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Replacement Research Reactor Project

SAR CHAPTER 13
CONDUCT OF OPERATIONS

Prepared By

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For

Australian Nuclear Science and Technology Organisation

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13 CONDUCT OF OPERATIONS

13.1 INTRODUCTION

This chapter provides a description of the organisational structure and responsibilities for the conduct of operations of the Replacement Research Reactor Facility (Reactor Facility). It addresses staffing, qualification and training, assessment, procedures, maintenance, testing and inspection, security, records and reports. The description applies to Reactor Facility operations following completion of commissioning activities.

The safe operation of the Reactor Facility requires that the organisational structure be clearly defined and personnel appropriately qualified. In addition to technical knowledge and abilities, Management and personnel involved in operation and maintenance of the reactor should be imbued with a healthy safety culture. Lines of authority, responsibility, and communication are defined and documented.

The objectives of this chapter are:

1. To describe the general safety arrangements applicable to the safe conduct of operations of the facility.
2. To provide a summary description of the proposed organisational structure and associated operational arrangements.
3. To identify features of the proposed organisational structure and associated operational arrangements that contribute to nuclear safety and radiation protection.

Australian Nuclear Science and Technology Organisation (ANSTO) is responsible for ensuring that the Reactor Facility is operated in a safe manner that does not jeopardise public health and safety. The corporate officer with ultimate responsibility for the Reactor Facility is the ANSTO Executive Director. The Reactor Manager is directly responsible for the safe operation of the Reactor Facility and has control over those activities associated with the ongoing operation and maintenance of the Reactor Facility. A single individual, the Shift Manager, is responsible for operating the Reactor Facility safely and maintaining compliance with the Operational Limits and Conditions. The Reactor Facility is operated within the framework of a documented Quality Management System and in accordance with conditions of an Operating Licence issued by ARPANSA.

End of Section

13.2 ORGANISATIONAL STRUCTURE

13.2.1 Responsible Body

ANSTO is the organisation responsible for the safe operation of the Reactor Facility. This national organisation is the centre for nuclear research and development, and provides a broad range of technical expertise to support national interests. ANSTO is a body corporate established by the Australian Nuclear Science and Technology Organisation Act of 1987. The functions and general powers are set out in the Act. ANSTO has many years of experience in research reactor operations.

ANSTO is responsible for:

a) Ensuring that operations are consistent with ARPANSA regulations and comply with licence conditions.

b) Ensuring that personnel are competent to perform assigned duties.

c) Providing sufficient resources for safe operation.

d) Complying with Operational Limits and Conditions.

e) Maintaining occupational radiation doses within agreed limits.

f) Maintaining releases of radioactive material within agreed limits.

g) Managing nuclear and radioactive materials.

13.2.2 Organisational Structure of the Responsible Body

ANSTO is the Reactor Facility licensee and, as such, has responsibility for nuclear safety and radiation protection. ANSTO assumes full responsibility by ensuring that all elements for safe operation are in place. The integration of the Reactor Facility within ANSTO's overall organisational structure is presented in Chapter 18, Quality Assurance.

13.2.3 Organisational Structure for the Conduct of Reactor Facility Operations

Lines of authority, responsibility, and communication are depicted for the operating organisation in Figure 13.2/1, Operating Organisation. Certain common elements are necessary for an effective reactor staff organisational structure. The ANSTO Executive Director is responsible for ensuring that a strong safety management system is established and maintained. A safety management system is a framework that facilitates safety performance and enhances safety culture. It provides for operational and maintenance support under the direction and supervision of the Reactor Manager[1]. Minimum shift staffing requirements for safe operation are stipulated in the OLCs. The minimum number of shift personnel is sufficient to address all postulated events. These requirements are based on reactor design, which includes defence-in-depth and passive features. Nuclear safety is assured without operator intervention for at least 30 minutes following any postulated event.

The actual number of personnel assigned to undertake operational functions varies, depending upon utilisation requirements. Qualified staff are employed to carry out normal activities, including the supervision of work done by external contractors. Staffing

[1] Although specific role titles are given herein, alternative titles may develop in future Reactor Facility documentation without affecting the safe operation of the Reactor Facility.

arrangements ensure backup for key positions and on-call requirements. Staffing levels take into account attrition and are sufficient to avoid the need for excessive overtime. The ANSTO Executive Director has ultimate responsibility for the operation of the Reactor Facility. The ANSTO Executive Director provides such measures as are needed to ensure acceptable performance of the staff in operating, maintaining, and providing technical support to the Reactor Facility are put in place.

13.2.3.1 Facility Nominee

The ANSTO Executive Director has delegated responsibilities associated with safety of the Reactor Facility to a nominee (ANSTO Policy APOL 2.1 D01). Under this delegation, the nominee has responsibility to develop local arrangements for safety management and to operate the systems to implement these arrangements. The nominee is also able to make, amend or vary the application or applications in the name of ANSTO, pursuant to Section 34 of the *Australian Radiation Protection and Nuclear Safety Act 1998* and Regulation 39(4)(b)(ii) of the *Australian Radiation Protection and Nuclear Safety Regulations 1999*.

13.2.3.2 Reactor Manager

The Reactor Manager is the facility officer directly responsible for the safe operation of the Reactor Facility. The Reactor Manager has control over those activities and resources necessary for safe operation and maintenance of the reactor. Day to day responsibility for safety resides with the Reactor Manager, who ensures that the necessary elements for achieving safety are present and that the need for safety governs operations. These responsibilities consist of reactor operations, maintenance, radiation protection and utilisation. The Reactor Manager is supported in carrying out his role by the Systems Engineering and Nuclear Analysis sections. The Reactor Manager is supported by ANSTO senior management, which assigns adequate financial and technical support. The Reactor Manager is appointed by ANSTO and reports to ANSTO senior management.

13.2.3.3 Reactor Operations Leader

The Reactor Operations Leader is responsible for providing day-to-day supervision and direction to the shift staff at the Reactor Facility. In addition, the responsibility for operations training related to the Reactor Facility resides with the Reactor Operations Leader. The Reactor Operations Leader reports to the Reactor Manager and is appointed by ANSTO.

Accreditation means that personnel have been trained, demonstrated their knowledge and competency and may be authorised to operate the Reactor Facility. Minimum shift staffing is based on ensuring that the Reactor Facility is capable of being operated safely; in particular, minimum shift staffing is that required to ensure nuclear safety at all times, including during any design basis event. One of the authorised operators on shift fulfils a supervisory role as Shift Manager. Authorised operators are appointed by ANSTO.

The Reactor Operations Leader is responsible for ensuring a sufficient number of personnel are rostered on shift to meet the minimum shift staffing requirements. Minimum shift staffing requirements are stipulated in the OLCs.

Responsibility for authorisation of operators is assigned to the Reactor Operations Leader.

13.2.3.4 Reactor Maintenance Leader

The Reactor Maintenance Leader is responsible for the conduct of maintenance at the Reactor Facility. This includes performance of corrective maintenance, preventive and predictive maintenance, and applicable testing. The Reactor Maintenance Leader reports to the Reactor Manager and is appointed by ANSTO.

This section liaises with Reactor Operations in carrying out its maintenance activities and consults with Systems Engineering on the matter of maintenance strategy. Responsibility for the training of staff involved in maintenance activities is assigned to the Reactor Maintenance Leader.

13.2.3.5 Reactor Utilisation Leader

The Reactor Utilisation Leader is responsible for the reactor production facilities at the Reactor Facility. This includes verification of target and canning specifications and calculations, planning and scheduling of irradiations, and movement of irradiation rigs and targets. The Reactor Utilisation Leader reports to the Reactor Manager and is appointed by ANSTO.

This section liaises closely with Reactor Operations in carrying out its production activities and consults with Nuclear Analysis and Systems Engineering on the matter of utilisation strategy.

Responsibility for the training of staff involved in utilisation activities is assigned to the Reactor Utilisation Leader.

13.2.3.6 Systems Engineering Leader

The Systems Engineering Leader is responsible for providing engineering support to the Reactor Facility. Responsibilities include system and equipment performance monitoring and the control of licensing and design bases documentation. This includes reactor chemistry and maintenance of the Reactor Facility Safety Analysis Report. In addition, the Systems Engineering Leader is responsible for the planning, in consultation with the Reactor Manager, and implementing of facility modifications. The Systems Engineering Leader is appointed by ANSTO.

Responsibility for training of reactor systems engineers, monitoring of safety system reliability and maintenance program effectiveness is assigned to the Systems Engineering Leader.

13.2.3.7 Nuclear Analysis Leader

The Nuclear Analysis Leader is responsible for the performance of analyses and calculations that support safe Reactor Facility operation. Areas of analysis and calculation include reactor physics, criticality, shielding, thermal/hydraulics, and nuclear fuel management. The Nuclear Analysis Leader is appointed by ANSTO.

Responsibility for the training of analysts and maintenance of the necessary calculation capability is assigned to the Nuclear Analysis Leader.

13.2.3.8 Other Support Roles

Additional roles provide the necessary functions relating to training and instruction, quality management, licensing and regulation, and administration. Personnel performing in these roles report to the Reactor Manager.

Expertise developed over years of nuclear experience is available through the ANSTO infrastructure, thus enabling ancillary support needs to be met efficiently and effectively.

The Radiation Protection Adviser is responsible for the establishment and maintenance of the Radiation Protection Plan for the Reactor Facility. The Radiation Protection Adviser is independent of the Reactor Facility operating organisation and, while dealing with operating organisation staff on a day-to-day basis, is in a reporting relationship that is distinct from that of the Reactor Manager. The Radiation Protection Adviser is appointed by ANSTO. Responsibility for the training of operating and other Reactor Facility staff in aspects of radiation protection is assigned to the Radiation Protection Adviser.

13.2.3.9 Shift Operations

The shift complement meets the requirements of Operational Limits and Conditions at all times. During operation, three individuals are required, at least two of whom are accredited operators. One of the accredited operators on shift fulfils a supervisory role as Shift Manager. Expertise in radiation protection and engineering may be provided by one or more of these individuals. Figure 13.2/2 depicts the on-shift arrangements during operation.

End of Section

Figure 13.2/1 Organisation Chart

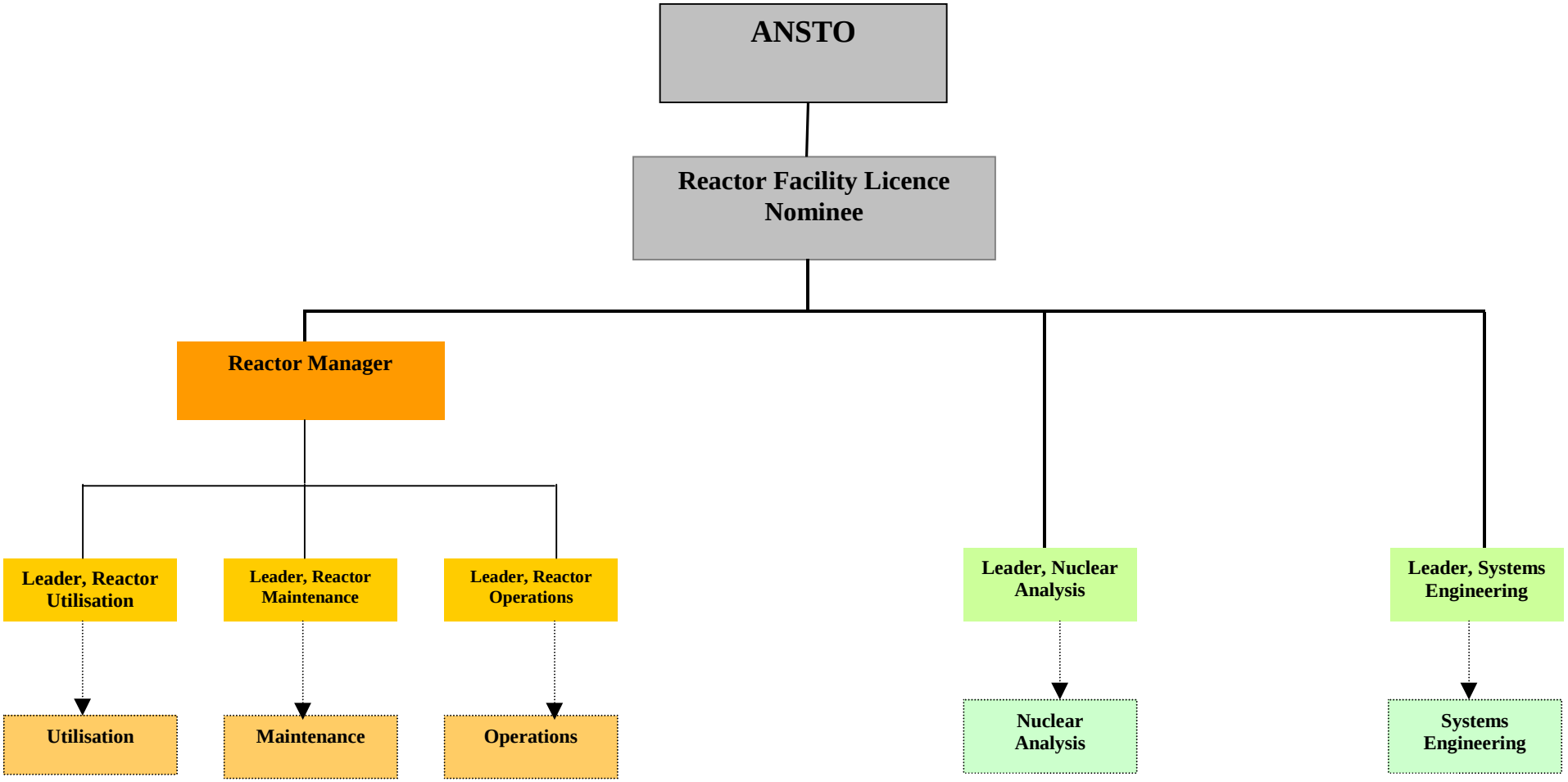
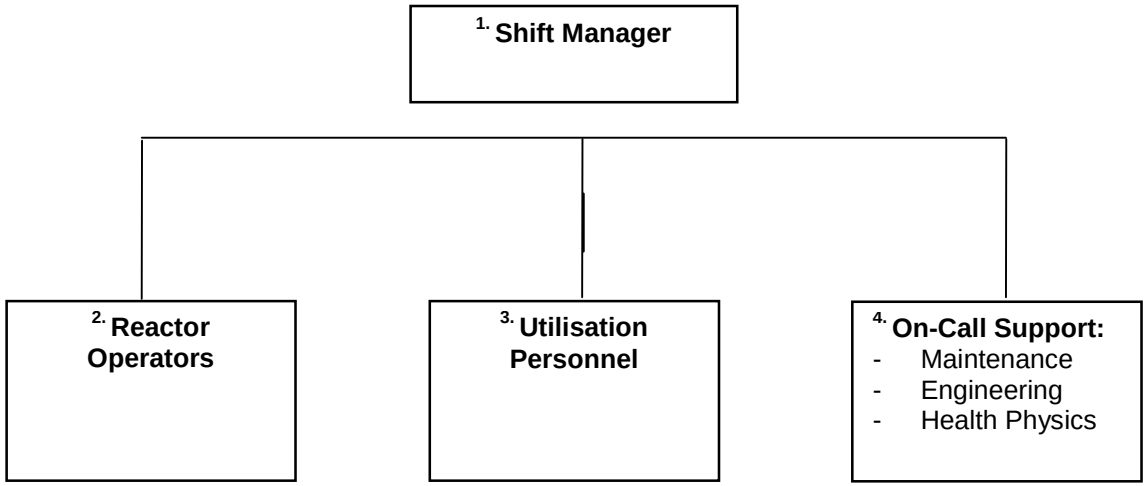


Figure 13.2/2: Shift Organisation During Operation



Notes:
1. The Shift Manager is an authorised operator.
2. Reactor Operators meeting OLC shift staffing requirements are accredited.
3. The number on shift depends upon ANSTO requirements. Utilisation personnel may be included in meeting the OLC requirement for non-authorised shift staffing.
4. On-call ANSTO support is available to the Shift Manager at all times.

End of Figures

13.3 STAFF QUALIFICATION AND TRAINING

Functions important to reactor safety are assigned to competent personnel. The ANSTO Executive Director and Senior Management team have put into place processes that are used to ensure that staff who are appointed to roles in the Reactor Facility can perform those roles so that the Facility is operated safely and efficiently. Through application of these processes Reactor Management arranges for the selection and training of staff for all roles in the Reactor Facility. Personnel selected to leadership roles are able to demonstrate through the selection process that they possess the knowledge, competencies and experience to perform those roles satisfactorily. Furthermore under the auspices of a certified quality system, approved processes and procedures are used to ensure frequent management review of staff performance and training at all levels, so that the capabilities of all staff are such that the Reactor Facility is operated safely and efficiently.

The term “accreditation” refers exclusively to the special qualifications of a reactor operator.

13.3.1 Reactor Manager

The Reactor Manager possesses a minimum of eight years of relevant professional experience, at least six years of which is nuclear reactor facility experience. An advanced degree may fulfil two of the eight years, and some of the nuclear experience on a one-for-one time basis. The Reactor Manager has a university qualification in engineering or science. The Reactor Manager also has knowledge of reactor physics, heat transfer and fluid flow, instrumentation and controls, and radiation safety. The Reactor Manager has operational experience and training comparable to that of an accredited reactor operator.

13.3.2 Reactor Operations Leader

The Reactor Operations Leader has a minimum of five years of relevant professional experience or has assessed equivalent experience and capability. The Reactor Operations Leader has a university qualification in engineering or science. The Leader is, or has been, an accredited reactor operator at a nuclear facility.

13.3.3 Reactor Maintenance Leader

The Reactor Maintenance Leader has a minimum of five years of relevant professional experience or has assessed equivalent experience and capability and possesses a university qualification in engineering. The Reactor Maintenance Leader is familiar with instrumentation, electrical and mechanical systems maintenance in a safety regulated industry.

13.3.4 Reactor Utilisation Leader

The Reactor Utilisation Leader has a minimum of five years of relevant professional experience with at least two years in the nuclear industry or has assessed equivalent experience and capability. The Reactor Utilisation leader has a university qualification in engineering or science. The Reactor Utilisation Leader has knowledge of target and canning specifications, planning and scheduling of irradiations, and movement of irradiation targets and rigs.

13.3.5 Systems Engineering Leader

The Systems Engineering Leader has a minimum of five years of relevant professional experience or has assessed equivalent experience and capability. The Systems Engineering Leader has a university qualification in engineering or science, and has knowledge of nuclear system design and modifications, nuclear systems performance monitoring, and nuclear licensing and design bases documentation. The responsibility for updating the Safety Analysis Report resides with Systems Engineering.

13.3.6 Nuclear Analysis Leader

The Nuclear Analysis Leader has a minimum of five years of relevant professional experience or has assessed equivalent experience and capability. The Nuclear Analysis Leader has a university qualification in engineering or science. The Nuclear Analysis Leader has knowledge of reactor physics, criticality, radiation shielding, thermal/hydraulics, fuel design, and associated computer codes.

13.3.7 Other Support Staff

In general, requirements for reactor support staff are consistent with the role requirements and are identified in role profiles.

The Radiation Protection Adviser has professional experience in applied health physics and radiation protection and possesses a university qualification in engineering or science.

13.3.8 Shift Personnel

Reactor operators are accredited. Reactor operators have a minimum of one year of relevant experience in nuclear reactor operation and possess appropriate tertiary educational credentials equivalent to a technical certificate or higher.

For the commissioning and initial Reactor Facility operating period, reactor operators having specific experience in design, construction and development of the Reactor Facility operations systems, together with demonstrated competence in operation on the reactor control system simulator, will be considered to have experience equivalent to the requirement of one year relevant experience in nuclear reactor operation.

Subsequent to initial Reactor Facility operation, operators will have appropriate operational Reactor Facility experience prior to their application for accreditation. Accredited operators possess the skills, knowledge, and abilities to ensure the safe operation of the Reactor Facility. They have training in transients and accident analysis, including control and mitigation of beyond design basis accidents in which the core may be damaged.

The Shift Manager has reactor operator accreditation. The Shift Manager has relevant nuclear reactor operating experience. In addition to the knowledge and experience gained in reactor operation, the Shift Manager has sufficient experience and leadership competencies to ensure that the shift team carries out its collective responsibilities diligently and efficiently. Commensurate with IAEA guidelines the Shift Manager has extra skills that assist in the responsibility of leading the shift in carrying out normal operational duties and ensuring that if an abnormal event occurs that the Reactor Facility is maintained in a safe condition. The Shift Manager is competent in managing radioactive material handling operations, reactivity control manipulation, event response and OLC compliance.

In addition to the role-specific training required, personnel rostered on shift are provided additional training in the areas of health physics and emergency response. Shift personnel are fully capable of performing health physics duties at the Reactor Facility.

End of Section

13.4 TRAINING SYSTEM

13.4.1 Introduction

The safe and reliable operation of a nuclear facility depends, in large part, on personnel who understand the fundamentals of nuclear technology, in addition to the specific features of the facility. Personnel must be aware of, and have a healthy respect for the particular safety challenges posed by nuclear technology and be competent in their roles of supporting operation. Training of personnel is essential to the conduct of safe and reliable operations.

Training provides personnel with the knowledge and skills needed to perform their roles, a healthy respect for nuclear safety and radiation protection issues, and an awareness of the impact that actions have on safety and performance. It provides assurance that individuals have the capabilities needed to perform various assignments. The three components of training at the Reactor Facility are: induction, role-specific, and ongoing training.

Induction training familiarises new personnel with various aspects of nuclear technology in the specific operating environment. Personnel entering the organisation may have extensive education in their particular fields of study. The goal of induction training is to supplement this education by ensuring that new personnel gain the knowledge and skills needed in their roles. Induction training may include areas such as familiarisation, awareness, administration, reactor fundamentals and introductory facility systems training. Induction training provides individuals with knowledge of the following:

a) An overview of the fundamental nuclear science relevant to facility operation.

b) An understanding of basic design and operational characteristics of the facility.

c) An understanding of organisational functions and arrangements.

d) The need for a commitment to reactor safety and high standards.

e) The need to conduct work activities according to applicable regulations and procedures.

f) An understanding of generic issues applicable to all personnel at the facility.

One key element of induction training is safety culture awareness. Safety culture refers to that assembly of characteristics and attitudes which establishes that, as an overriding priority, nuclear safety issues receive the attention warranted by their significance. Safety culture has two general components. The first is the necessary safety management framework within the organisation, which is the responsibility of the senior management of the organisation. The second is the attitude of personnel at all levels in responding to and working within the framework. This training includes understanding of the importance of good safety culture and identification of its aspects and characteristics.

Role-specific training allows personnel to acquire the requisite knowledge and ability to support safe and efficient reactor operations. It includes a combination of classroom and on-the-job training to ensure that personnel obtain the necessary role-related competencies in the actual work environment. Practical training provides hands-on experience and allows trainee personnel to become familiar with facility characteristics and operating routines. Analysis, design, development, implementation and evaluation of training are performed to establish and deliver appropriate training required to achieve job competence for relevant Reactor Facility personnel.

Role-specific training provides those who support the operation of the Reactor Facility with the knowledge and skills to:

a) Perform assigned duties safely, effectively, and efficiently.

b) Contribute to the day-to-day teamwork necessary for successful operation.

c) Conduct assignments according to applicable standards, regulations, policies, and procedures.

Ongoing training maintains and enhances personnel performance and develops a broader scope and depth of position-specific knowledge and skills. In addition, continuing training keeps personnel current with respect to management expectations, facility modifications, procedural changes, operating experience, and technical advances associated with their roles.

A systematic approach to training (SAT) is used for the implementation of initial and ongoing training to ensure that job competence requirements are achieved. This systematic approach to training is used to maintain adequate job performance levels and keep them current. Using a systematic approach, training needs are identified. These needs are reflected in the development of training materials. A systematic approach addresses the following:

Staff roles.

Required training courses.

Competency requirements.

Pre-requisite experience - both academic and practical.

Pre-requisite training - both academic and practical.

Selection processes.

Formal certification requirements where appropriate.

Generic course management arrangements.

Competency tests.

On-going or refresher training, including accreditation renewal for reactor operators.
Training records.

Training validation and review.

SAT is used in the analysis, design, development and implementation of initial and continuing training. The SAT involves continuous evaluation to enhance job performance and meet the needs of the organisation. The training program is comprised of an appropriate combination of classroom instruction, simulator training, on-the-job training, laboratory and workshop training and supervised self-study.

Training is developed and conducted to be consistent with the recommendations of the Safety Guide “Recruitment, Qualification and Training of Personnel for Nuclear Power Plants” (IAEA NS-G-2.8, 2002). Training is directed to the achievement of personnel competence as part of ensuring safe operation of the Reactor Facility at all times.

13.4.2 Training for Reactor Operators

An important example of role-specific training is that which leads to the accreditation of reactor operators. Formal training for operators covers areas of technology to the levels necessary for their operational role. The training helps develop a thorough theoretical

and practical knowledge of plant systems, their function, layout and operation. Emphasis is placed on systems having safety significance. The training also emphasises the importance of maintaining the reactor facility within the licensing and design bases by ensuring that operation is in compliance with the Operational Limits and Conditions (OLC) and subordinate procedures and instructions.

Because reactor operators have the responsibility to control or supervise changes in the operational status of the reactor and have duties with a direct bearing on nuclear safety, they are accredited. Although all personnel require training, only Reactor Operators and Reactor Shift Managers need to be accredited. Having acquired accreditation, it is necessary for the operators and shift managers to be authorised to undertake operational duties by the Leader, Reactor Operations who must be satisfied that they are fit for duty. Their authorisation may be withdrawn from time to time at the discretion of the Leader, Reactor Operations without necessarily affecting their accreditation status. As part of their training and accreditation, reactor operating personnel accrue an extensive knowledge of reactor diagnostics and safety system operation.

13.4.2.1 Initial Classroom Training

Classroom training for reactor operators encompasses the general areas of reactor theory, reactor technology, facility-specific systems, operating procedures and administrative requirements as well as facility specific aspects such as transient and accident analysis. A summary of the required subject matter for each area is given below. The list is not intended to be definitive. Greater details are given in procedures.

Reactor fundamental training includes consideration of the fundamentals of nuclear physics and reactor theory. This includes the fission process, neutron multiplication, source effects, control rod effects, criticality indications, reactivity coefficients and reactor poison effects. Also included are reactor kinetics, radiological safety principles and procedures, radiation monitoring methods and survey equipment, principles of shielding, heat transfer, thermodynamics and fluid flow and materials technology.

Reactor Technology considers general design features of the core structures, Fuel Assemblies, control rods and Reactor Building as well as reactor control and instrumentation systems, safety systems, reactor cooling systems, auxiliary systems and Containment design features.

Facility specific systems includes experimental and isotope production facilities together with the Cold Neutron Source (CNS).

Operating principles include reactor operating characteristics during steady state and transient conditions, OLC, core management and reactivity control, chemistry control, fuel handling facilities and procedures, procedures for normal and off normal operating conditions, emergency plans and procedures, and the handling and disposal of radioactive materials and effluent.

Administrative requirements include: nuclear material accountability, planning and scheduling, operations, facility access control, radiation protection, security, operational records retention, and reporting.

Training is also provided in the areas of:

a) Procedures for design and operating changes to the facility

b) Radiation hazards that may arise during normal and abnormal situations, including maintenance activities and various contamination conditions

c) Assessment of facility conditions and selection of appropriate procedures during normal, abnormal, and emergency conditions

d) Procedures and limitations involved in initial reactor core loading, alterations in core configuration, control rod movement, and determination of various internal and external effects (including the effects of movement of irradiation rigs and targets) on reactivity

e) Transient and accident analysis

f) Instrument failure analysis

g) Core damage mitigation

h) Relevant regulatory requirements and codes/standards

The specific training syllabus for Reactor Operators is identified in the Reactor Facility Training Plan.

13.4.2.2 Initial Practical Training

Reactor operator candidates are trained using the simulator to the extent practicable. This training may include:

a) Performance of pre-startup procedures for the facility, including operating of those controls associated with equipment that could affect reactivity.

b) Manipulation of the console controls to operate the facility between shutdown and operating conditions.

c) Identification of alarms and condition-indicating signals and performance of appropriate remedial actions where appropriate.

d) Identification of the instrumentation systems and the significance of facility instrument readings.

e) Observation and safe control of the operating behaviour characteristics of the facility.

f) Performance of control manipulations to obtain desired operating results during normal, abnormal, and emergency situations.

g) Safe operation of the facility heat removal systems and identification of the relations of the proper operation of these systems to the operation of the facility.

h) Safe operation of the facility auxiliary standby and emergency systems, including operation of those controls associated with equipment that could affect reactivity or the release of radioactive materials to the environment.

i) The use and function of the facility radiation monitoring systems, including fixed radiation monitors and alarms, portable survey instruments, and personnel monitoring equipment.

j) Exercises in identification of significant radiation hazards, including permissible levels in excess of those authorised, and implementation of procedures to reduce excessive levels of radiation and to guard against personnel exposure.

k) Participation in Emergency Exercises to acquire knowledge of the Emergency Plan for the facility.

13.4.2.3 Ongoing Training

Ongoing training is necessary to maintain and enhance the level and currency of competence of reactor operators in terms of their knowledge, skills, and abilities. It is

carried out on a regular basis. Classroom training reinforces those aspects set out in 13.4.2.1. The Reactor Facility simulator is also used in the maintenance of proficiency.

As part of their ongoing training, operators receive instruction in supervisory skills and teamwork. The scope and depth of ongoing training is based on facility operating experience.

13.4.2.4 Evaluation Training Effectiveness

Reactor Operator training is evaluated for effectiveness in a variety of ways.

a) Written examinations and practical tests for initial accreditation

b) Written examinations which determine the Reactor Operator's knowledge of subjects in the ongoing training program and provide a basis for evaluating their knowledge of abnormal and emergency procedures

c) Systematic observation and evaluation of the performance and competency of reactor operators in the performance of their role, including evaluation of actions taken during actual events or following simulated abnormal and emergency events

Provisions may be made for participation in an accelerated training program when performance evaluations conducted in accordance with the above indicate the need.

13.4.3 Training of Other Personnel

In addition to personnel directly involved with operation of the Reactor Facility, other personnel perform roles which may have an impact on nuclear safety. These personnel undergo appropriate training as described in 13.4.1 above and are assessed for their competence prior to being authorised to perform their role. These personnel include the Reactor Physicist, and key maintenance and utilisation personnel. The assessment of the Reactor Manager and Section Leaders to perform their roles is undertaken as part of the recruitment and selection process for these positions.

Reactor Maintenance personnel undertake tasks on safety-related equipment and the potential exists for affecting the availability of those systems or impairing the performance of the safety function of those systems. In addition to specific system and component maintenance training, maintenance staff are appropriately trained in:

a) the design of systems and components, systems interfaces and interactions;

b) the OLC, Engineered Safety Features and Minimum Plant Configuration;

c) QMS procedural requirements, including plant isolations, danger tagging and safe work permits;

d) the potential safety implications on removal of systems for maintenance; and

e) human factors associated with the performance of maintenance work and return to service of items maintained, including particular attention on the impact of errors of omission and errors of commission.

The Reactor Physicist is responsible for performing calculations to determine core and irradiation configurations and to ensure compliance of those configurations with the OLC. Reactor Utilisation personnel undertake activities associated with the movement of fuel and irradiation targets in the facility pools, elevators and hot cells, as well as other tasks. These personnel are trained in the items above. They are also trained in the relevant procedural requirements, potential safety implications, and human factors-

related aspects of the performance of their roles, in addition to the specific training required for those roles, namely reactor physics calculations and utilisation activities.

The specific training syllabi for these personnel are identified in the Reactor Facility Training Plan.

13.4.4 Training for Emergencies

Special training is provided for Reactor Facility staff having assigned roles under the Emergency Plan. Additional information regarding the Emergency Plan and Emergency Training is provided in Chapter 20, Emergency Planning and Preparedness.

End of Section

13.5 REVIEW AND AUDIT

As part of the continuing operation of the Reactor Facility, measures are in place to review and audit the facility's operations. There are three basic levels of responsibility and control for this review and audit. They are the management, the Reactor Assessment Committee, and the Quality System.

13.5.1 Management

The safe operation of the Reactor Facility requires that the organisation be staffed by competent personnel who have the proper awareness of the technical and administrative requirements for safety. The staff should be imbued with a healthy safety culture. This culture, which is reinforced by day-to-day conduct, goes beyond the simple implementation of minimum requirements. Pervasive safety awareness is important for all who are involved in reactor operations. This pervasive safety approach is a key element in safety culture.

It is the responsibility of all levels of management within ANSTO to establish a safety culture and to develop the tools that enable this safety culture to permeate and take root in all activities, including the Reactor Facility operation.

13.5.2 Reactor Assessment Committee

The Reactor Assessment Committee (RAC) reviews issues of operational significance and advises the Reactor Manager regarding nuclear and radiation safety. The RAC chairman is in a reporting relationship distinct from that of the Reactor Manager, and is appointed in writing by the ANSTO Executive Director or nominee.

A quorum consists of five members, including the Chairman. Members are knowledgeable and are chosen judiciously by the Chairman so that the RAC has the capability to review issues in the areas of reactor operations, maintenance, instrumentation and control, engineering and radiation protection. The RAC is responsible for reviewing proposed changes that have potential for significant implications for safety; events and non-conformances of significance; and required reports to ARPANSA.

The RAC provides advice to the Reactor Manager and supports the process by which issues having significant implications for safety are referred to ARPANSA for review and approval. This advisory committee meets regularly and written minutes of the meeting are maintained.

13.5.3 Radiation Safety Committee

An ongoing review of the radiation protection program and radiation safety aspects of the Reactor Facility is performed through a Radiation Safety Committee. Details of operations of this Committee are provided in Section B: Plans and Arrangements, Radiation Protection.

13.5.4 Quality

ANSTO staff are responsible for performing Quality audits. These audits may be considered a form of self-assessment.

The ANSTO Quality System requires that planned and periodic audits be performed to verify compliance of activities affecting quality and to determine effectiveness. Personnel perform such performance-based audits on internal activities, as necessary, to provide

an objective evaluation of the effectiveness of their programs; to ensure that their programs are in compliance with established requirements, methods, and procedures; and to verify implementation of recommended corrective action.

ANSTO audits are conducted in accordance with established procedures. Procedures provide the means to assure that audits are performed in a thorough and professional manner. Audit checklists may be used to ensure that audits include the objective evaluation of work areas, activities, processes and items and the review of documents and records. It is a requirement that a formal report be prepared upon completion of each audit. The audit report identifies any deficiencies or non-conformances found during the audit, and recommends corrective actions.

End of Section

13.6 FACILITY DOCUMENTS

13.6.1 Introduction

The Quality Management System for the Reactor Facility which is ISO 9000 certified, includes arrangements for:

a) Operation, which takes account of the International Atomic Energy Agency (IAEA) Safety Requirements of Research Reactors (Draft DS272, September 2002).

b) Utilisation and modification, which uses IAEA guidance on the safe Utilisation and Modification of Research Reactors (IAEA Safety Series No.35-G2, 1994).

Facility documents required for safe reactor operation are available to relevant personnel. Such documents include the:

Safety Analysis Report.

Operational Limits and Conditions (incorporated into the SAR by reference).

Operating Manual (including Plant Operating Procedures and Instructions).

Systems Manuals (Design and Operation).

Testing and Inspection Plan, Plant Maintenance Manual and Systems Maintenance manuals.

Training Plan.

QA Plan.

Radiation Protection Plan.

Emergency Plan.

13.6.2 Plans

A number of high level operational plans support the operation of the Reactor Facility. These include:

Plan for Effective Control

Safety Management Plan

Radiation Protection Plan

Radioactive Waste Management Plan

Security Plan

Plan for Ultimate Disposal or Transfer

Environmental Management Plan and

Emergency Management Plan.

In addition to the above plans, Radiation Protection and Radioactive Waste Management are addressed in SAR Chapter 12 whilst Emergency Planning is addressed in SAR Chapter 20.

Maintenance, and Testing and Inspection Plans are discussed in Section 13.7.

13.6.3 Procedures

ANSTO's activities are governed by principles, policies and processes. In addition to ensuring safety, site-wide documentation aims to achieve efficiency, effectiveness and consistency in all of ANSTO's activities. These principles, policies and processes are generally applicable to all of ANSTO, including the Reactor Facility.

Written procedures and supporting instructions are established, implemented, and maintained covering activities that affect nuclear and radiation safety. The procedures include sufficient information to operate the reactor safely. Procedures are prepared in accordance with administrative guidance that governs the format, development, review, revision and control of such procedures. An approved set of written procedures is used to conduct facility operation and maintenance. Areas of Reactor Facility operation for which written procedures are available include:

Operations.

Emergency and Abnormal Operation.

Administrative.

Surveillance and Testing.

Maintenance.

Waste Handling, Chemistry, and Radiation Protection.

Reactor Utilisation.

Security.

Nuclear Material Accountability.

Procedures, and changes thereto, with implications for safety are reviewed by the Reactor Assessment Committee as part of the review process before final authorisation is granted by the Reactor Manager for implementation.

13.6.3.1 Operating Procedures and Operating Instructions

Facility operations are conducted in accordance with written operating procedures and operating instructions. The operating procedures cover the performance of integrated facility operations such as startup and shutdown as well as response to transients. The operating procedures may refer to specific operating instructions which are detailed step-by-step instructions for operating individual systems or specific components within a system.

13.6.3.2 Emergency and Abnormal Operating Procedures

Facility operation during abnormal conditions is governed by written procedures. These procedures are written such that the minimum shift complement of personnel can perform the immediate actions necessary to mitigate the event in progress.

13.6.3.3 Administrative Procedures

Administrative procedures provide general guidelines or policies related to the general administration, operation, utilisation and maintenance of the facility. These procedures receive the same level of control and review as operating procedures and instructions.

13.6.3.4 Surveillance and Test Procedures

Surveillance and test procedures are used to perform operations for the purpose of performance analysis. Much of the routine testing is performed by Reactor Operators.

13.6.3.5 Maintenance Procedures

Facility maintenance is conducted in accordance with written general maintenance procedures which provide guidelines to be followed by ANSTO personnel and contractors to ensure safety and quality control. Maintenance procedures are prepared in advance to cover foreseeable maintenance tasks which are performed routinely, such as preventative maintenance. Routine maintenance is carried out by Reactor Maintenance, other ANSTO divisions under QMS service level agreements and contractors. Maintenance procedures for infrequent tasks are written on an as-needed basis.

13.6.3.6 Waste Handling, Chemistry, and Radiation Protection Procedures

These procedures cover the surveillance, scheduling, and control of waste, chemistry, and radiation protection activities. These procedures receive the same level of control and review as operating procedures and instructions.

13.6.3.7 Reactor Utilisation Procedures

These procedures provide written instruction governing the surveillance, scheduling, and control of the Reactor Facility irradiation facilities. These procedures receive the same level of control and review as operating procedures and instructions.

13.6.4 Procedure Change Process

All proposed procedure changes are reviewed by an independent reviewer. The process calls for a competent person, independent of the preparer, to review the proposed change. In addition to being knowledgeable in the functional area affected, the Independent Qualified Reviewer has completed appropriate training. One of the primary purposes of this review is to assess any significant implications for safety. Proposed changes with the potential for significant implications for safety are also reviewed by the Reactor Assessment Committee.

End of Section

13.7 MAINTENANCE, TESTING AND INSPECTION

It is important that equipment needed to support the safe and reliable operation of the Reactor Facility be properly maintained and kept in good operating condition. Maintenance refers to those organised activities that do this, and includes both preventive and corrective maintenance. A preventive maintenance program is used to optimise equipment reliability. The overall maintenance program manages risks that may arise as a result of maintenance activities. The Reactor Facility design incorporates many desirable features such as defence-in-depth, redundancy, and testability. As such, routine testing and maintenance can be conducted during operation. The benefits of performing maintenance activities during power operations include increased system and facility availability, reduction of equipment and system material condition deficiencies that could adversely impact operations, and reduction of work scope during refuelling outages.

Programs for maintenance, testing, and inspection of structures, systems, and components required for nuclear safety are established and maintained. As holder of the licence to operate the nuclear reactor, ANSTO monitors the performance and condition of such systems, structures and components in a manner sufficient to provide assurance that they are capable of fulfilling their intended safety functions. It is important that high standards be applied to those systems, structures and components that are relied upon to remain functional during and following design basis events. This requirement is to ensure adequate core cooling and the integrity of the reactor coolant boundary, the capability to shut down the reactor and maintain it in a safe shutdown condition, or the capability to prevent or mitigate the consequences of accidents that could result in potential offsite doses.

Maintenance, testing, and inspection of safety systems is performed using approved procedures. The results of post-maintenance testing are reviewed by an authorised operator prior to restoring operability. Surveillance testing is conducted in accordance with Operational Limits and Conditions to ensure that selected systems, structures and components are capable of fulfilling their intended safety functions.

The maintenance, testing and inspection program addresses:

a) Systems, structures and components that are necessary for nuclear safety.
b) Inspection and testing criteria.
c) Maintenance, inspection and test intervals.
d) Responsibilities for inspection, testing and maintenance.
e) Maintenance, testing and inspection records.
f) Post-maintenance testing requirements.

Control over maintenance activities is provided to ensure that safety requirements are met. The maintenance, testing and inspection program is reviewed at regular intervals to incorporate the lessons learned from experience.

The performance of maintenance will not result in deliberate or unintentional design changes to the system being maintained. Procedures for implementation of a modification are followed if a maintenance activity requires a design change or indicates that a design change should be made.

Records of maintenance, testing and inspection conform to the requirements of the Quality System.

End of Section

13.8 PHYSICAL SECURITY

The physical security arrangements are developed by ANSTO in consultation with the Australian Safeguards and Non-proliferation Office.

The security system is designed to counter and discourage hostile actions by one or more persons inside or outside the facility.

High availability and reliability is designed into the system. The system is fully integrated with the Lucas Heights Science and Technology Centre security arrangements.

End of Section

13.9 RECORDS AND REPORTS

Records and reports are prepared as a routine part of operation. Records are kept of the Reactor Facility condition, changes in the reactor design, insertion and removal of flux monitors or samples, fuel movements, and abnormal occurrences. Care is exercised to avoid accumulation of irrelevant or unimportant data so as not to obscure important information. To the extent practicable, information is concentrated or condensed in order to facilitate retrieval and storage. ARPANSA reporting requirements are identified in Standard Licence Conditions.

13.9.1 Outline of Record Contents

13.9.1.1 Operating logs

Operating logs document all significant events that occur during Reactor Facility operation. The principal log of record is the Main Control Room logbook.

13.9.1.2 Modifications

A record of every modification to the Reactor Facility is kept. The record includes a description of the modification and the impact on safety.

13.9.1.3 Movement of Nuclear Fuel

Movement of nuclear fuel is described in this record and includes:

(a) Entrance/removal of new or spent Fuel Assemblies to/from the Reactor Building and storage in the Fuel Room.

(b) Changes in position within the reactor core grid.

(c) Loading/unloading of new or spent Fuel Assemblies into/from the reactor core grid.

(d) Loading/unloading of new or spent Fuel Assemblies into/from the Reactor Pool storage racks.

(e) Transfer to/from the Reactor Pool to the Service Pool.

(f) Loading/unloading in the Service Pool of spent Fuel Assemblies into/from storage racks.

Movement of associated nuclear materials is also recorded.

The records list the transfer operation and include a list of material stored at each location.

In addition, the movement of other relevant nuclear materials is documented and controlled per procedures.

13.9.1.4 Radiation Dose and Medical Examinations

Records of radiation dose to Reactor Facility staff and the results of medical examinations are retained.

13.9.1.5 Effluent and Environmental Monitoring

Records of liquid and gaseous effluent discharges are maintained.

13.9.1.6 Abnormal occurrence reports

Abnormal occurrences are recorded. A description of the occurrence or event and its effect on safety is included in the reporting and recording system.

13.9.1.7 Documents on Training

Documents generated within the required training programs are retained. Retention of such documentation complies with applicable requirements.

13.9.1.8 Storage and Retention

Records are stored during the lifetime of the Reactor Facility in accordance with regulatory requirements.

End of Section