



**ANSN THIRD ANNUAL MEETING
of the
Regional Advisory Safety Committee for Research
Reactors in Asia and the Pacific (RASCAP)
(EBP-ASIA)**

Hosted by the
Government of Indonesia
through the
Badan Tenaga Nuklir Nasional (BATAN)
Serpong, Tangerang Selatan, Indonesia
31 August-4 September 2015

Deshraju Rao
RRSS/NSNI
IAEA



Training and Qualification of Personnel for Research Reactors



Contents

- Introduction
- Research reactor staffing arrangements
- Training system
- Training programme for research reactor personnel
- Qualification and authorization of operating personnel
- Concluding remarks



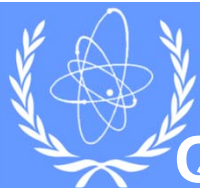
Introduction

- Safe and efficient operation of a research reactor require an operating organization with an organizational structure that is clearly specified, and staffed with qualified operating personnel who have a deep knowledge of the technical and administrative requirements for safety.
- Efficient training and retraining programme will help establish continuity of the organizational expertise as new operating personnel replace experienced ones.



Introduction: Feedback from the IAEA activities

- *The feedback from the events reported to the IRSRR indicated that operators errors is the one of the most important root causes of the incidents, representing about 40 % .*
- In relation to training and qualification, the feedback from the IAEA safety review services indicated that improvements are needed related to:
 - *Clear definition of the functions and responsibilities for key personnel (Reactor Manager, Director of the Reactor Operation Division, Reactor Supervisor);*
 - *Establishment of a dedicated training programme for every position in the organizational chart for operation;*
 - *Establishment of a formal retraining programmes.*



Introduction: IAEA Safety Guide on Training and Qualification for Research Reactor Personnel

The Safety Guide covers:

- The nature of the operating organization, and guidance on its establishment;
- The recruitment process for reactor personnel, including the required qualifications;
- The initial training and re-training programmes of reactor personnel;
- The authorization process for individuals whose duties have an immediate relation with safety.

IAEA Safety Standards for protecting people and the environment

The Operating Organization
and the Recruitment,
Training and Qualification
of Personnel for
Research Reactors

Safety Guide
No. NS-G-4.5





Staffing arrangements for research reactor operation

- Staffing arrangements for research reactor operation (including the definition of responsibilities of and the competencies necessary for each position) form the basis for defining the required qualification, initial training and retraining programmes.
- The key positions include the reactor manager, operation head, shift supervisor, operator, maintenance head and responsible for different maintenance groups, and radiation protection officers.
- In addition to the experimenters, other large research reactor organizations may include additional supporting personnel such as training officers and quality assurance officers.



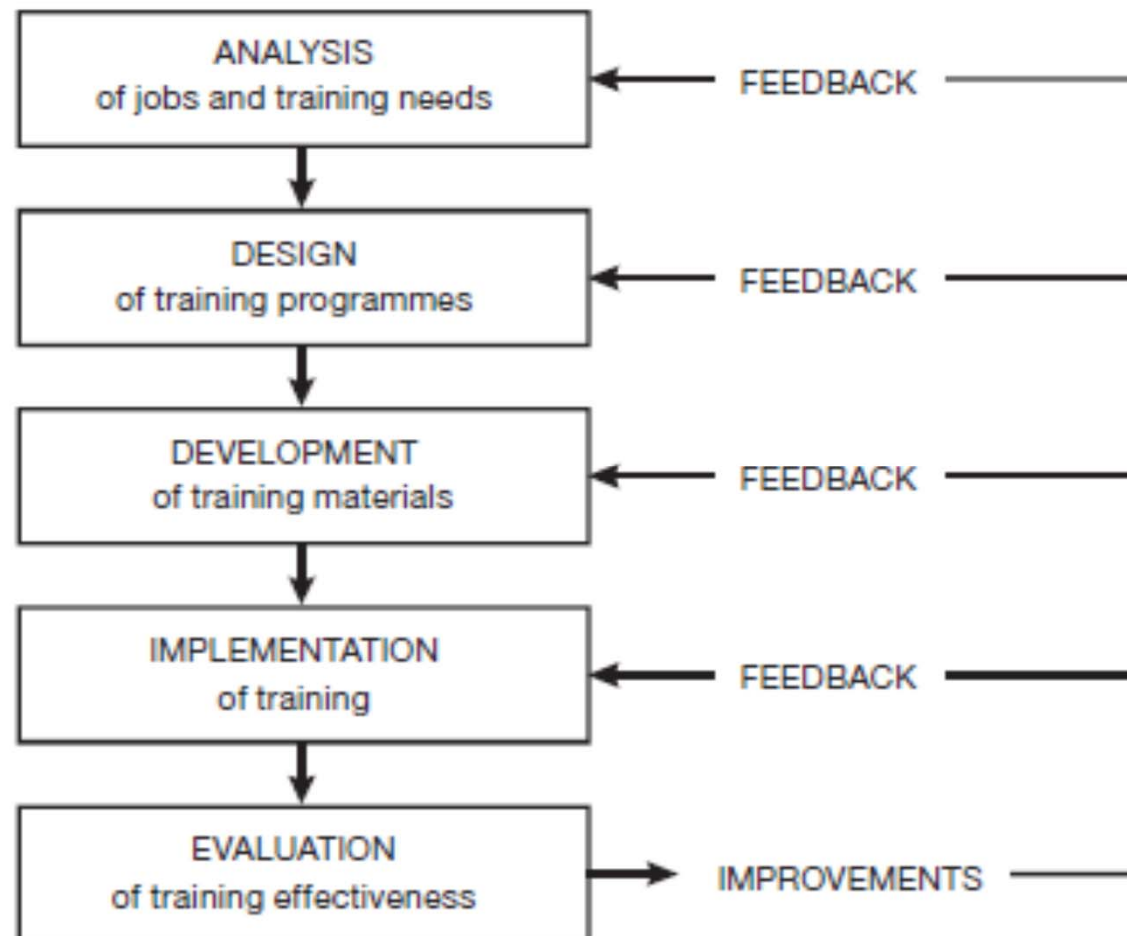
Staffing arrangements for research reactors

- In any case, when determining the organization chart and staffing of a research reactor, the need to ensure that all levels of the Defence in Depth concept are properly implemented. These include the need to ensure that:
 - *All reactor systems and components remain in accordance with their design intents, and all basic safety functions are met.*
 - *Radiation protection measures are implemented including minimizing and controlling radioactive releases to the environment, and conducting activities in accordance with the requirements of the quality assurance programme;*
 - *The adequate emergency preparedness are established;*
 - *The necessary arrangements are established for performing additional services such as fuel management, performing in-service inspections, and modifying special items.*



Training system: Systematic Approach to Training (SAT)

- SAT was initially introduced for preparation, implementation, and evaluation of the training programme and trainees at NPP.





Training system

- Training methods:
 - *Classroom instructions;*
 - *Self-study (guidance from a designated expert);*
 - *Laboratory/workshop training;*
 - *On-the-job training.*
- Training materials:
 - *Subjects relevant text books;*
 - *Facility documents (SAR, OLCs, emergency plan, operating procedures, etc.);*
 - *IAEA publications.*
- Trainers: Specialists that have been trained to provide training, including senior staff of the facility.



Initial training programme

- Although some of the required competences are common, separate training programmes should be established for each position.
- It is a common practice to have two courses:
 - *Knowledge of nuclear fundamentals (which is commonly divided in several modules, and is reactor type/size independent)*
 - *Facility specific knowledge.*
- The training duration depends on the reactor design and complexity, well as on the experience and education background of the trainees.



Initial training programme

- **Knowledge on nuclear fundamentals- Example:**

1. Fundamentals of nuclear physics
 - 1.1. Quantities, units and symbols
 - 1.2. Structure of the atom and radioactive decay
 - 1.3. Interaction of radiation with matter
2. Reactor physics
3. Energy release and thermohydraulics
4. Fundamentals of reactor engineering and reactor safety
5. Radiation protection
6. Occupational safety
7. Statutory bases
 - 7.1. National regulations and international codes and standards
 - 7.2. Radiation protection regulations



Initial training programme

- **Facility Specific Knowledge - Example**

1. Facility engineering
 - 1.1. Buildings and equipment
 - 1.2. Layout, operating modes and functions of the reactor equipment
 - 1.2.1. Reactor core, tank and/or pool and internals
 - 1.2.2. Reactor cooling system
 - 1.2.3. Reactor control
 - 1.2.4. Control rod drives
 - 1.2.5. Reactor protection system
 - 1.2.6. Reactor containment system or means of confinement
 - 1.2.7. Instrumentation and control systems, including alarm systems
 - 1.2.8. Reactor auxiliary systems
 - 1.2.9. Conventional service systems
 - 1.2.10. Cooling water systems
 - 1.2.11. Electric power supply systems and distribution systems
 - 1.3. Control room
 - 1.3.1. Control room and auxiliary control stations
 - 1.3.2. Control room engineering
 - 1.3.3. Computer systems



Initial training programme

- **Facility Specific Knowledge: Example (Cont.)**

2. Facility operation
 - 2.1. Facility control
 - 2.2. Core management
 - 2.3. Abnormal operating events
 - 2.3.1. Malfunctions of important facilities
 - 2.3.2. Anticipated operational occurrences and incidents
 - 2.3.3. Unforeseen event sequences
 - 2.4. External events
 - 2.5. Radiation protection and monitoring
 - 2.6. Environmental monitoring
 - 2.7. Facility chemistry
 - 2.8. Access control
3. Administrative requirements
 - 3.1. Conditions imposed and directives issued by the authorities
 - 3.2. Operating manual
 - 3.3. Organization of operation
 - 3.3.1. Control room and shift duty rules
 - 3.3.2. Alert plans
 - 3.3.3. Other operating rules



Re-training programme

- The objective is to ensure that the knowledge, skills, and attitudes of the reactor operating personnel are maintained. Duration is normally ranges from one to two weeks per year.
- The programme could include:
 - *Tasks that are infrequently performed or that are difficult to perform;*
 - *Exercises on the emergency procedures;*
 - *Changes in the reactor safety documents;*
 - *Recent changes made to the reactor systems and equipment;*
 - *Changes in the operating procedures;*
 - *Operating experience feedback from events occurred in the facility and other facilities;*
 - *Refreshment on selected topics from initial training programme.*



Qualification and authorization of personnel

- Upon completion of the training programme, the reactor management should make an assessment of the trainees before applying for or applying to perform the duties of the position.
- Individual(s) from the operating organization with specific knowledge of the reactor manager duties can make the assessment of the reactor manager.
- A qualification examination can consist of one or more of the following:
 - *Assessment of knowledge of the facility by means of written examination;*
 - *Assessment of practical skills (by means of performance demonstration);.*
 - *Oral examination (may be a part of a facility walkthrough);*
 - *Assessment of the performance under stress (e.g. under simulated emergency conditions).*



Qualification and authorization of personnel

- The regulatory body may conduct the qualification examination and issue a license. Alternatively, the operating organisation may be responsible for conducting the examination possibly with the presence of the regulatory body.
- *“The reactor manager, the shift supervisors and the reactor operators shall hold a license or certification issued by an appropriate authority”*
- *Each authorization should be facility and position specific. Only individuals holding specific authorization are allowed to operate the reactor.*
- *To maintain an authorization, an individual should perform the duties of the authorized position on a regular basis. If it is not the case. Reauthorization is needed in same cases if the licensee was a way from the job for a certain period (typically 3- 6 months).*

**Thank you for your
kind attention!**



This activity is conducted by the IAEA, with funding by Japan, among others. The views expressed in this presentation do not necessarily reflect the views of Japan.