR PHWRS)

IA.1 Shift Charge Engineer (SCE)/LEVEL-I

The candidate must have passed all the examinations prescribed for ASCE position and worked for a minimum period of two years as licensed Assistant Shift Charge Engineer (main plant) with a supplementary qualification in fuel handling operations. Those who secured ASCE license after working as a Licensed CE (F) or ASCE (F) do not require the latter supplementary FHS qualification.

He should have been exposed to the following courses.

Courses for Level-I Licence:

Sr.No.	**Topics**
(i)	Administration and Accounts Procedures.
(ii)	General Management Course.
(iii)	Operation Management Course.
(iv)	Fuel Handling System Operation (Retraining) (Sl.No.(iv) not required for those originally qualified as ASCE(F) and sponsored for SCE position). He shall be checked by the NPC members on the licensing committee in his final assessment interview on the above orientation besides other areas.

IA.2 Assistant Shift Charge Engineer (ASCE)

IA.2.1 The candidate should have completed all the examinations prescribed for Control Engineers (main plant) and secured either a supplementary qualification in FHS operation or a CE(F) licence. He should have worked for a minimum period of two years as a Control Engineer at a NPP as applicable. Candidates coming from Fuel Handling operation positions as ASCE(F)/CE(F), must have at least cleared all checklists for and function under supervision as CE, for main plant systems for one year in the preceding five years. Candidates who function as CE(Main Plant) shall

have minimum one year experience on fuel handling operations under the guidance of CE(F). They may obtain the supplementary operations in FHS operations by clearing all Level-III FHS checklists, demonstrating competence in refuelling operations under guidance for at least two channels and a final certification by the NPC Final Assessment Committee.

IA.2.2 The candidates are required to pass the written examinations on the following papers before appearing for licensing interview for acquiring the position of Assistant Shift Charge Engineer.

IA.2.3 In case of new stations where it has become necessary to induct professional engineers with long experience of four years and above in thermal power plants and chemical industries they should have been subjected to Level A checklists, hands-on experience of at least one year in any NPP of similar type and their cases shall be specifically got cleared by Regulatory Body.

Written Examinations for Level-II (ASCE) Licence

Paper Nos. (II indicates level)	**Title of the Paper**
Paper - II-1	Nuclear System (Abnormal Operation and Incidents)
Paper - II-2A	Turbine Generator Systems (Abnormal Operation and Incidents)
Paper - II-3	Instrumentation and Control System (Abnormal Operation and Incidents)
Paper - II-4	Plant Electrical Systems and Grid Systems (Abnormal Operation and Incidents)
Paper - II-5	Station operation
Paper - II-6	Radiation Protection (advanced)

IA.2.4 In case of new stations, during the initial start up the candidate should have at least completed all the level A system field checklists, passed in walk-through tests and final interviews, besides participation in commissioning activities and passing of the above licensing examinations.

IA.2.5 Assistant Shift Charge Engineer (Fuel) [ASCE(F)] (Level-II)

IA.2.5.1 The candidate should have passed all the examinations prescribed for Control Engineer (Fuel) and worked for two years minimum as a Control Engineer (Fuel). He should have additionally cleared all Level A nuclear systems checklists.

IA.2.5.2 In addition the candidate should pass the following papers for acquiring the position of Assistant Shift Charge Engineer (Fuel).

IA.2.5.3 In case of new stations, during the initial start up the candidate should have at least completed the Level-A system field checklists passed, in walk-through tests and final interviews, besides participation in commissioning activities.

IA.2.5.4 The candidature of direct recruits has to be cleared by the Regulatory Body in case of I 2.3.

Written Examinations for Level-II [ASCE(F)] Licence

Paper Nos. (II indicates level)	**Title of the Paper**
Paper - II-1	Nuclear System (Abnormal Operation and Incidents)
Paper - II-2B	Fuel Handling Systems (Abnormal Operation and Incidents)
Paper - II-3	Instrumentation and Control System (Abnormal Operation and Incidents)
Paper - II-4	Plant Electrical Systems and Grid Systems (Abnormal Operation and Incidents)
Paper - II-5	Station operation
Paper - II-6	Radiation Protection (advanced)

IA.3 Control Engineer (CE) of Main Plant (Level-III)

IA.3.1 The candidate should have completed the year initial training or equivalent training as applicable to engineers and have acquired RPT Green

qualification. In addition, he must have completed at Level A main plant system field checklists and other prerequisites as mentioned before.

IA.3.2 For acquiring the position of Control Engineer, he shall pass the following examinations and walk-through and licensing interviews.

Written Examinations for Level-III (CE) Licence

Paper Nos. (III indicates level)	**Title of the Paper**
Paper - III - 1	Moderator and Auxiliaries (Normal and Abnormal Operation)
Paper - III - 2	Primary Heat Transport and Auxiliaries, Boiler Steam and Water System (Normal and Abnormal Operation)
Paper - III - 3	Reactor Structure and Reactor Auxiliaries, Reactivity Mechanisms (Normal and Abnormal Operation)
Paper - III - 4A	Turbine Generator and Auxiliaries (Normal and Abnormal Operation)
Paper - III - 5A	Electrical System (Normal and Abnormal Operation)
Paper - III - 6A	Control System (Normal and Abnormal Operation)
Paper - III - 7	Fuel Handling System (Normal and Abnormal Operation)
Paper - III - 8	Common Processes and Services (Normal and Abnormal Operation)
Paper - III - 9	Station Operation and Technical Specification, Operational Physics and Chemistry (Normal and Abnormal Operation)
Paper - III - 10	Radiation Protection and Emergency Procedures and Access Control

IA.4 Control Engineer (Fuel) [CE(F)] (Level-III)

IA.4.1 The candidate should have completed the one year initial training as applicable to engineers and have acquired RPT Green qualification. In addition, he must have completed Level A system field checklists nuclear systems and fuel handling.

IA.4.2 For acquiring the position for Control Engineer (Fuel), he shall pass the following examinations and walk-through and licensing interviews.

Written Examinations for Level-III [CE(F)] Licence

Paper Nos. (III indicates level)	**Title of the Paper**
Paper - III - 1	Moderator & Auxiliaries (Normal and Abnormal Operation)
Paper - III - 2	Primary Heat Transport and Auxiliaries, Boiler Steam and Water System (Normal and Abnormal Operation)
Paper - III - 3	Reactor Structure and Reactor Auxiliaries, Reactivity Mechanisms (Normal and Abnormal Operation)
Paper - III - 4B	Fuel Engineering and Fuel Management
Paper - III - 5B	Fuel Handling Mechanical and Control Equipment (Normal and Abnormal Operation)
Paper - III - 6B	Fuel Transfer System Operation and Control (Normal and Abnormal Operation)
Paper - III - 7	Fuel Handling System (Normal and Abnormal Operation)
Paper - III - 8	Common Processes and Services (Normal and Abnormal Operation)
Paper - III - 9	Station Operation and Technical Specification, Operational Physics and Chemistry (Normal and Abnormal Operation)
Paper - III - 10	Radiation Protection and Emergency Procedures and Access Control

IA.5 First Operator (FO)

IA.5.1 The candidate should have completed the stipendiary training as applicable to diploma Operators and worked for at least two-and-a-half years in main plant. He should have obtained RPT Green qualification, passed in D_2O handling, station protection code and completed applicable system field checklists at level B and satisfy other pre-requisites stipulated earlier.

IA.5.2 Higher Secondary passed or S.S.C. + ITI passed candidates should have completed initial training as applicable to them and worked for at least three years as a Secondary Operator. They should have obtained RPT Green qualification and system field checklists at level B.

IA.5.3 In case of new stations, during the initial start-up the candidate should have at least completed the Level-B system field checklists, passed in walk-through tests and final interviews, besides participation in commissioning activities.

IA.5.4 For acquiring the position for First Operator, they shall pass the following written examinations, the walk through and final assessment interviews.

Written Examinations for Level-IV (FO) Qualification

Paper Nos. (IV indicates level)	**Title of the Paper**
Paper - IV - 1	Moderator and Auxiliaries
Paper - IV - 2	Primary Heat Transport and Auxiliaries, Boiler Steam and Water System
Paper - IV - 3	Reactor Structure and Reactor Auxiliaries, Reactivity Mechanisms
Paper - IV - 4A	Turbine Generator and Auxiliaries
Paper - IV - 5A	Electrical System
Paper - IV - 6A	Physics and Chemical Control, Fuel handling Systems and Operations

Paper Nos. (IV indicates level)			Title of the Paper
Paper	-	IV - 7	Station Operation and Technical Specification requirements
Paper	-	IV - 8	Common Processes and Services
Paper	-	IV - 9	Radiation Protection and Emergency Procedures and Access Control
Paper	-	IV - 10	Station Control System

IA.6 First Operator (Fuel) [FO(F)]

IA.6.1 The candidate should have completed initial stipendiary training as applicable to diploma Operators and worked for at least two-and-a-half years in main plant.

IA.6.2 He should have obtained RPT Green qualification, passed in D_2O handling, station protection code and completed applicable system field checklists at level B and satisfy other pre-requisites stipulated earlier.

IA.6.3 In the case of new stations, during the initial start-up the candidate should have at least completed the Level-B system field checklists, passed in walk-through tests and final interviews, besides participation in commissioning activities.

IA.6.4 For acquiring the position for First Operator (Fuel), he should pass the following written examinations, the walk through and final assessment interviews.

Written Examinations for Level-IV [FO(F)] Qualification

Paper Nos. (IV indicates level)	**Title of the Paper**
Paper - IV - 1	Moderator and Auxiliaries
Paper - IV - 2	Primary Heat Transport and Auxiliaries, Boiler Steam and Water System
Paper - IV - 3	Reactor Structure and Reactor Auxiliaries, Reactivity Mechanisms
Paper - IV - 4B	Fuel Handling Equipment (Mechanical and Control)
Paper - IV - 5B	Fuel Transfer System Operation
Paper - IV - 6B	Fuel Handling Operation and Control/Refuelling Operation
Paper - IV - 7	Station Operation and Technical Specification requirements
Paper - IV - 8	Common Processes and Services
Paper - IV - 9	Radiation Protection and Emergency Procedures and Access Control

IA.7 Qualification Procedure for Second Operator (SO)

IA.7.1 He should pass the following written examination. Paper Nos. V-1 to V-7 are compulsory and of the remaining any one set is to be passed thus making a total of nine papers. He should have completed all level-C checklists on the above systems. (Importance has been given to Fuel Handling Systems and Electrical Systems and hence made compulsory). The choice of sets 1,2,3 for the level V qualification shall be such that the required number of qualified operators are available in each set so that shift operations can be ensured without any shortage in any discipline.

Written Examinations for Level-V (SO) Licence

Paper Nos. (V indicates level)			Title of the Papers
COMPULSORY	Paper -	V - 1	Elementary Radiation Protection
	Paper -	V - 2	Moderator and Auxiliaries
	Paper -	V - 3	PHT and Auxiliaries
	Paper -	V - 4	Station Electrical System
	Paper -	V - 5	Turbine Generator and Auxiliaries
	Paper -	V - 6	F/M and Local Control Console
	Paper -	V - 7	F/T System Auxiliaries
(Common Services)			
SET 1	Paper -	V - 8	Compressed Air and Chilled Water System
	Paper -	V - 9	Water Treatment and Fire Water
(Nuclear Auxiliaries)			
SET 2	Paper -	V - 10	Shield Cooling System, Ventilation and Waste Management
	Paper -	V- 11	Upgrading Plant and D_2O Recovery Dryers
(Secondary System and Auxiliaries)			
SET 3	Paper -	V - 12	Condensate and feed Water System
	Paper -	V - 13	Condensate and Cooling and Process 3 Water System

IA.8 Academic Qualification and Experience

The following requirements shall be complied with for qualifying the candidates to each of the positions/levels.

Sr. No.	Positions (Level)	Minimum Academic Qualification	Training/Station Qualification/Field Experience/Training
1.	SCE (Level-I)	B.E.	8 years minimum or equivalent including 2 years as a qualified ASCE in the same or the similar PHWR/LWR station in India.
2.	ASCE/ASCE(F) (Level-II) (to be merged in course of time)	B.E.	6 years minimum or equivalent including 2 years as a qualified CE or CE(F) in the same or similar plants and with the supplementary FHS or the Main Plant Qualification as stipulated.
3.	CE/CE(F) (Level-III)	(i) B.E.	4 years minimum or equivalent experience including training on Nuclear Systems, TG System, Electrical and Process Auxiliary System Operations and or Commissioning
			OR
		(ii) Diploma Holders in Engg.	10 years minimum experience as above including 3 years as a FO/FO(F)
4.	FO/FO(F) (Level-IV)	(i) Diploma Holders/ B.Sc.	4 years minimum including training in field operations in reactor, FHS, Turbine and Services systems commissioning and Control Room operations under CE's/CE(F)'s guidance as applicable.
5.	SO (Level-V) (Common for Main Plant and FHU) Operations.	H.S.C./S.S.C. (refer 4.5 for exceptional cases)	8 years minimum including training in identified areas of Main Plant, FH and Auxiliary Services

IA.9 Typical Qualification Requirements for Senior Management Positions:

IA.9.1 Persons occupying senior management positions in the Operating Stations must have atleast Level III Control Engineer's License, except in the case of Operations Superintendent, who must have a Level-I Shift Charge Engineer's License.

IA.9.2 For persons from non-operation discipline, their equivalent training and qualification in their disciplines would be such that they already possess qualification in plant systems, safety, quality assurance and related science fundamentals. These topics are not thus repeated in the management qualification written examination.

IA.9.3 The identified focus for Superintendent qualification is reactor safety and radiation safety, and those at such management positions are responsible for inculcating Safety Culture and for realising the defence-in-depth concept.

IA.9.4 Those who have secured Level III Control Engineer's licence for the concerned station, i.e. for the station the candidate is seeking Superintendent's qualification, any time in the past, will not be required to pass this test, but are required to acquire Level I position in any of the above O&M streams for the concerned station namely: operation, maintenance, technical, and training.

This means Level III and current licence holders must continue to be in O&M duties and qualification programs and in case they are diverted to non-O&M positions, they would need to pass the tests here as a pre-requisite for taking Superintendent positions.

IA.9.5 Similarly, Level III control engineers license holders continuing in operation discipline are exempted from writing these examinations, but must reach Level I Shift Charge Engineers position before they are considered for Superintendents positions, in general for the concerned station and in particular, for the Operation Superintendent position.

IA.9.6 A superintendent qualified for a PHWR Station in one of the two above manners can be re-qualified for another PHWR Station, if he passes the only one written examination paper besides the appropriate walk-through and final interview for the new position. This procedure is valid also for

those transferees who have satisfied in their previous station, the above requirements but were not put on the superintendent position for want of vacancies there.

IA.9.7 The superintendents qualified through the management qualification procedure do not need requalification as long as they are holding any of the approved Superintendents position in the same Station.

IA.9.8 Persons from non-operation disciplines should have three months field orientation in operations and pass in oral checks on control room operations checklist. They should pass the following Management Papers:-

Sr. No.	**Paper No.**	**Paper Title**
1.	MGT-1	Safety design overview
2.	MGT-2	Safety analysis overview
3.	MGT-3	Operational safety overview
4.	MGT-4	Root cause analysis of events and safety culture case studies (oral presentation and oral assessment by a specially appointed NPC committee)

Apart from the above, they should also pass the walk-through examination limited to control room operations conducted by a committee appointed by the Chief Superintendent concerned. The final assessment is done by the committee appointed by the Regulatory Body before the license is given.

ANNEXURE-IB

TYPICAL SCHEDULE OF WRITTEN EXAMINATIONS AND SPECIFIC STIPULATIONS FOR EACH POSITION (FOR BWRS)

IB.1 Shift Charge Engineer (SCE)/LEVEL-I

The candidate must have passed all the examinations prescribed for ASCE position and worked for a minimum period of two years as Licensed Assistant Shift Charge Engineer (main plant).

He should have been exposed to the following courses.

Courses for Level-I Licence:

Sr.No.	Topics
(i)	Administration and Accounts Procedures
(ii)	General Management Course
(iii)	Operation Management Course

IB.2 Assistant Shift Charge Engineer (ASCE)

IB.2.1 The candidate should have completed all the examinations prescribed for Control Engineers (main plant). He should have worked for a minimum period of two years as a Control Engineer at a NPP as applicable.

IB.2.2 The candidates are required to pass written examinations on the following papers before appearing for licensing interview for acquiring the position of Assistant Shift Charge Engineer.

IB.2.3 In the case of new stations where it has become necessary to induct professional engineers with long experience of four years and above in thermal power plants and chemical industries, they should have been subjected to Level A checklists, hands on experience of at least one year in any NPP of similar type and their cases shall be specifically got cleared by the Regulatory Body.

Written Examinations for Level-II (ASCE) Licence

Paper Nos. (II indicates level)	**Title of the Paper**
Paper - T-II-1	Nuclear System (Abnormal Operations and Incidents)
Paper - T-II-2	Turbine Generator Systems (Abnormal Operations and Incidents)
Paper - T-II-3	Instrumentation and Control (Abnormal Operation and Incidents)
Paper - T-II-4	Plant Electrical Systems and Grid Systems (Abnormal Operation and Incidents)
Paper - T-II-5	Station operation (Abnormal Operation and Incidents)
Paper - T-II-6	Radiation Protection (advanced)

IB.2.4 In case of new stations, during the initial start up the candidate should have at least completed all the level A system field checklists, passed in walk through tests and final interviews, besides participation in the commissioning activities and passing of the above licensing examinations.

IB.3 Control Engineer (CE) of Main Plant (Level-III)

IB.3.1 The candidate should have passed in one year initial training or equivalent training as applicable to Engineers and have acquired RPT Green qualification. In addition, he must have completed at levels A Main Plant System field checklists and other prerequisites as mentioned before.

IB.3.2 For acquiring the position for Control Engineer, he shall pass the following examinations and walk through and licensing interviews.

Written Examinations for Level-III (CE) Licence

Paper Nos. (III indicates level)	Title of the Paper
Paper - T-III-1	Features of Facility Design
Paper - T-III-2	General Operating and Specific Operating Characteristics
Paper - T-III-3	Instruments and Controls
Paper - T-III-4	Safety and Emergency Systems
Paper - T-III-5	Technical Specifications
Paper - T-III-6	Standard and Emergency Operating Procedures
Paper - T-III-7	Radiation Protection
Paper - T-III-8	Fuel Handling and Core Parameters and Reactor Physics
Paper - T-III-9	Radioactive Material Handling and Hazards

IB.5 First Operator (FO)

IB.5.1 The candidate should have passed in stipendiary training as applicable to Diploma Operators and worked for at least two-and-a-half years in main plant.

IB.5.2 Higher Secondary passed or S.S.C. + ITI passed candidates should have completed initial training as applicable to them and worked for at least three years as a secondary operator. They should have obtained RPT Green qualification and system field checklists at level B.

IB.5.3 In the case of new stations, during the initial start-up the candidate should have at least completed the Level-B system field checklists, passed in walk-through tests and final interviews, besides participation in commissioning activities.

IB.5.4 For acquiring the position for First Operator, they shall pass the following written examinations, the walk through and final assessment interviews.

Written Examinations for Level-IV (FO) Qualification

Paper Nos. (IV indicates level)		**Title of the Paper**
Paper - T-IV-1		Principles of Reactor Operation
Paper - T-IV-2		Reactor and Auxiliary Systems
Paper - T-IV-3		Nuclear Control System, Safety and Emergency System
Paper - T-IV-4		Turbine Generator and its Auxiliary Systems
Paper - T-IV-5		Common Auxiliary Systems
Paper - T-IV-6		Water Chemistry and Associated Systems, Waste Disposal Systems
Paper - T-IV-7		Radiation Protection and Industrial Safety

IB.7 Qualification Procedure for Second Operator (SO)

IB.7.1 He should pass the following written examination. Paper Nos. V-1 to V-7 are compulsory and of the remaining any one set is to be passed thus making a total of nine papers. He should have completed all Level-C checklists on the above systems. (Importance has been given to Fuel Handling Systems and Electrical Systems and hence made compulsory). The choice of sets 1,2,3 for Level V qualification shall be such that the required number of qualified operators are available in each set so that shift operations can be ensured without any shortage in any discipline.

Written Examinations for Level-V (SO) Qualification

Paper Nos. (V indicates level)		**Title of the Papers**
Paper - T-V-1		Reactor Physics and TAPS Reactor
Paper - T-V-2		Reactor Auxiliary System
Paper - T-V-3		Turbine and Auxiliary System
Paper - T-V-4		Electrical System
Paper - T-V-5		Radwaste, Water Chemistry and Associated System
Paper - T-V-6		Balance Plant Systems
Paper - T-V-7		Radiation Protection and Industrial Safety

IB.8 Academic Qualification and Experience

The following requirements shall be complied with for qualifying the candidates to each of the positions/levels.

Sr. No.	**Positions (Level)**	**Minimum Academic Qualification**	**Training/Station Qualification/Field Experience/Training**
1.	SCE (Level-I)	B.E. or equivalent	8 years minimum including 2 years as a qualified ASCE in the same or the similar PHWR/LWR station in India.
2.	ASCE (Level-II)	B.E. or equivalent	6 years minimum including 2 years as a qualified CE or CE(F) in the same or similar plants and with the supplementary FHS or the Main Plant Qualification as stipulated.

Sr. No.	Positions (Level)	Minimum Academic Qualification	Training/Station Qualification/Field Experience/Training
3.	CE (Level-III)	(i) B.E. or equivalent	4 years minimum experience including training on Nuclear Systems, TG System, Electrical and Process Auxiliary System Operations and or Commissioning
			OR
		(ii) Diploma Holders in Engg.	10 years minimum experience as above including 3 years as a FO/FO(F)
4.	FO (Level-IV)	(i) Diploma Holders/ B.Sc.	4 years minimum including training in field operations in reactor, FHS, Turbine and Services systems commissioning and Control Room operations under CE's/CE(F)'s guidance as applicable.
5.	SO (Level-V)	H.S.C./S.S.C. (refer 4.5 for exceptional cases)	8 years minimum including training in identified areas of Main Plant, FH and Auxiliary Services

IB.9 Typical Qualification Requirements for Senior Management Positions:

IB.9.1 Persons occupying senior management positions in the Operating Stations must have atleast Level III Control Engineer's License, except in the case of Operations Superintendent, who must have a Level-I Shift Charge Engineer's License.

IB.9.2 For persons from non-operation discipline, their equivalent training and qualification in their disciplines would be such that they already possess qualification in plant systems, safety, quality assurance and related science fundamentals. These topics are not thus repeated in the management qualification written examination.

IB.9.3 The identified focus for Superintendent qualification is Reactor Safety and Radiation Safety, and those at such management positions are responsible for inculcating Safety Culture and for realising the defence-in-depth concept.

IB.9.4 Those who have secured Level III Control Engineer's licence for the concerned Station, i.e. for the Station the candidate is seeking Superintendent's qualification, any time in the past, will not be required to pass this test, but are required to acquire Level I position in any of the above O and M streams for the concerned station namely:

Operation;
Maintenance;
Technical; and
Training.

This means Level III and current licence holders must continue to be in O and M duties and qualification programmes and in case they are diverted to non-O and M positions, they would need to pass the tests here as a pre-requisite for taking Superintendent positions.

IB.9.5 Similarly, Level III Control Engineers license holders continuing in Operation discipline are exempted from writing these examinations, but must reach Level I Shift Charge Engineers position before they are considered for Superintendents positions, in general for the concerned station and in particular, for the Operation Superintendent position.

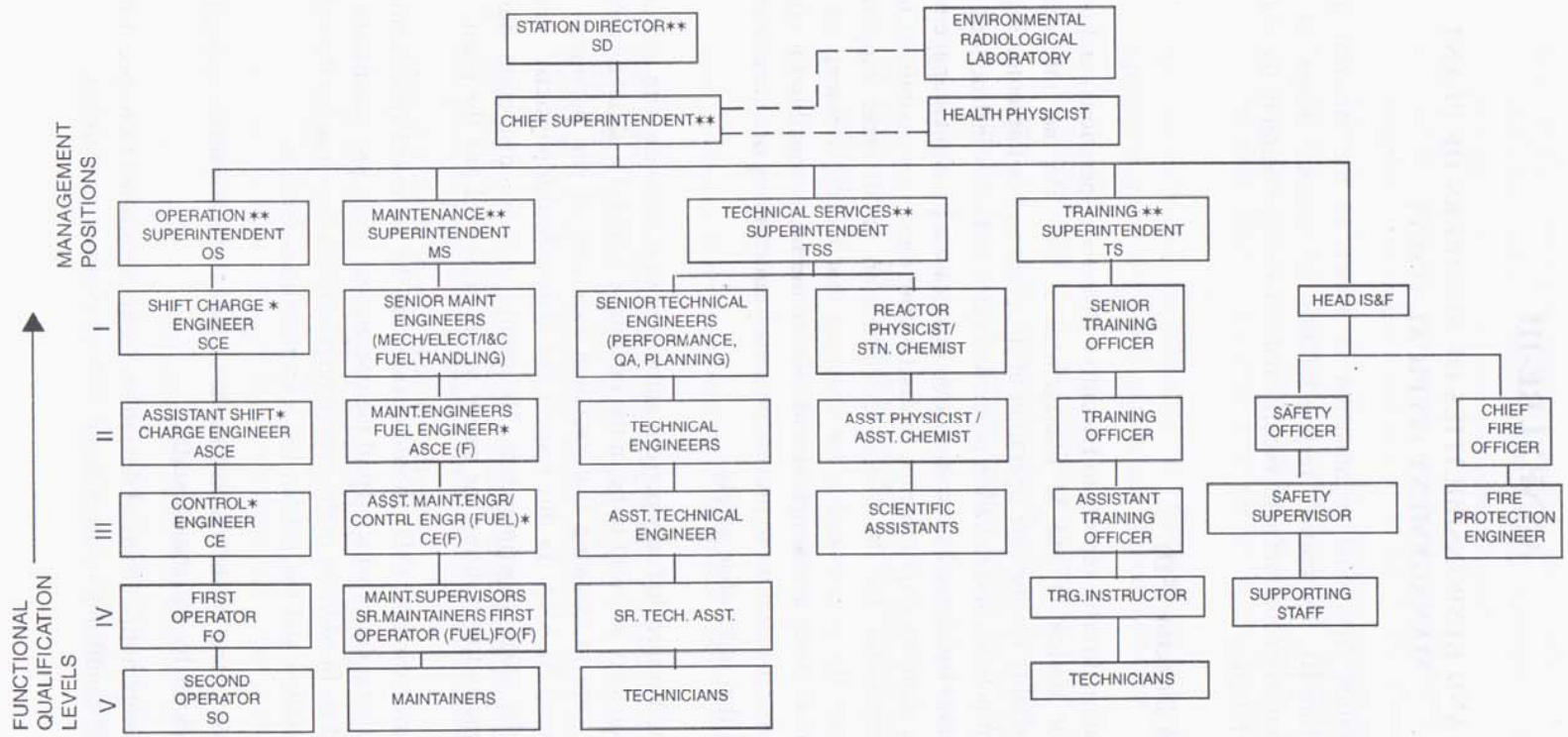
IB.9.6 A Superintendent qualified for a PHWR Station in one of the two above manners can be re-qualified for another PHWR Station, if he passes the only one written examination paper besides the appropriate walk-through and final interview for the new position. This procedure is valid also for those transferees who satisfied in their previous Station, above requirements but were not put on the Superintendent position for want of vacancies there.

IB.9.7 The Superintendents qualified through the management qualification procedure do not need requalification as long as they are holding any of the approved Superintendents position in the same Station.

IB.9.8 Persons from non-operation disciplines should have three months Field Orientation in Operations and pass in oral checks on Control Room Operations Check List. They should pass the following Management Papers:-

Sr. No.	Paper No.	Paper Title
1.	MGT-1	Safety Design Overview
2.	MGT-2	Safety Analysis Overview
3.	MGT-3	Operational Safety Overview
4.	MGT-4	Root Cause Analysis of Events and Safety Culture Case Studies (Oral Presentation and Oral Assessment by a specially appointed NPC Committee). Apart from the above, they should also pass the walk-through examination limited to Control Room Operations conducted by a Committee appointed by the Chief Superintendent concerned. The final assessment is done by the Committee appointed by the Regulatory Body before license is given.

ANNEXURE - II



NOTES:

1. HP PERSONNEL ARE ALSO QUALIFIED AS ABOVE.
2. POSITIONS SUCH AS ACE (QA), ACE (DESIGN AND ENG.), ACE (SERVICES) NOT SHOWN ABOVE.
3. **CERTIFIED POSITIONS MANNED BY PERSONS HAVING MANAGEMENT QUALIFICATION
4. * CERTIFIED POSITIONS MANNED BY PERSONS HAVING LICENCE.
5. FIRE BRIGADE ORGANISATION SHOULD BE AS PER APPENDIX-IV OF 'STANDARD FOR FIRE PROTECTION SYSTEM OF NUCLEAR FACILITIES', AN AERB PUBLICATION

LEGEND

——— LINE OF COMMAND

— — — — LINE OF COMMUNICATION

TYPICAL ORGANISATION CHART OF PLANT MANAGEMENT

ANNEXURE-III

DUTIES AND RESPONSIBILITIES OF MEMBERS OF PLANT MANAGEMENT (TYPICAL ONLY)

III.1 The station functional organisation is shown in the attached chart (Annexure-II). Functional responsibilities of various wings of the organisation to conduct safe, orderly and efficient operation of the station are as follows:

III.2 Station Director (SD)

III.2.1 The station director reports to Executive Director (Operations) and is the chief of station O and M management at site. He has the overall responsibility for the safe operation of the plant and in implementing all relevant policies and radiation protection rules and other instructions and procedures laid down by the operating organisation for plant management, and the statutory requirements. In discharging these responsibilities he is also responsible for the overall co-ordination of all other supporting functions. He is responsible for ensuring that the requirements of the Regulatory Body are complied with. He should be responsible for taking reasonable precautions to prevent persons from carrying out unauthorised actions that jeopardise safety.

He should ensure that only persons authorised in accordance with approved procedures are allowed to be in the operating island. He should exercise utmost care in ensuring that radiation exposure of site personnel are maintained ALARA. In this respect, the station health physicist should assist the chief superintendent. He should exercise discretion during emergencies for ensuring the safety of the personnel and the plant.

The station director (SD) should ensure that the technical specifications and station policies which detail the operational limits and conditions are adhered to. In addition to the overall responsibility for ensuring the safety of the station and the public, his responsibilities include:

(i) Overseeing of strict adherence to technical specifications and station policies by the station staff;

(ii) Prompt notifications of deviations from established tech. spec. limits and conditions in accordance with procedures established;

(iii) For maintenance of quality assurance in all activities at the station and in particular in maintenance, testing, examination and inspection of structures, systems and components; and

(iv) For ensuring that only duly approved modifications according to established procedures and as may be necessary after review by the relevant authorities, are carried out. For this purpose he should have all modification proposals reviewed by SORC. Modifications which may fall within the safety category, as identified by SORC, should be implemented only after approval by Safety Committee/SARCOP.

III.2.2 He may authorise the following in exigencies pertaining to safety of equipment, plant personnel, public and the environment.

(a) radiation exposure to an individual exceeding 1 rem, but less than 3 rems, provided the annual dose limits are not exceeded in accordance with the radiation protection manual issued by SARCOP;

(b) jumpering of reactor safety system, if required to handle exigencies;

(c) permitting entry to areas which are accessible only when the reactor is shutdown;

(d) release of radioactivity in excess of permissible limits, in consultation with health physicists; and

(e) deviations from requirements of technical specification.

All such cases should be reviewed by SORC promptly and reported to the Unit Safety Committee and SARCOP within stipulated periods along with the details of the circumstances which demanded such authorisations.

III.2.3 The alternate arrangements to discharge responsibilities in the top-most positions of plant management should be as per technical specification. Typically the following may be adopted:-

(i) In the absence of SD, CS assumes the responsibility for the station and will exercise all these powers.

(ii) In the absence of both SD and CS, the technical services superintendent (TSS) should function as CS.

(iii) Unless specially authorised by ED(O), atleast one of the above three should be available at the plant headquarters at all times. In the event of concurrent absence of SD, CS and TSS, the person designated

to assume the responsibility for the station should be specified before hand by ED(O) and be available at that plant headquarters.

III.3 Chief Superintendent (CS)

He is responsible for co-ordinating the safe and orderly operation and maintenance of the station/systems in accordance with approved procedures. Operation, maintenance and Technical Services Superintendents, and Safety Officer assist him in this regard. Other service organisations should also provide the necessary support in this regard.

III.4 Technical Services Superintendent (TSS)

TSS is the head of technical services and is responsible for:

(a) engineering assistance required to efficiently operate the station/ system at optimum performance, quality assurance and technical audit;

(b) performing engineering/technical studies and reviews;

(c) issuing of work plans for jobs during operation and shutdown;

(d) reactor physics and fuel management;

(e) chemistry control of the systems;

(f) computer facilities; and

(g) upkeep and updating of all technical documentation including all design manuals and all drawings.

III.5 Engineer Incharge Quality Assurance

Engineer In-charge Quality Assurance is responsible for:

(a) developing of new ISI tools and techniques, QA of maintenance by station personnel,

(b) QA during functional testing by operations,

(c) developing of special procedures after special maintenance,

(d) overseeing Technical Audit Engineer's function, and

(e) organising external and internal audits.

III.6 Operation Superintendent (OS)

Operation Superintendent (OS) is directly responsible for :

(a) safe operation of station/systems according to approved objectives, regulations, procedures, station policies within limits and conditions laid down in the Technical Specification;

(b) station heavy water management;

(c) bringing to notice of SORC members deviations/ deficiencies in the operation of the systems;

(d) ensuring that shifts are manned efficiently by providing adequate trained and licensed manpower;

(e) bringing to notice of SD/CS/TSS promptly, all deviations from technical specifications, station policies and all incidents with full information and along with his comments and recommendations;

(f) arranging to convene SORC atleast once a month and also as and when necessary; and

(g) upkeep and updating of operating manuals.

III.7 Maintenance Superintendent (MS)

The Maintenance Superintendent (MS) is directly responsible for:

(a) planned preventive/breakdown maintenance in respect of mechanical, electrical and control equipment/systems;

(b) operation and maintenance of fuel handling machine and related systems;

(c) maintenance of adequate spares and consumables;

(d) modifications to systems after approval by SD/CS; and

(e) service maintenance.

III.8 Training Superintendent (TS)

Training Superintendent (TS) is responsible for co-ordinating arrangements for :

(a) training of station staff in radiation protection, first-aid and emergency procedures, industrial safety and fire protection;

(b) training/qualification of operation staff;

(c) training/qualification of maintenance staff; and

(d) training/qualification of fuel handling staff.

He should maintain close liaison with other agencies involved in training of station staff.

III.9 Engineer Incharge Heavy Water

He is responsible for management of heavy water storage and movement in the Station (other than PHT and Moderator System). He is responsible for safe operation of downgraded heavy water system, clean up and evaporation systems and upgrading plants.

His responsibility includes :

(a) safe operation of the downgraded heavy water systems as per approved procedures and station policies;

(b) bringing to notice of SORC members deviations, deficiencies, maloperation and incidents in the operation of the systems with full information along with his comments and recommendations; and

(c) ensuring adequate trained manpower for the operation of the system.

In addition he is also responsible for heavy water upgrading plant.

III.10 Health Physicist

The health physicist is responsible for advising SD/CS on radiation protection. This should include advice on personnel exposure, radiation monitoring and surveys and liaison with CWMF regarding discharges and management of radioactive wastes, equipment for radiation protection and emergency arrangements and environmental surveys within the boundary of the Unit. He is responsible for maintaining appropriate records including personnel dose records. He advises on, and monitors, the procedures to be followed for carrying out the work in accordance with radiation protection procedures issued by the station, and any other requirements stipulated by SARCOP. For ensuring radiation safety he is responsible for making measurements and observations during normal operations, as well as during abnormal occurrences.

III.11 Industrial Safety Officer

The duties of the safety officers shall be to advise and assist the management in the fulfillment of its obligations, statutory or otherwise, concerning prevention of personal injuries and maintaining a safe working environment. These duties shall include the following, namely:

(a) to advise the concerned departments in planning and organising measures necessary for the effective control of personal injuries;

(b) to advise on safety aspects in all job studies, and to carry out detailed job safety studies of selected jobs;

(c) to check and evaluate the effectiveness of the action taken to prevent personal injuries;

(d) to ensure that all personal protective equipment provided to workers as required under any of the provisions of the Act or the Rules conform to the relevant Indian Standards;

(e) to provide advice on matters related to carrying out plant safety inspections;

(f) to carry out plant safety inspections in order to observe the physical conditions of work and the work practices and procedures followed by workers and to render advice on measures to be adopted for removing the unsafe physical conditions and preventing unsafe actions by workers;

(g) To render advice on matters related to reporting and investigation of industrial accidents and diseases;

(h) to investigate selected accidents;

(i) to investigate the cases of industrial diseases contracted and reportable dangerous occurrences;

(j) to advise on the maintenance of such records as are necessary relating to accidents, dangerous occurrences and industrial diseases;

(k) to promote setting up of safety(industrial) committee and act as adviser and catalyst to such committees;

(l) to organise in association with the concerned departments, campaigns, competitions, contests and other activities which will develop and maintain the interest of the workers in establishing and maintaining safe conditions of work and procedures; and

(m) to design and conduct either independently or in collaboration with the training department, suitable training and educational programme for the prevention of personal injuries.

III.12 Fire Protection Engineer

The fire protection engineer shall be responsible for:

(a) co-ordination of fire protection programme requirements, including consideration of potential hazards associated with building layout and system design;

(b) design, testing and maintenance of fire detection and suppression systems;

(c) fire prevention activities, including the preparation of plant procedures and administrative controls;

(d) training and manual fire fighting activities of plant personnel and the fire brigade;

(e) pre-fire planning;

(f) effective implementation of the overall fire protection quality assurance programme; and

(g) analysis of proposed changes in existing fire protection systems and approval prior to implementation of the change.

III.13 Planning Engineer (PE)

The Planning Engineer (PE) should normally be a Senior Licensed Engineer and is responsible for:

(a) collecting information on all outstanding jobs and classifying them according to priority;

(b) co-ordinating plans for all jobs, for implementation during:
  (i) operation,

  (ii) poison shutdown,

  (iii) annual shutdown and,

  (iv) emergency shutdown.

III.14 Technical Audit Engineer

The Technical Audit Engineer is responsible for auditing and monitoring of compliance with Operating Procedures, Surveillance Test Procedures, SORC recommendations, In-service Inspection and Engineering Change Notices of all safety related systems. He should also monitor deviations of the Technical Specifications and Station Policies and follow-up implementation of the decisions given by SORC/Unit Safety Committee/ SARCOP from time to time. He should send periodically reports to station director as specified in station technical specification.

III.15 Shift Charge Engineer (SCE)

The shift charge engineer (SCE) is responsible for authorising all operation and maintenance activities of the Station on shift basis. He is delegated all the powers given to the CS except those stated in Section 11.1.2, to maintain the reactor systems under safe condition during operation and shutdown of the reactor. He is responsible for safe startup, operation and shutdown of the reactor, turbo-generator and auxiliaries. In the absence of SCE, the assistant shift charge engineer (ASCE) discharges these responsibilities. Both SCE and ASCE hold senior engineer licenses including authorisation for control panel operation. He is responsible for the initial assessment of the nature and extent of any incidents, including any which might result in radioactivity release and, subsequently for taking the first steps necessary to minimise the consequences, ensuring safety of personnel and, initiating the actions required by the emergency plan. Either the SCE or ASCE should be present in the Control Room at all times.

III.16 Engineer-In-Charge, Liquid Effluent Management Plant (LEMP)

The operation of LEMP is the responsibility of Station O & M. Centralised Waste Management Facility (CWMF) is responsible for the collections of solid and liquid radioactive waste from the station, transport, treatment and disposal of such waste as per approved procedures. (This includes accountability of activity discharged consistent with norms laid down by the Health Physics Unit).

III.17 Operating Staff

III.17.1 Safety of a Nuclear Power Station in a major way depends on the alertness, skill and competence of the operating staff, even though great care and attention may have been given to safety during design and construction.

The required number of adequately trained and licensed operating staff in each shift should be available, for ensuring safe operation of the Station as given in the Technical Specifications.

III.17.2 Positions Requiring Licensing as Qualification

Following operational positions are to be manned by personnel formally qualified by the Committee constituted by the Regulatory Body or NPC as the case may be. The word licensing is used where the final interviews are held and candidates are certified by a committee appointed by the Regulatory Body. The word Qualification is used where the final interviewing committee is appointed by NPC.

(i) **Certifying Requirement**

Management Positions	**Levels**	**Committee**
Station Director	Management	AERB Committee
Chief Superintendent	,,	,,
Operation Superintendent	,,	,,
Maintenance Superintendent	,,	,,
Tech. Services Superintendent	,,	,,
Training Superintendent	,,	,,
Control Room Positions	**Levels**	**Committee**
Shift Charge Engineer	I	AERB Committee
Assistant Shift Charge Engineer and ASCE (FHU)	II	,,
Control Engineer and CE(FHU)	III	,,

(ii) **Qualification Requirement**

Positions	**Levels**	**Committee**
First Operator and FO (FHU)	IV	NPC Committee
Second Operator and SO (FHU)	V	,,

ANNEXURE -IV

TYPICAL MINIMUM STAFF REQUIREMENT (Please see 2.5.2)

Minimum Complement of Staff at the Station in any Shift on Three Shift Basis

Area/Equipment	Designation	No. required	
Control Room	Shift Charge Engineer	1	
Main panels	Assistant Shift Charge Engineer	1	
	Control Engineer	3	
	First Operator	2	
	Plant Operator	2	
Reactor Building	Field Engineer	1	
	First Operator	1	
	Plant Operator	2	
Turbine Building	Field Engineer	1	
	First Operator	1	
	Plant Operator	2	
D.M.Plant	Plant Operator	2	
Compressors & Chillers	Plant Operator	1	
LEMP Operation	Plant Operator	1	
Health Physics	Health Physicist	1	
Chemistry	Chemist	1	
Maintenance	Maintainers	6	
Reactor Physics	Reactor Physicist	1	on call duty
Fuelling Operations	ASCE (F)	1	
	Control Engineers	2	
	First Operator	2	
	Plant Operator	2	
	Total	37	

All designations are typical and indicative and can be changed to suit plant requirements.

BIBLIOGRAPHY

1. AERB Safety Code, Code of Practice on Safety in Nuclear Power Plant Operation, AERB/SC/O, 1989

2. IAEA Safety Guide, Staffing of Nuclear Power Plants and Recruitment, Training and Authorisation of Operating Personnel, 50-SG-O1, 1978

3. IAEA Safety Guide, In-Service Inspection of Nuclear Power Plants, 50-SG-O2, 1980

4. IAEA Safety Guide, Operational Limits and Conditions for Nuclear Power Plants, 50-SG-O3, 1980

5. IAEA Safety Guide, Commissioning Procedures for Nuclear Power Plants, 50-SG-O4, 1980

6. IAEA Safety Guide, Radiation Protection During Operation of Nuclear Power Plants, 50-SG-O5, 1983

7. IAEA Safety Guide, Preparedness of Operating Organisation for Emergencies in Nuclear Power Plants, 50-SG-O6, 1982

8. IAEA Safety Guide, Maintenance of Nuclear Power Plants, 50-SG-O7, 1982

9. IAEA Safety Guide, Surveillance of Items Important to Safety in Nuclear Power Plants, 50-SG-O8, 1982

10. IAEA Safety Guide, Management of Nuclear Power Plants for Safe Operation, 50-SG-O9, 1984

11. IAEA Safety Guide, Core Management and Fuel Handling for Nuclear Power Plants, 50-SG-O10, 1985

12. IAEA Safety Guide, Operational Management of Radioactive Effluents and Wastes Arising in Nuclear Power Plants, 50-SG-O11, 1986

13. AERB Safety Manual Governing the Authorisation Procedure for Nuclear Power Plant/Project, No. M/NSD-3, 1989

14. Atomic Energy (Factories) Rules, 1996

15. AERB Standard for Fire Protection Systems of Nuclear Facilities, AERB/ S/ISRD-I, 1996.

LIST OF PARTICIPANTS

ADVISORY COMMITTEE ON CODES, GUIDES AND ASSOCIATED MANUALS FOR SAFETY IN OPERATION OF NUCLEAR POWER PLANTS (ACCGASO)

Dates of Meeting	:	November, 15 & 16, 1994 December, 22 & 23, 1995 July, 13 &1 4, 1998

Members and alternates participating in the meeting:

Shri G.V. Nadkarny (Chairman)	:	Former Director E&PA, NPC
Shri V.S. Srinivasan	:	NPC
Shri Y.K. Joshi	:	RAPS/NPC
Shri Ravindranath	:	TAPS/NPC
Shri V.V. Sanathkumar	:	MAPS/NPC
Shri R.S. Singh	:	AERB
Shri Ram Sarup	:	AERB
Shri S.T. Swamy (Co-opted)	:	AERB
Shri S.K. Warrier (Member-Secretary)	:	AERB

ADVISORY COMMITTEE ON NUCLEAR SAFETY (ACNS)

Dates of the Meeting	:	April 26, 1997

Members and Alternates participating in the Meeting:

Shri S.K.Mehta(Chairman)	:	Formerly Director Reactor Group, BARC.
Shri S.M.C.Pillai	:	Nagarjuna Power Corp.
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Shri S.K.Bhave	:	BHEL
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Shri S.K.Warrier (Invitee)	:	AERB
Smt. Usha A.Menon (Permanent-Invitee)	:	AERB

PROVISIONAL LIST OF GUIDES ON OPERATION OF NUCLEAR POWER PLANTS

Safety Series Nos.	Provisional Title
AERB/SG/O-1	Staffing, Recruitment, Training, Qualification and Certification of Operating Personnel of Nuclear Power Plants
AERB/SG/O-2	In-Service Inspection of Nuclear Power Plants
AERB/SG/O-3	Operational Limits and Conditions for Nuclear Power Plants
AERB/SG/O-4	Commissioning Procedures for Pressurised Heavy Water Reactor Based Nuclear Power Plants
AERB/SG/O-5	Radiation Protection during Operation of Nuclear Power Plants
AERB/SG/O-6	Preparedness of the Operating Organisation for Emergencies at Nuclear Power Plants
AERB/SG/O-7	Maintenance of Nuclear Power Plants
AERB/SG/O-8	Surveillance of Items Important to Safety in Nuclear Power Plants
AERB/SG/O-9	Management of Nuclear Power Plants for Safe Operation
AERB/SG/O-10A	Core Management and Fuel Handling for Heavy Water Reactor Based Nuclear Power Plants
AERB/SG/O-10B	Core Management and Fuel Handling for Boiling Water Reactor Based Nuclear Power Plants
AERB/SG/O-11	Management of Radioactive Waste Arising During Operation of Nuclear Power Plants
AERB/SG/O-12	Renewal of Authorisation for Operation of Nuclear Power Plants
AERB/SG/O-13	Operational Experience Feedback for Nuclear Power Plants

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