Third Annual Meeting of the Regional Advisory Safety Committee for Research Reactors in Asia and the Pacific (RASCAP)

Presented by

Dr. Jahanara Begum

Nuclear Safety & Security Division

Bangladesh Atomic Energy Regulatory Authority

- **Previously** Nuclear Safety and Radiation Control Division (NSRCD) was a division under BAEC.

- Under this division Nuclear Safety and Radiation Control Act-1993 and Nuclear Safety and Radiation Control Rule-1997 were established for peaceful uses of atomic energy and to regulate all activities of nuclear and radiation facilities.

- To strengthen the peaceful use of nuclear activities and for the establishment of the first nuclear power plant in Bangladesh in accordance with national and international standards and requirements, the NSRC Act-1993 was repealed and a new Act entitled Bangladesh Atomic Energy Regulatory (BAER)Act-2012 has been passed by the National Parliament on 19 June, 2012.

- According to section- 71 of the BAER Act-2012 NRSCD of BAEC which was formerly responsible for the implementation of NSRC Act and Rules, has been dissolved and a new independent authority named

"Bangladesh Atomic Energy Regulatory Authority" was formed under section-4 of BAER Act on 12 February 2013.

Bangladesh Atomic Energy Regulatory Authority, (BAERA) has been established.

Basis of Regulatory Infrastructure

Legal Basis

1. Bangladesh Atomic Energy Regulatory Act-2012(Act no 19 of 2012)

2. Nuclear Safety and Radiation Control (NSRC) Rules-1997

Regulatory Authority Under the BAER Act 2012

- An Act entitled "Bangladesh Atomic Energy Regulatory Act-2012" has been drafted on the basis of IAEA Handbook of Nuclear Law and existing NSRC Act-1993 with consultation of International Atomic Energy Agency (IAEA), Russian Federation and National Expert. A total of 74 clauses have been incorporated in the BAERA Act – 2012.

- As per section-4 of BAER Act-2012, an independent regulatory body entitled “Bangladesh Atomic Energy Regulatory Authority (BAERA)” has been established on 12th February 2013.

- Provisions of the BAERA Act-2012 cover nuclear safety, security and safeguard of nuclear as well as radioactive material and also ensure civil liability for nuclear damage in the event of an accident.

Sections of BAER Act-2012 regarding Safety, Security and Safeguards

Section 11- Responsibilities and Functions of the Authority

Section 23- Responsibilities of the Authorization Holder

Section 29- Safety and Security of Radioactive Materials

Section 33- Physical Protection of Nuclear Material and Installation

Section 34- Safeguards and Import & Export Control

Section 35- State System of Accounting for and Control of Nuclear Material (SSAC)

Section 36- Information Requirements Additional to Material Accounting and Control

Section 37- Illicit Trafficking

The objective of the act is :

- To establish an independent regulatory authority for regulating nuclear safety and radiological protection
- to ensure the protection of human life, health and living conditions of both present and future generations, the environment and property from the harmful effects of ionizing radiation
- To ensure safety and security of nuclear material and radiation sources.
- to enable Bangladesh meet its international obligations on the peaceful uses of nuclear energy.

Some Key Elements of the BAER Act-2012

- Establishment of Independent Regulatory Body
- Authorization Process
- Radiation Protection
- Safety and Security of Radioactive Materials
- Nuclear Safety
- Physical Protection of Nuclear Material and Installation;
- Safeguards and Import and Export Control

Some Key Elements of the BAER Act-2012

- State System of Accounting for and Control of Nuclear Material (SSAC)
- Transport and Waste Safety
- Emergency preparedness and Response
- Nuclear liability and coverage, etc.
- Inspection and Enforcement
- Offense, Trial and Penalty

List of Proposed Regulations under BAER Act-2012

- Vide section -69 of BAER Act-2012, there is a provision to prepare more than 30 nos of different regulations.

- Among these initially following regulations will be prepared as a priority.

Based on priority Under the BAER Act-2012 following draft Regulations are under process

1. Regulations on the Safety of nuclear Installation-Site Evaluation
2. Regulations for Authorization Process of nuclear Installation(s)
3. Regulations on the Safety of nuclear Power Plant (NPPs)- Operation
4. Regulation on Radiation Protection
5. Regulations on Radiation Facilities other than Nuclear Installations Licensing

Based on priority Under the BAER Act-2012 following draft Regulations are under process

6. Regulations on Management of a Nuclear or radiological Emergency

7. Regulations on the Safety of nuclear Installation-Design

8. Regulation on Safe Transport of Radioactive Material

9. Regulations on the Safety and Security of Radioactive Materials, Nuclear Material and Safeguards

10. Bangladesh Atomic Energy Regulatory Authority Service Regulations (already submitted to ministry for approval)

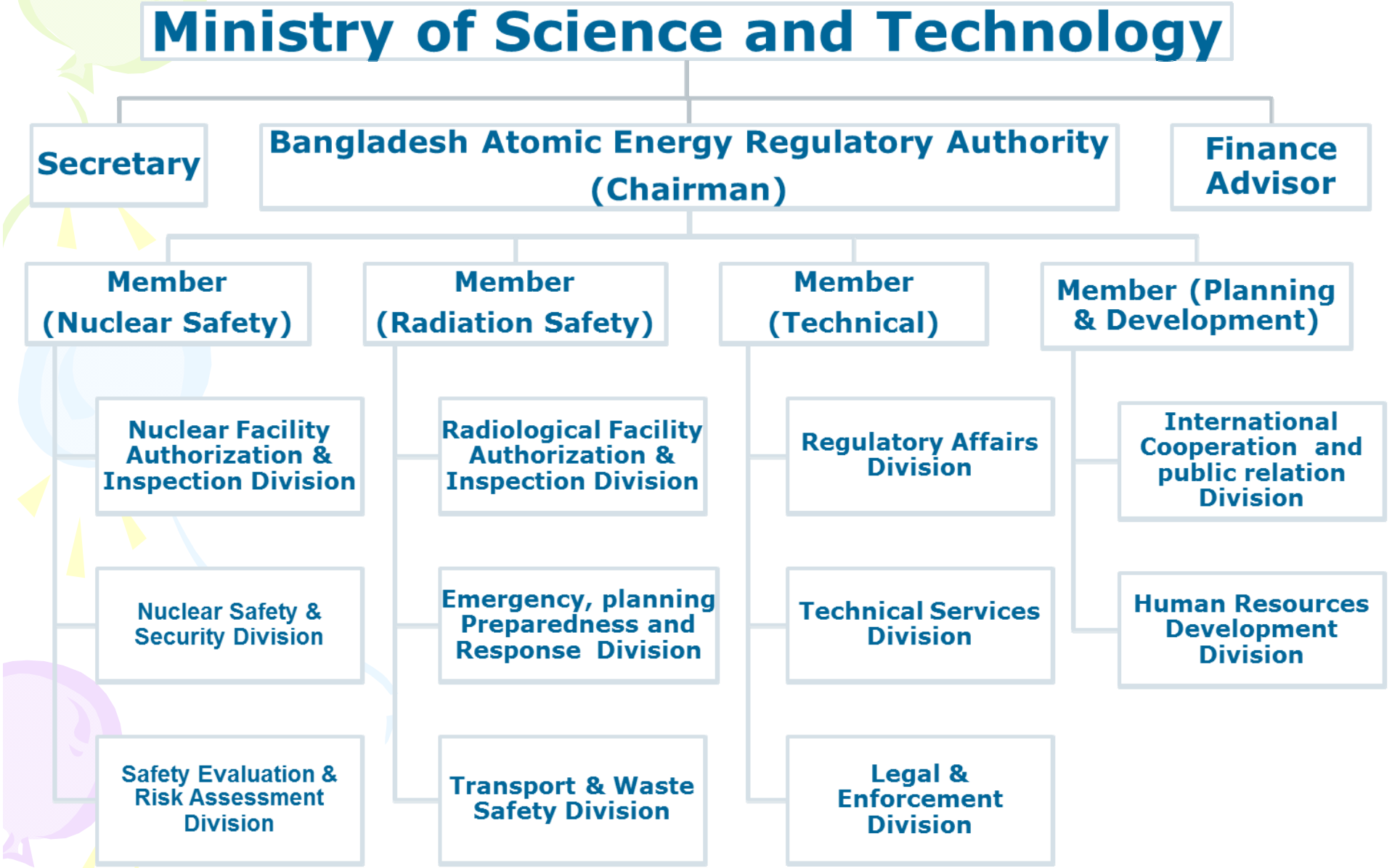
Manpower

Existing Manpower

- Total Manpower : 62
- Technical : 23
- Non-Technical : 39

Proposed Organogram for BAERA

Total Proposed manpower-360



Current Regulatory Inventory Status

Nuclear Installation

- 1 TRIGA Mark II Research Reactor (3 MW)
- 1 Central Waste Processing and Storage Facility

Radiation Facility

- 3700 X-ray Installations which have 3700 units of CT Scanner, fixed and portable X-ray machines, OPG, Mammography, etc.
- 14 Radiotherapy Facilities have 09 units Co-60 Teletherapy machines and 09 LINAC machines
- 18 Nuclear Medicine Facilities
- 03 Co-60 Irradiation facilities
- 69 Industrial practices (NDT, Well-logging, Nucleonic Gauge)
- 12 Research and Education facilities
- 1 Beach Sand Minerals Exploitation Centre (Pilot Plant)

Nuclear Facilities, Nuclear Materials and Radioactive Sources in Bangladesh

TRIGA MARK-II Research Reactor

Radioactive Waste Management

Co-60 Gamma Irradiator at IFRB

Co-60 Gamma Irradiator at IRPT

Regulatory Supervision:

Documents reviewed by the regulatory body:

(1) SAR of the Reactor Facility

(2) RCO report

(3) Annual report

(4) Authorization

(4) All operational records of the RR, such as –

- Console log book,
- Instrument log sheets,
- Startup and shutdown checklists,
- Various reports in connection with the evaluation of Miscellaneous incident reports, ISI data, etc. safety of in-core experiments

Regulatory Authority meet every quarterly with the reactor operation and maintenance groups

IAEA Safety Standards

Safety of Research Reactors

Safety Requirements No. NS-R-4

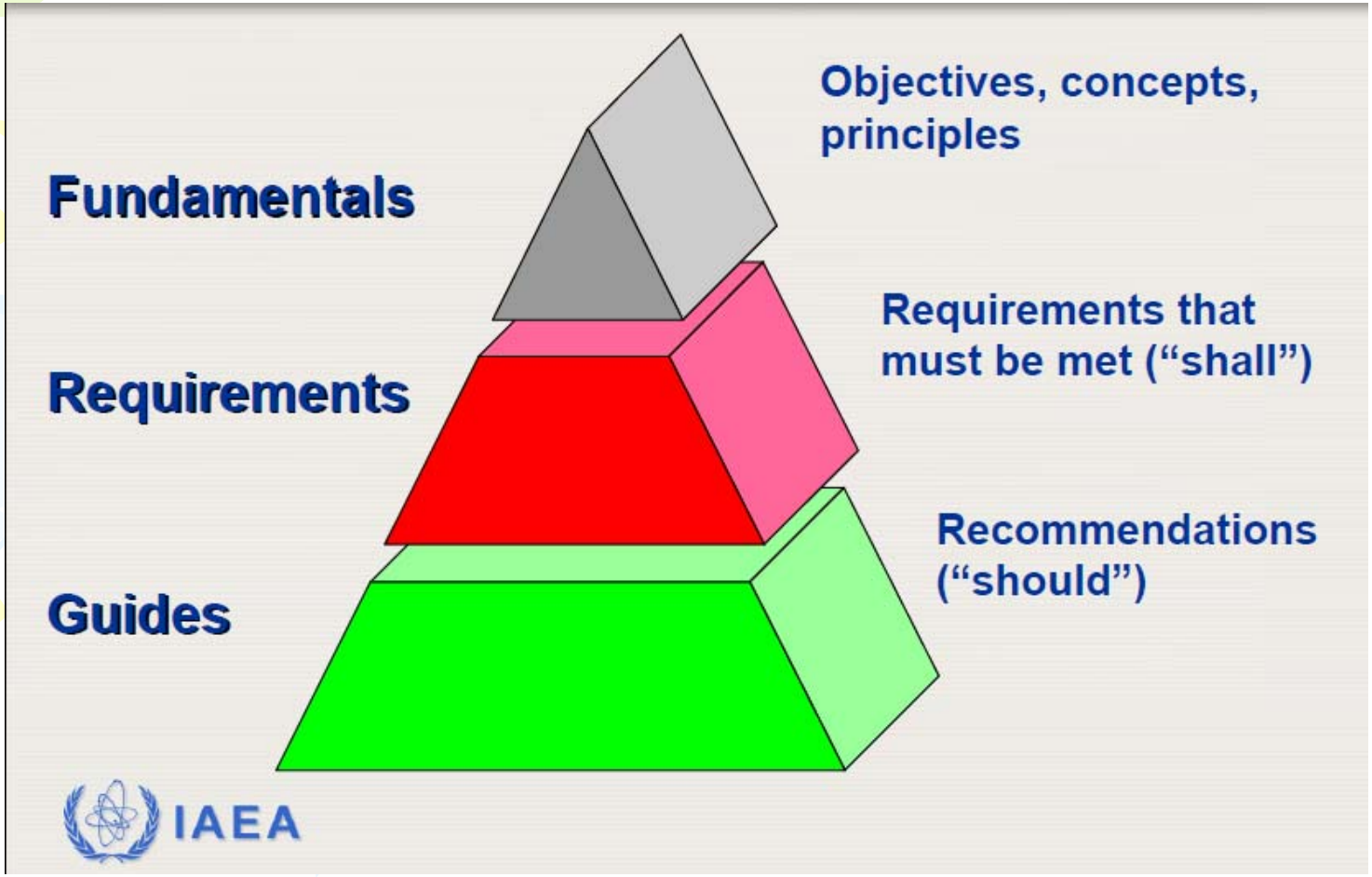
- **The safety standards reflect an international consensus on what constitutes a high level of safety for protecting the people & the environment**
- **IAEA safety standard series:**

- Safety fundamentals: Presenting the objectives, concepts and principles of protection and safety and providing the basis for the safety requirements

- Safety requirements: Establishing the requirements that must be met to ensure the protection of people and the environment. The requirements which are expressed as 'shall' statements.

- Safety guides: Providing recommendations and guidance on how to comply with the safety requirements. Recommendations in the safety guides are expressed as 'should' statements.

Safety Standards Series hierarchy



- There are three safety objectives:

- General Nuclear Safety Objective: To protect individuals, society and the environment from harm by establishing and maintaining in nuclear installations effective defences against radiological hazards.

- Radiation Protection Objective: To ensure that in all operational states radiation exposure within the installation is kept below prescribed limits and as low as reasonably achievable, and to ensure mitigation of the radiological consequences of any accidents

- Technical Safety Objective : To take all reasonably practicable measures to prevent accidents in nuclear installations and to mitigate their consequences should they occur.

Although measures are taken to limit radiation exposure in all operational states to levels that are as low as reasonably achievable and to minimize the likelihood of an accident, there will remain a probability that an accident might happen. Measures are therefore taken to ensure that the radiological consequences of any accident that might happen are mitigated. Such measures include : engineered safety features, on-site procedures established by the operating organization, and possibly also off-site intervention measures put in place by the appropriate authorities to mitigate radiation exposures if an accident does occur.

Safety Concepts & Principles

- The safety philosophy that is followed to fulfil the objectives relies on the defence in depth concept and on safety principles. The safety principles encompass three areas. Defence in depth, management issues and technical issues.
- Concepts of defence in depth:

  The concepts of defence in depth, as applied to all activities for safety, whether organizational, behavioural or design related, ensures that they are subject to overlapping provisions so that if a failure were to occur, it would be detected and compensated for or corrected by means of appropriate measures.
- Application of the concept of defence in depth throughout design and operation provide a graded protection over a wide variety of transients, and anticipated operational consequences and accidents.
- Application of the concept of defence in depth in the design of the research reactor provides a series of levels of defence which are aimed at preventing accidents and ensuring appropriate protection in the event that prevention fails.

- First level of defence : The aim of the first level of defence is to prevent deviations from normal operation and to prevent system failures.
- Second level of defence : The aim of the second level of defence is to control deviations from operational states so as to prevent anticipated operational occurences from escalation to accident conditions.
- Third level of defence : For the third level of defence, it is assumed that, although very unlikely, the escalation of certain anticipated operational occurrence or postulated initiating events may not be arrested by a preceding level of defence and a more serious event may develop. These unlikely events are anticipated in the design basis for the research reactor and inherent safety features, fail-safe design, additional equipment and procedures are provide to control their consequences and to achieve stable and acceptable states of the nuclear installation following such events.
- Fourth level of defence : The aim of the fourth level of defence is to address beyond design basis accidents (BDBAs) in which the design basis may be exceeded and to ensure that radioactive releases are kept as low as practicable. The most important objective for this level is the protection of the confinemnet function.
- Fifth level of defence : The fifth and final level of defence is aimed at mitigation of the radiological consequences of potential releases of radioactive material that may result from accident conditions.

Legislative and regulatory infrastructure

- For a nuclear installation a legal infrastructure is required to be established that provides for the regulation of nuclear activities and for the clear assignment of responsibilities for safety. Government is responsible for the adoption of legislation that assigns ***the prime responsibility for safety to the operating organization*** and establishes a regulatory body responsible for a system of licensing, for the regulatory control of nuclear activities and for the enforcement of the regulations. The three principles are (Ref: IAEA, The Safety of Nuclear Installations, Safety series no 110) :

  1. The government shall establish a legislative and statutory framework for the regulation of nuclear installations. There shall be a clear separation of responsibilities between the regulatory body and the operating organization.

  2. The prime responsibility for safety shall be assigned to the operating organization

  3. The regulatory body shall be effectively independent of the organization. iT shall have licensing, inspection and enforcement responsibilities and shall have adequate authority, competence and resources to fulfill its assigned responsibilities. No other responsibility shall jeopardize or conflict with its responsibility for safety.

MANAGEMENT OF SAFETY

2.11. Management of safety encompasses all the principles pertaining to general management, including management of personnel, that form the basis for the measures required to ensure that an acceptable level of safety is maintained throughout the lifetime of the installation, including decommissioning. The starting point for the management of safety is the senior managers of all organizations concerned. "The principles of safety management broadly apply to all organizations. Thus, the practices described for the operating organization apply, where relevant, to other organizations with safety responsibilities" (Ref. [1], para. 402). The principles for the management of safety are established in Section 4 (Principles 4–8) of Ref. [1] and are reproduced below:

"(4) *Organizations engaged in activities important to safety shall establish policies that give safety matters the highest priority, and shall ensure that these policies are implemented within a managerial structure having clear divisions of responsibility and clear lines of communication.*

"(5) *Organizations engaged in activities important to safety shall establish and implement appropriate quality assurance programmes* [see footnote 14] *which extend throughout the life of the installation, from siting and design through to decommissioning.*

"(6) *Organizations engaged in activities important to safety shall ensure that there are sufficient numbers of adequately trained and authorized staff working in accordance with approved and validated procedures.*

"(7) *The capabilities and limitations of human performance shall be taken into account at all stages in the life of the installation.*

"(8) *Emergency plans for accident situations shall be prepared and appropriately exercised by all organizations concerned. The capability to implement emergency plans shall be in place before an installation commences operation.*"

Review and assessment by the regulatory body

3.11. A review and assessment of the information (usually in the form of a SAR) submitted by the operating organization in support of its licence application shall be performed by the regulatory body to determine whether the proposed facility can be sited, constructed, commissioned, operated, utilized, modified and decommissioned without undue radiological risks to the personnel at the site, the public and the environment. The review and assessment shall be performed in accordance with the potential magnitude of the hazard associated with the research reactor (see also paras 1.11–1.14). Within this general aim, the review and assessment shall have the following specific objectives:

(a) To determine whether the site is adequate for the type, power and usage of the proposed research reactor facility.
(b) To determine before construction whether the proposed design of the facility (systems or modifications) meets the regulatory body's requirements and to impose any further requirements or conditions that may be deemed necessary by the regulatory body.
(c) To determine whether the applicant has the ability, reliability, resources, organizational structure and competent personnel to meet the regulatory requirements; in particular, whether the personnel requiring a licence at the research reactor facility have been appropriately and adequately trained and have been licensed.
(d) To determine whether the construction remains consistent with the regulatory body's requirements.

(e) To determine whether the commissioning programme is adequate and whether its results conform to the intentions in the design.

(f) To determine whether the OLCs, including the actions required to be taken when a safety limit or a limiting condition is violated, are justified and consistent with the regulatory requirements and whether an adequate level of operational safety can be ensured.

(g) To determine whether the operation, utilization and procedures for modification of the facility meet the requirements of the regulatory body.

(h) To determine whether the proposed decommissioning process meets the regulatory requirements.

(i) To ensure that all design and operational activities are conducted in such a way as to facilitate ultimate decommissioning.

(j) To ensure that financial instruments for decommissioning are put in place.

(k) To determine whether periodic summary reports and incident reports are in accordance with the regulatory requirements.

(l) To determine whether systematic safety reassessments are sufficiently comprehensive and whether account is taken of operating experience and new safety related information.

4. MANAGEMENT AND VERIFICATION OF SAFETY

RESPONSIBILITIES OF THE OPERATING ORGANIZATION

General

4.1. The operating organization shall have the prime responsibility for the safety of the research reactor over its lifetime, from the beginning of the project for site evaluation, design and construction, through to commissioning, operation, utilization, modification and decommissioning. In order to ensure rigour and thoroughness at all levels of the staff in the achievement and maintenance of safety, the operating organization shall:

(a) Establish and implement safety policies and ensure that safety matters are given the highest priority;
(b) Clearly define responsibilities and accountabilities with corresponding lines of authority and communication;
(c) Ensure that it has sufficient staff with appropriate education and training at all levels;
(d) Develop and strictly adhere to sound procedures for all activities that may affect safety, ensuring that managers and supervisors promote and support good safety practices while correcting poor safety practices;
(e) Review, monitor and audit all safety related matters on a regular basis, implementing appropriate corrective actions where necessary;
(f) Be committed to safety culture on the basis of a statement of safety policy and safety objectives which is prepared and disseminated and is understood by all staff.

- VERIFICATION OF SAFETY
- Safety assessments :

  A comprehensive safety assessment shall be carried out by the operating organization to confirm that the design meets the safety requirements . The basis for this assessment shall be the data derived from tha safety analysis as well as information from the other sources.

- Safety Committees :

One or more reactor advisory groups or safety committees that are independent of the reactor manager shall be established to advise the operating organization on (a) relevant aspects of the safety of the reactor and the safety of its utilization and (b) on the safety assessment of design, commissioning and operational issues.

- Application of the IAEA safety standards will help member states to achieve the highest level of safety

- The IAEA programme on research reactors/NPPs operational safety gives priority to the development and promotion of proper use of the IAEA safety standards, through :

  – Assistance to member states in application of the safety standards
  – Conduct of safety review missions and training activities based on the safety standards

Concluding Remarks

* We are moving forward to develop competency and resources for an effective independent nuclear regulatory authority, the Bangladesh Atomic Energy Regulatory Authority.

* Bangladesh is firmly committed to ensure Nuclear Safety, Security and Safeguards implementation for all of its nuclear and radiological materials and facilities. More efforts are needed in the coming years to establish nuclear safety & security culture at national level. Bangladesh needs help from international bodies and its strategic partners, especially for Human Resource Development in the areas of Nuclear Safety, Security & Safeguards.

* Bangladesh desires cooperation from the IAEA and the other bilateral partners in a coordinated way (soft coordination) to expedite legal and regulatory framework development for building 2000 MW(e) Nuclear Capacity by 2020 – 2021 in a safe and cost-effective manner.

Our honorable Prime Minister Sheikh Hasina lays the foundation stone of the first phase work of the Rooppur Nuclear Power Plant on 2nd of October 2013 in Ishwardi Pabna, 161 kilometres (100 miles) north of Dhaka.

Thank you all !