

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

31 August - 04 September 2015
Serpong, Indonesia

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Atomic Energy Research Establishment

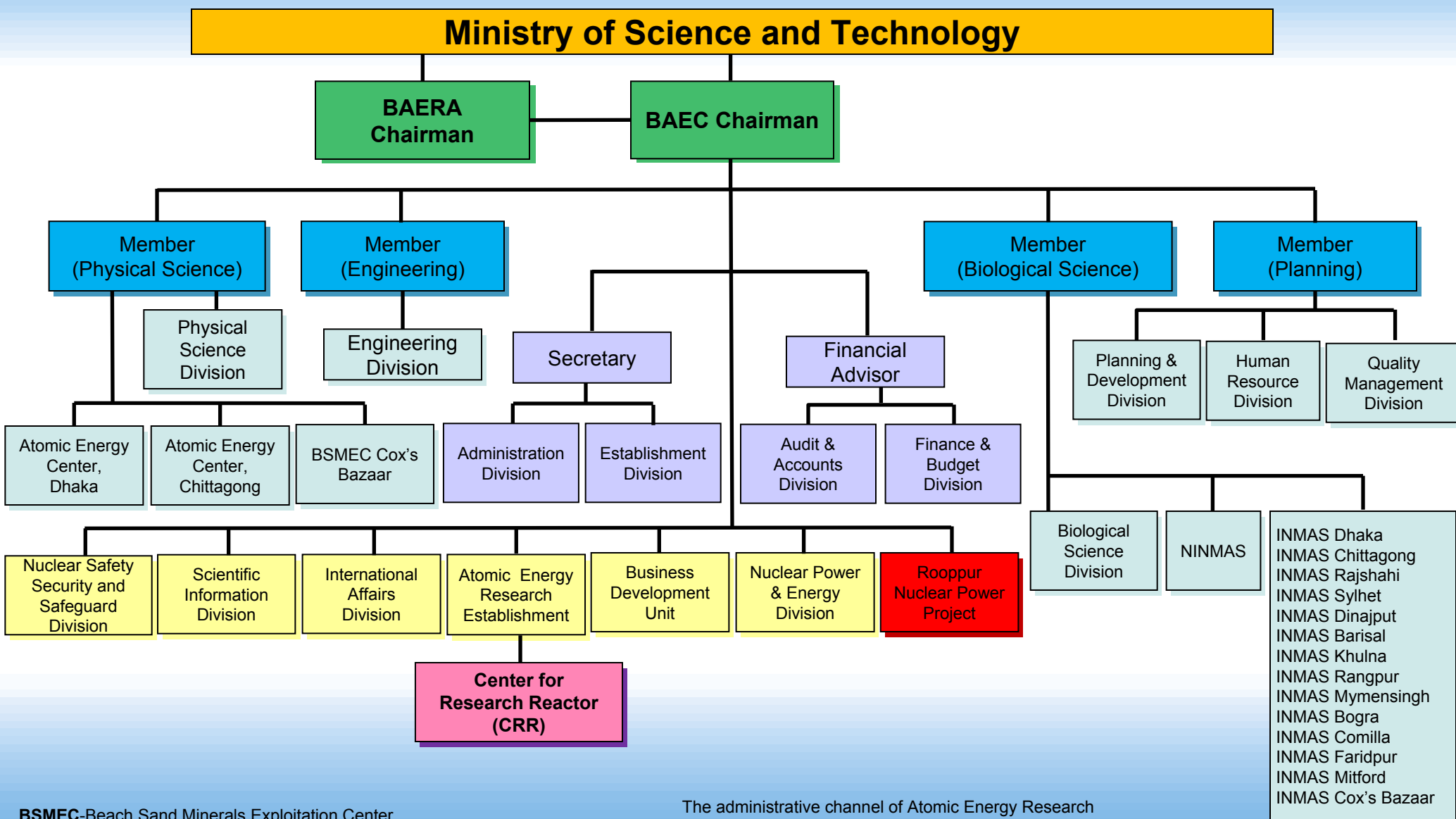


Bangladesh Atomic Energy Commission

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Organization: BAEC Organogram



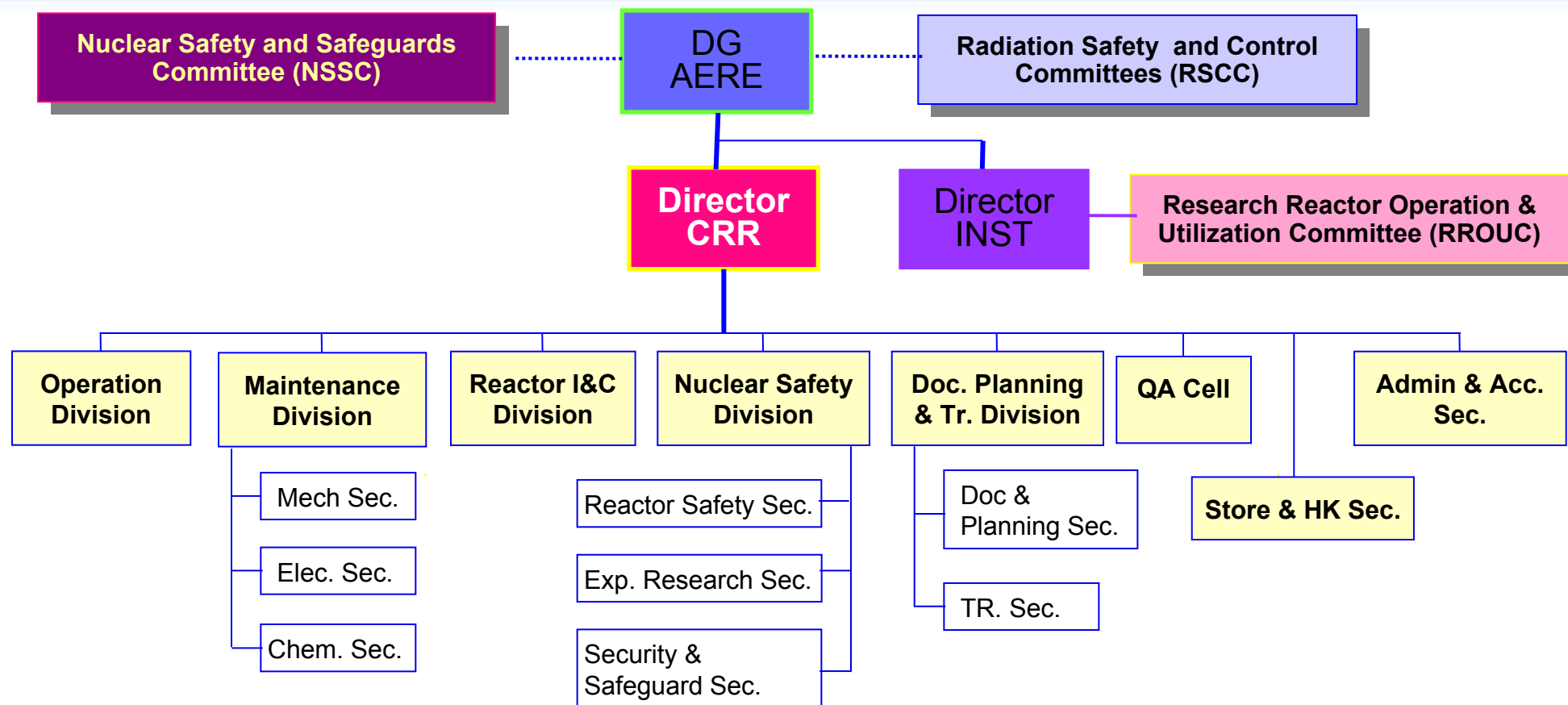
BSMEC-Beach Sand Minerals Exploitation Center

NINMAS-National Institute of Nuclear Medicine and Allied Sciences

INAMS-Institute of Nuclear Medicine and Allied Sciences

The administrative channel of Atomic Energy Research Establishment (AERE) is directly linked to the Chairman, BAEC and the channels for R&D activities of AERE are linked to the respective Member of BAEC.

Organization Structure of Center for Research Reactor (CRR)



AERE : Atomic Energy Research Establishment
INST : Institute of Nuclear Science & Technology

Overview of BTRR



**Reactor
Building**

Overview of BTRR...

BAEC 3 MW **TRIGA** Mark-II Research Reactor



Training
Research
Isotope production
General **A**tomics

Shield Structure of the **TRIGA** Reactor

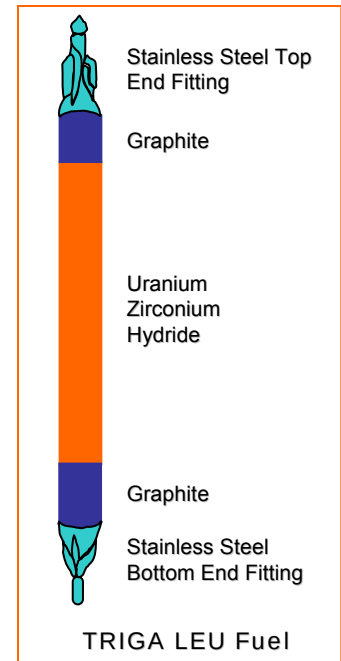
Overview of BTRR...

Brief History:

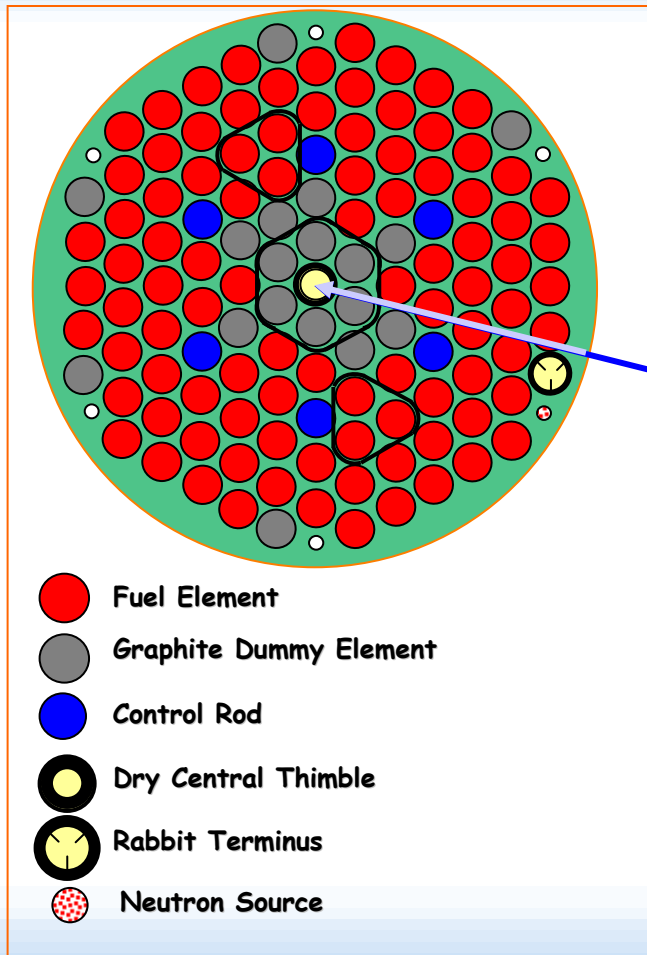
- 1979 Nov : Contract signed with GA (General Atomics of the USA)
- 1981 May : Construction started
- 1986 Sep : Criticality achieved (14 September)
- 1987 Jan : Official inauguration by the President
- 1997 – '01 : Operations at high power remained suspended when there developed a leakage problem in the N-16 Decay Tank of the primary cooling loop in 1997.
- 2001 Aug : Commissioning of the renovated cooling system.
- 2010 Mar : Solving the Radial Beam-port (RBP-1) leakage problem using locally developed technology.
- 2011 July : Digital Console Installation Work Started

Overview of BTRR...

Thermal power output	:	3 MW
Fuel element cooling	:	Natural convection (≤ 500 kW) Forced convection (> 500 kW)
Uranium enrichment	:	19.70 wt%
Fuel-moderator material	:	Uranium = 20.00 wt% ZrH_{1.6} = 79.53 wt% Er-167 = 00.47 wt%
Control Rod Material	:	Boron Carbide (B₄C)
Reflector Material	:	Graphite with Al cladding



Overview of BTRR...



Reactor core configuration

- **Std. Fuel Elements** : 100 Nos.
(93 STD + 2 IFE + 5 FFCR)*
- Graphite Dummy Element: 18 Nos.
- Dry central Thimble : 1 No.
- Rabbit Terminus : 1 No.
- Neutron Source : 1 No.
- Control Rod : 6 Nos.
- Fission Chamber : 3 Nos.
- Gamma Chamber : 1 No.

* STD: Standard; IFE : Instrumented Fuel Element; FFCR: Fuel Follower Control Rod

Overview of BTRR...



Old Analog Console

New Digital Console



Introduced Seismic Switches after FD accident

Overview of BTRR...

Safety Systems in BTRR:

BAEC TRIGA reactor is equipped with a number of passive as well as engineered safety systems.

Passive Safety Systems

1. Prompt negative temperature coefficient of reactivity of the fuel element.
2. High fission product retention in the fuel matrix.
3. No metal-water reaction.
4. High fuel clad strength.
5. High Temp. (~ 1150 °C) withstanding capability of Fuel Element.
6. Anti-siphon break line

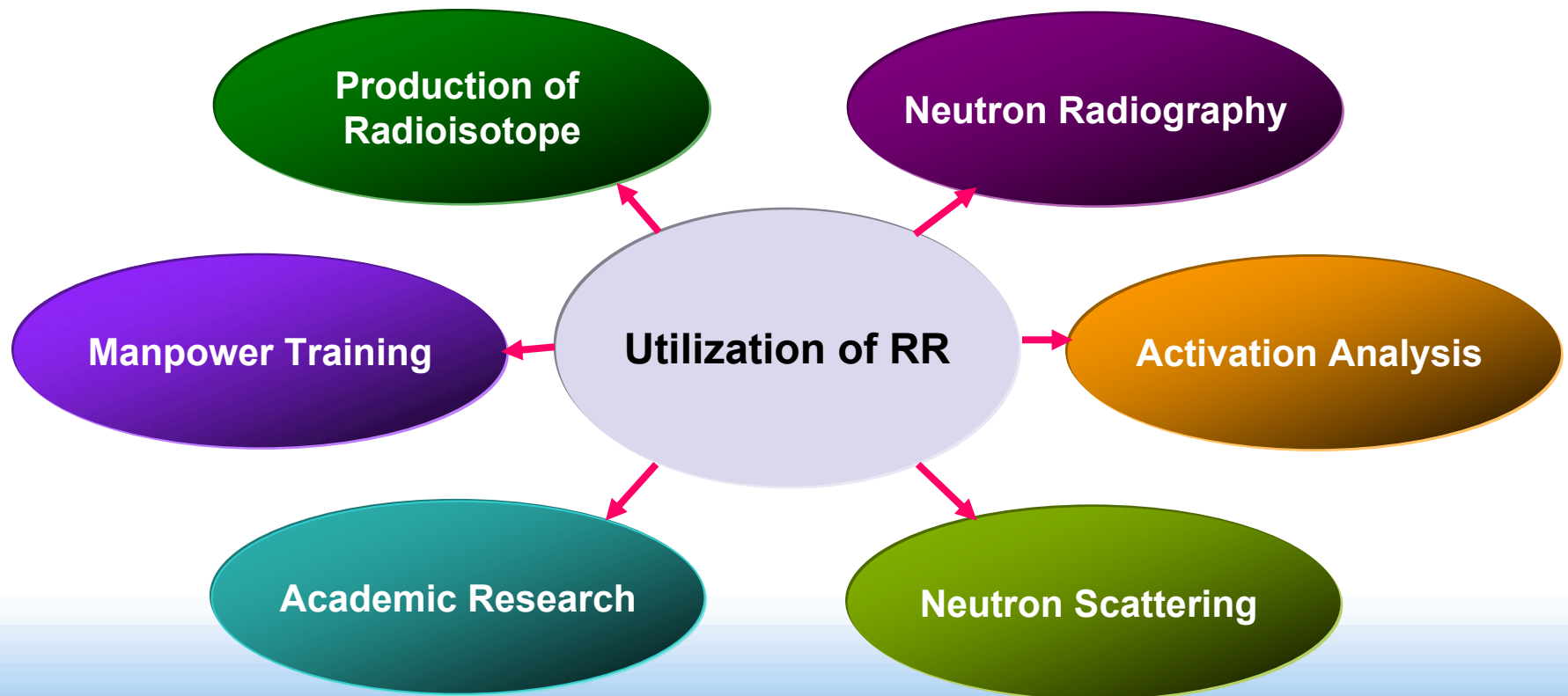
Overview of BTRR...

Engineered safety systems

- **Automatic reactor scram system** which provides shutdown of the reactor under various abnormal conditions.
- **Emergency core cooling system (ECCS)** which limits fuel melting in the event of loss of coolant accident (LOCA).
- **Emergency purging system** which removes post accident radioactivity from the reactor hall.

Overview of BTRR...

Areas of Utilization



Safety Management System of BTRR

Management levels of CRR

- Level 1: Director, CRR (Reactor Manager)
- Level 2: Reactor Shift Supervisors (RSS)
- Level 3: Heads of different Divisions/Sections and Operating Personnel

The facility is under the control of the Director, CRR or in his absence, Reactor Shift Supervisor (RSS).

Safety Management System of BTRR...

Minimum Staffing:

The minimum staffing required when the reactor is in operation :

- Reactor Shift Supervisor/Senior Reactor Operator shall be readily available within a distance reachable by twenty minutes from the facility and having telephone/mobile communication.
- Two licensed Reactor Operators.
- Three shift operation technicians.
- One health physicist.

Safety Management System of BTRR...

Responsibilities of Reactor Manager:

- The Reactor Manager (Director, CRR) must be a licensed Senior Reactor Operator (SRO).
- He is the chief administrative person and is the individual with the over-all responsibility for the safe and competent operation of the reactor facility.
- Establishment of administrative controls through various operating procedures.
- Approve the training programs for trainee reactor operators and their re-qualification programs.
- Coordination with various Institutes/Units within or outside the BAEC.

Safety Management System of BTRR...

Responsibilities of Reactor Shift Supervisor (RSS):

- The Reactor Shift Supervisor (RSS) must be a licensed Senior Reactor Operator (SRO).
- Ensuring that the reactor facility is operated in a safe and competent manner at all times.
- Supervising all aspects of the daily operations and maintenance of the reactor facility.
- Ensuring that all license conditions are fulfilled.

Safety Management System of BTRR...

Responsibilities of SRO/ROs:

- Senior Reactor Operator/Reactor Operator, each individual must be a licensed personnel .
- The SRO/RO will be responsible for the operation and maintenance of the reactor and associated system and sub-system.
- A SRO/RO shall be physically present in the control room at all times during reactor operation.
- Filling out log sheets and following all check-out, operating and experimental procedures. .

Safety Management System of BTRR...

Four committee are to review, audit and implement of all the activities being carried out in and around the research reactor facility to ensure the safety.

- AERE Research Reactor Operation & Utilization Committee (AERE-RROUC)
- AERE Radiation Safety and Control Committee (AERE-RSCC)
- AERE Nuclear Safety and Safeguards Committee (AERE-NSSC)
- Committee for the implementation of the Code of Conduct for the Safety of Research Reactor

Safety Management System of BTRR...

Different Safety Committees to ensure the safety :

1. AERE Research Reactor Operation & Utilization Committee (AERE-RROUC):

-The functions of the Committee (RROUC) include operation, maintenance and utilization of the reactor and/all nuclear and ionizing radiation equipment/facilities used in the TRIGA Reactor Facility (TRF). The committee performs the functions of review and audit or designates a knowledgeable person for audit functions.

2. AERE Radiation Safety and Control Committee (AERE-RSCC):

The general purpose of the AERE Radiation Safety and Control Committee shall be to strengthen and implement radiation safety and control activities in accordance with the NSRC-Law-21/1993 and the NSRC Rules '97 (SRO No. 205-Law/97) and applicable safety standards, codes and guides adopted by the Component Authority.

Safety Management System of BTRR...

3. AERE Nuclear Safety and Safeguards Committee (NSSC):

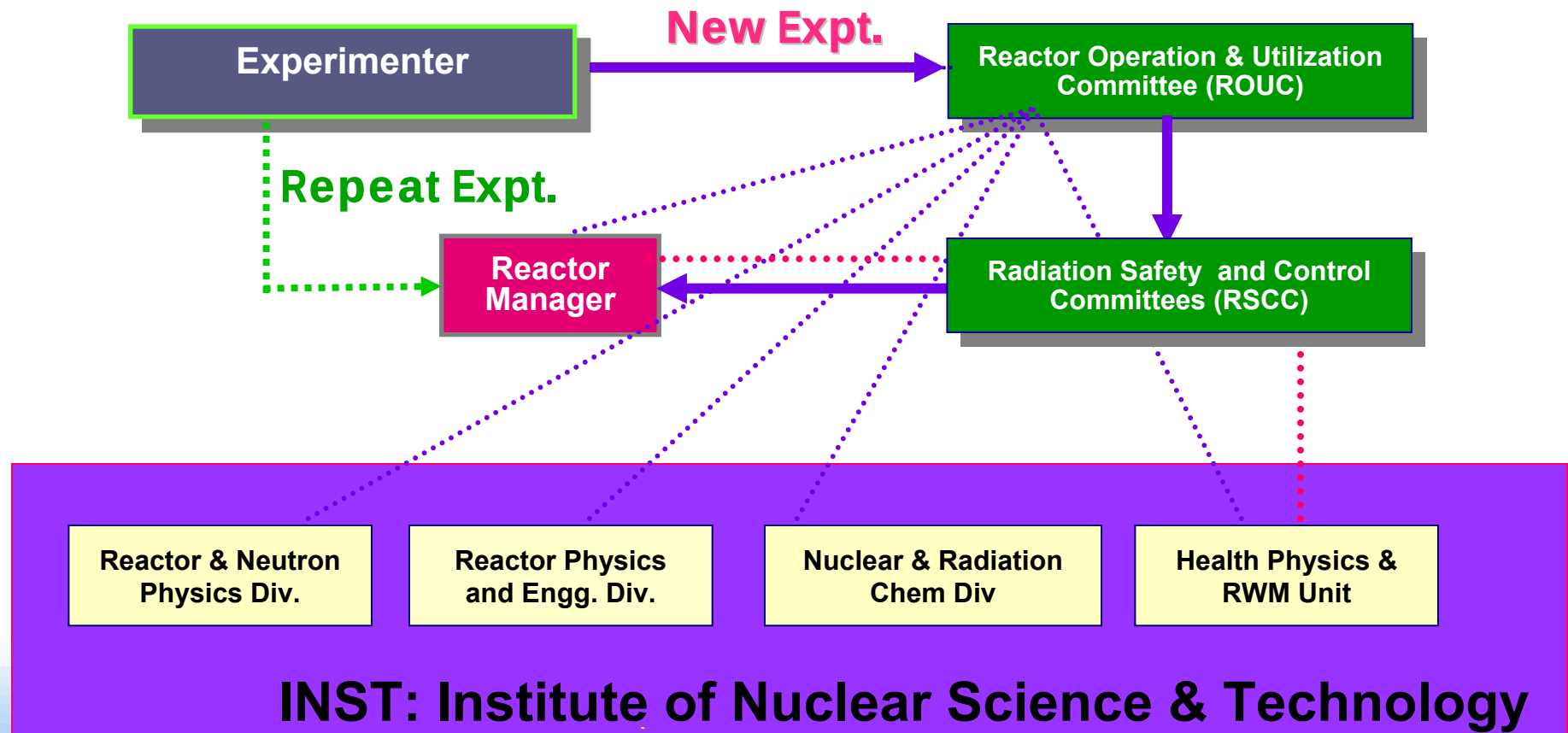
The purpose of the committee is to audit, review, evaluate, recommend and approve all programs, actions and issues involving inventory accounting and safeguards of all nuclear materials as per the Safeguards Agreement and its Subsidiary Arrangements between the Govt. of People's Republic of Bangladesh and IAEA under the Non Proliferation Treaty (NPT) signed in September 1979.

4. Safety committee for the implementation of IAEA Code of Conduct on the Safety of Research Reactors:

The objective of the committee is to achieve and maintain a high level of safety in research reactor through the enhancement of national measures and international safety related technical cooperation.

Safety Management System of BTRR...

How experiment proposals are approved:



Safety Infrastructure of BTRR

Access Control Procedure

- The only people allowed to access into the reactor facility are Reactor Manager, RSS, reactor operation personnel, Radiation Control Officer, health physics personnel and authorized experimenters.
- All other personnel must first receive permission to enter the reactor facility from Reactor Manager. After getting permission, the personnel must complete entries into the visitors' book kept at the front security desk of the CRR.
- Before entry into the reactor hall, the reactor control room must be contacted and acknowledgment received.

Safety Infrastructure of BTRR...

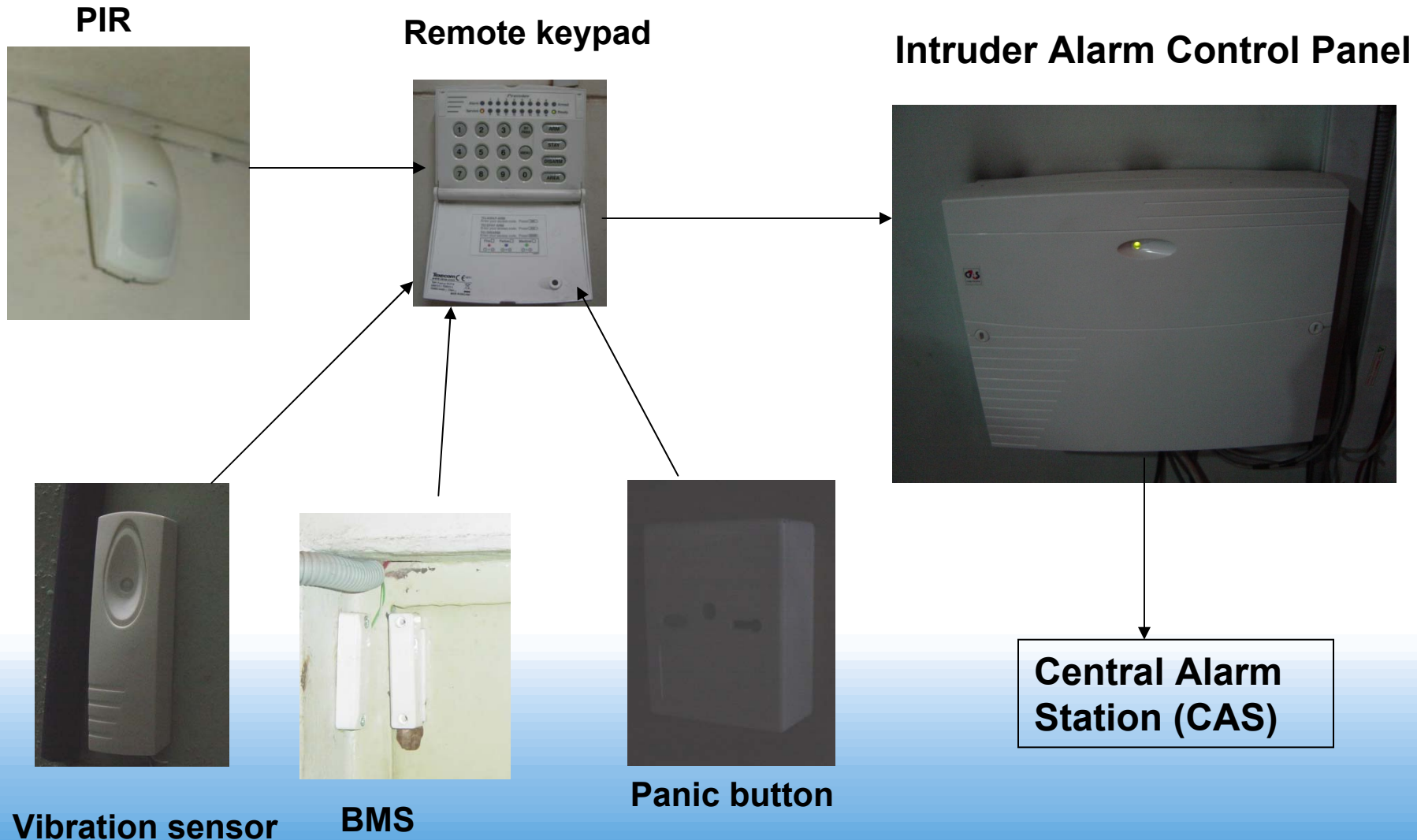
Detection Systems at the TRF

- ❑ Passive Infra Red (PIR) detector
- ❑ CCTV System
- ❑ Microwave detector and perimeter beam detector.
- ❑ Micro switches and Balanced Magnetic Switches (**BMS**) on access doors.
- ❑ Vibration detectors on the walls
- ❑ Lighting system around the TRF.
- ❑ Hand held metal detector
- ❑ Personnel **ID** system

TRF: TRIGA Reactor Facility

Safety Infrastructure of BTRR...

Detection Systems at the TRF



Safety Infrastructure of BTRR...

Emergency Plan and Response Program

- The 3 MW TRIGA Reactor Facility of AERE have an Emergency Plan and Response Program as per Section 10.13(B) of the Nuclear Safety and Radiation Protection Rule (NSRCD Rule-1997) of Bangladesh Government
- The objectives of this emergency plan are to identify types of emergencies, establish guidelines and designate areas of responsibility for the emergency management team should an accident or incident occurs at the BTRR.

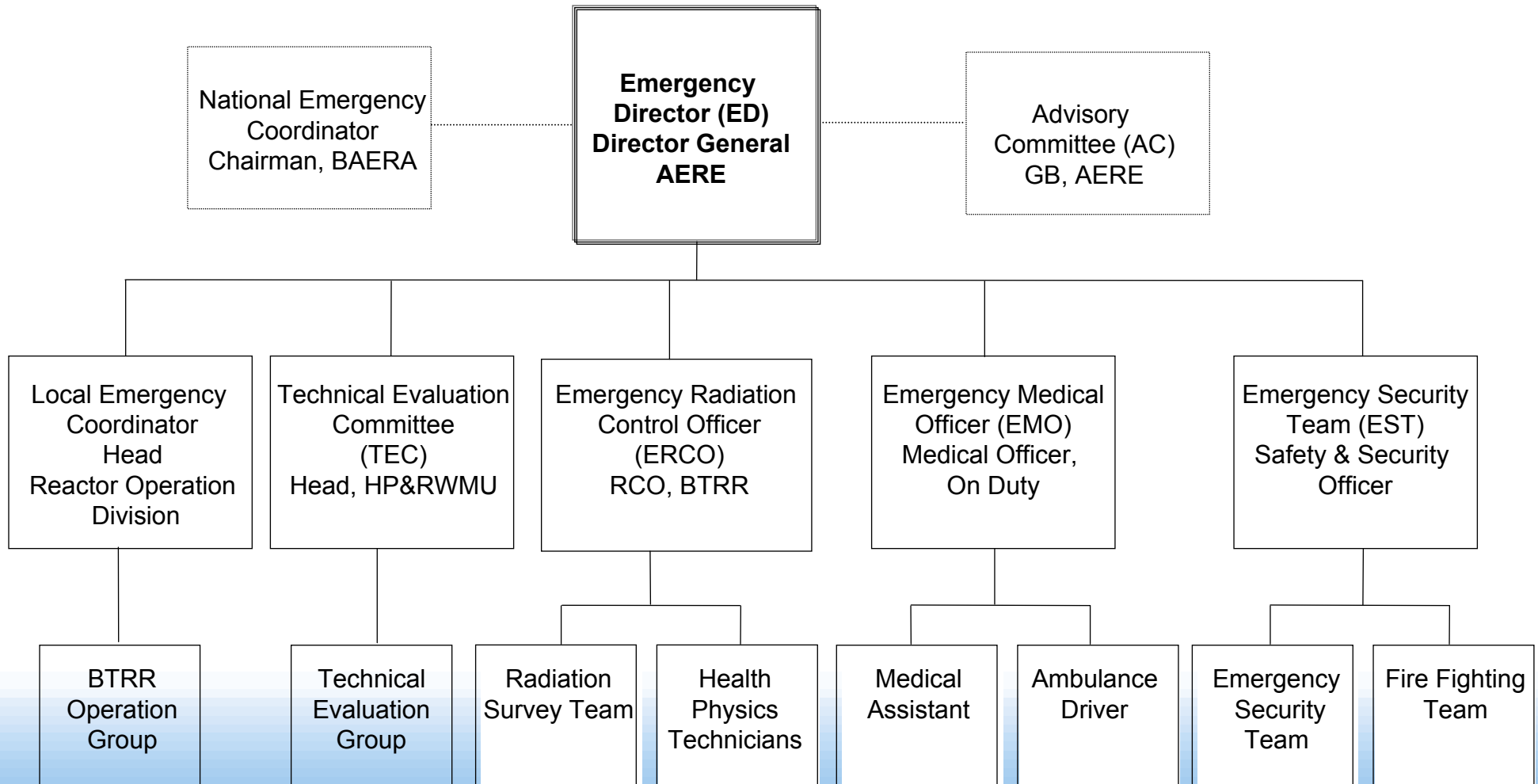
Safety Infrastructure of BTRR...

Groups participating in the emergency response activities include:

- Reactor Operations Group
- Health Physics Group
- Medical Team of AERE Clinic, AERE, Security Personnel
- Fire Fighting Personnel of local Fire Station and
- Bangladesh Atomic Energy Regulatory Authority (BAERA)

Safety Infrastructure of BTRR...

Organization of Emergency Management of AERE



Peer Review of BTRR

The peer review of the BTRR of Bangladesh was conducted from 19 to 23 May, 2014 in Dhaka, Bangladesh.

➤ The review team Identified the good practices and weaknesses of safety management systems of reactor facilities and made recommendation/suggestions for the improvement

Peer Review of BTRR...

FNCA SMS Workshop & BTRR Peer Review

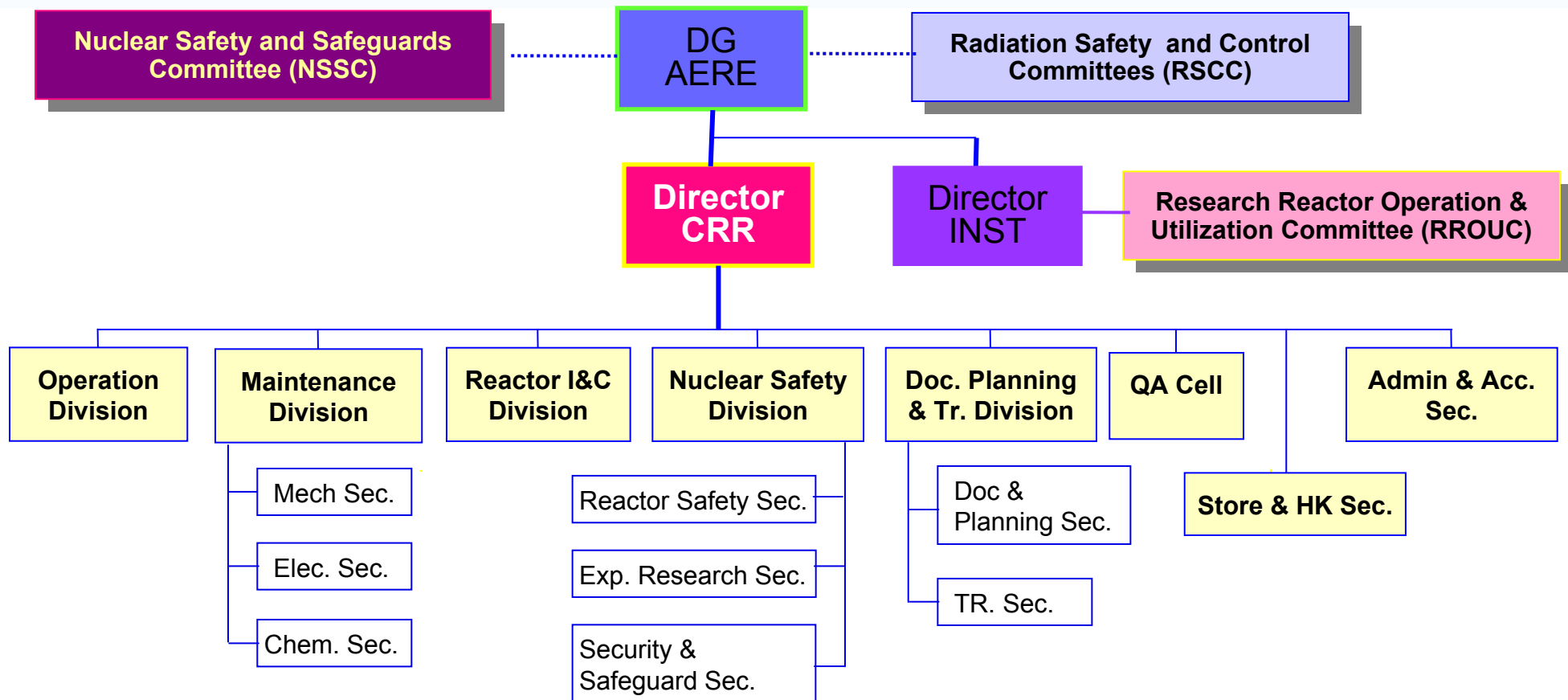


Peer Review of BTRR....

- Peer review team identified 11 “Good Practices, 21 “Comments and 14 “Recommendations.
- There are several recommendations and comments which are mainly related to the development of an integrated management system under a quality management framework.

BTRR Peer Review Results

Present Organization Structure of Center for Research Reactor (CRR)



AERE : Atomic Energy Research Establishment

INST : Institute of Nuclear Science & Technology

Organization Structure Changed from 12 January, 2015

BTRR Peer Review Results

Safety signage has been Reviewed:

- Safety signage has been reviewed after the Peer Review



Fire Detection Panel: Fire Zones & Emergency Contact Numbers are added

Evacuation and Safety Signage have been Reviewed:

- Safety signage has been reviewed after the Peer Review
- Evacuation signage has been also reviewed



Caution Signage has been Reviewed:



Beam Port Opening Indication Signal :



Beam Port Opening Indication Signal was introduced for the Neutron Radiogray Facility and Dose Rate Reviewed

In-house training among all the staff has been enhanced:

- A training co-ordinator for technical staff has been selected
- Training co-ordinator arranged training on the following fields:
 - ❖ Electrical Substation
 - ❖ Fire Pump Operation
 - ❖ Fire safety and emergency preparedness
 - ❖ Water treatment plant, cooling systems, ventilation systems
 - ❖ Diesel Generators etc.

These kinds of training are arranged almost every week except reactor operation days

Regulatory Infrastructure

Independent Regulatory Authority

On 19th June 2012, **Bangladesh Atomic Energy Regulatory Act-2012** has been passed by the National Parliament and has been enacting since 12 February 2013.

Bangladesh Atomic Energy Regulatory Authority, BAERA has been established.



Regulatory Infrastructure...

Regulatory Supervision:

Documents reviewed by the regulatory body:

(1) Safety Analysis Report of the Reactor Facility

(2) 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 safety of in-core experiments,
- Miscellaneous incident reports, ISI data, etc.

Regulatory Infrastructure...

**Rather than this Regulatory Authority
meet every quarterly with the reactor
operation and maintenance groups**

Assessment and Improvement

Major Repair/Refurbishment/Maintenance Work Carried Out:

- ☐ Refurbishment of Primary Cooling System of the RR.
- ☐ Improvement of ECCS
- ☐ Improvement of shielding of the delay tank room
- ☐ Improvement of the shielding of the Radial Beam Port
- ☐ Replacement of Central Thimble
- ☐ Repair of Leaking Beam Port (RBP-1)
- ☐ Installation of Digital Control Console System

Assessment and Improvement

- **Further improvement /updated is necessary:**
 - **Ageing management activities;**
 - **Emergency planning and response preparedness program of the facility needs to be strengthened;**
 - **Measurement of radioactive release;**
 - **Strengthening the ISI activities**
 - **Update of Safety Analysis Report (SAR)**

Conclusions

- **A management structure with clear definition of roles, responsibilities and lines of communication is in place.**
- **A management policy that makes safety is the highest priority.**
- **Bangladesh emphasizes on Safety Culture and Good Practices for ensuring Safety of RR.**

Conclusions

- BAEC highly appreciates the **assistance of the IAEA , ANSN** and other international stakeholders for their continued supports for addressing various safety related issues associated with the **safety management systems** of the BTRR.

The End

**Thank you for your kind
attention !!**