A COMPREHENSIVE STUDY ON THE PHYSICAL PROTECTION OF BAEC TRIGA RESEARCH REACTOR AND STATUS OF NUCLEAR MATERIAL ACCOUNTANCY AND CONTROL IN THE FACILITY

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International Conference on Physical Protection of Nuclear Material and Nuclear Facilities
13-17 November 2017, IAEA Headquarter, Vienna, Austria

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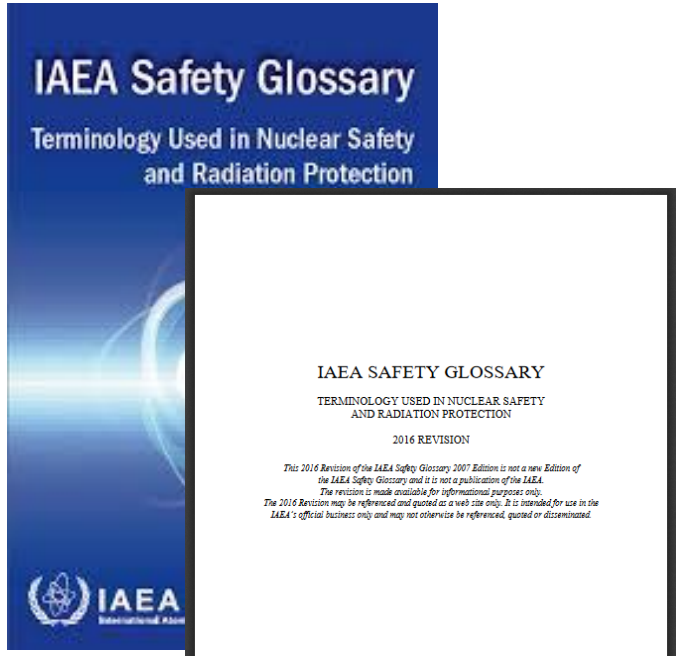
Nuclear Safety & Security

Proper Operating Conditions

Prevention of accidents

Mitigation of accident consequences

PROTECT PEOPLE AND ENVIRONMENT FROM RADIOLOGICAL HAZARDS



Protection of Nuclear Material, radioactive substances and associated facilities

From

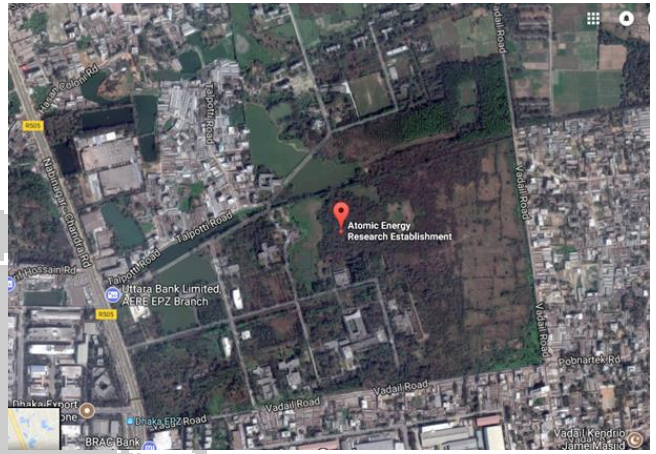
- Theft
- Sabotage
- Unauthorized access
- Illegal transfer
- Other malicious acts

Detection

Delay

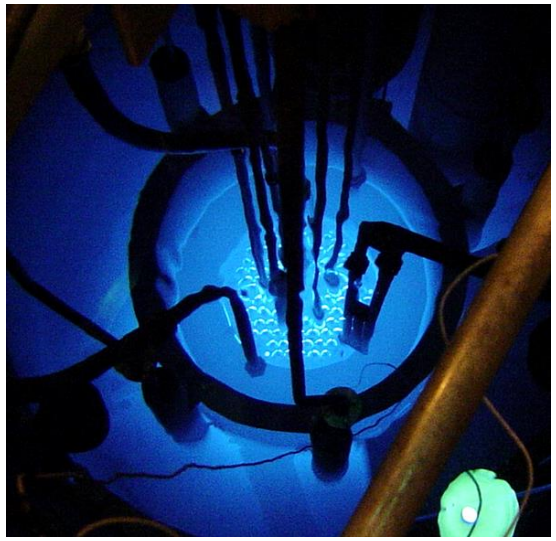
Response

Facility Description



Facility Description

- Reactor Type: TRIGA Mark-II (Tank type RR)
- Thermal Power: 3 MW (with Pulsing capability 852 MW)
- Thermal Flux: 7.46×10^{13} n/cm^{2}s
- First Criticality: Sept 1986



- Number of fuel elements: 100
- Cladding materials: Stainless Steel
- Control rod: Boron carbide
- Reflector: Graphite
- Coolant: Demineralized Water

Present Concerns

Security was less important at the time of installation.

Presence of Export Processing Zone (EPZ) near the facility and present industrialization of the country, demography changes over the time

Bangladesh is a developing country and most of the people are moderate in nature

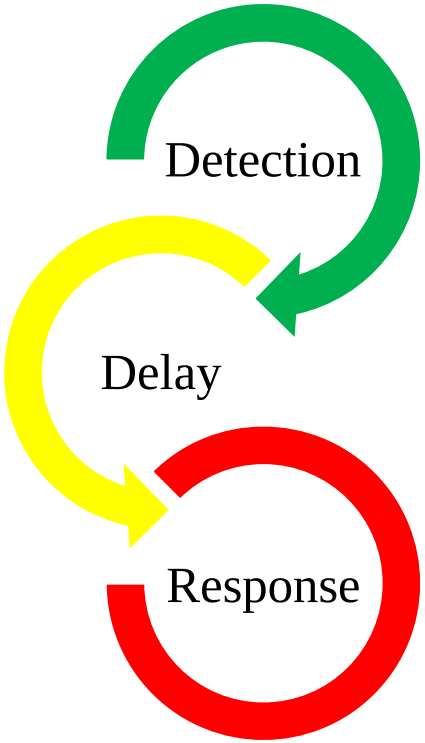
Mass people have less knowledge about nuclear

Few incident of small violence occurred for the last decade

Physical Protection Systems

The PPS being used for protecting the research reactor in Bangladesh has three basic elements,

- Detection
- Delay
- Response



Physical Protection Systems

Detection element at the BTRR facility

- PIR detector;
- Surveillance cameras (CCTV cameras);
- Micro switches and Balanced Magnetic Switches (BMS) on access doors;
- Vibration detectors on the walls;
- Lighting system around the TRF;
- Hand held metal detector;
- Personal ID system


Access Control


Alarm Control Panel


PIR Motion Sensor


Camera

Physical Protection Systems

Delay elements at the BTRR facility

- Hardened wall with hardened door;
- Security fencing around the TRF;
- High security hasps and locks;
- Heavy duty steel plate in the primary return trench;
- Steel doors & Collapsible gates;
- Fireproof security safe and keypad-entry type key box;

Hardened Door

Security Safe

Steel Plate in Primary Trench

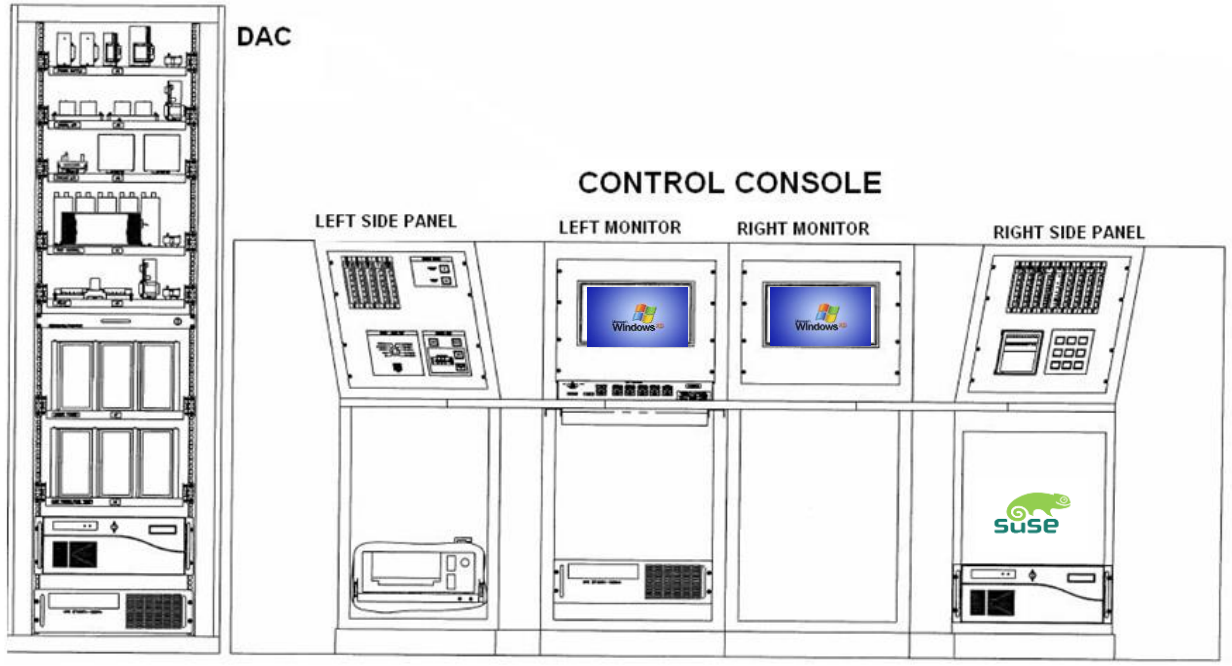
Security Lock

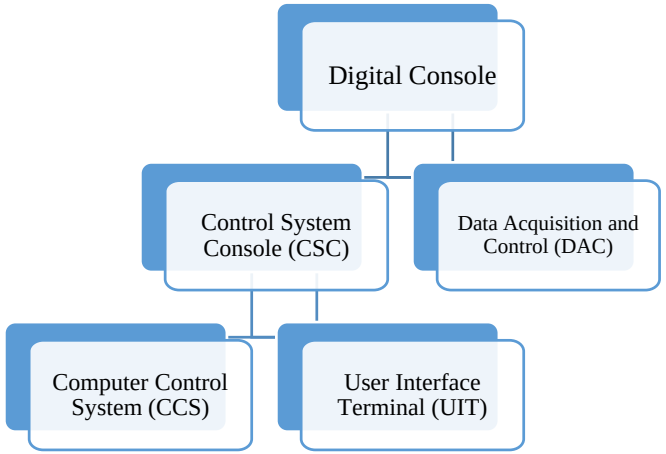
Physical Protection Systems

Response forces

- BAEC Security Guards;
- Ansar;
- Police Forces ;

Computer Security





All the Console Control System (CCS), Data Acquisition system (DAC) and User Interface Terminal (UIT) CPUs are locked at the front side. Without the key no one can access the front side of those CPUs.

Computer Security

- BTRR digital console computers have both hard and soft security
- CPUs are locked at the front side
- The software of the digital console system asks for operator login first to perform any action
- Sole networked computer system which is not connected to any other computer network or internet
- It is strictly prohibited to connect any memory stick to any CPU of the digital console system

Safety & Security Culture

Possible threat reduces
–Security
Ensures efficient activity/operation and personal accountability
–Safety

Not possible to unauthorized access
–Security
Safe operation/activity
–Safety

Safety & Security Culture

Reduces contingency planning and procedures
–Safety & Security

Personal accountability & trustworthiness
– Safety & Security

Good Practices

- Following manufacturer's instructions as part of routine operation and maintenance of equipment;
- CRR and reactor user group periodically make a 5 year strategic plan and the plan is submitted to the BAEC and relevant Ministry;
- Monthly and annual activities of CRR routinely sent to the BAEC, Regulatory Authority and Ministry of Science and Technology (MOST);

FNCA

Forum for Nuclear Cooperation in Asia

FNCA is a Japan-led cooperation framework for peaceful use of nuclear technology in Asia. The cooperation consists of FNCA meetings and the project activities with the participation of Australia, Bangladesh, China, Indonesia, Kazakhstan, Korea, Malaysia, Mongolia, Philippines, Thailand and Vietnam.

Good Practices

- Very open culture within the Reactor Organization, the Research Institute and the Regulatory Authority, with strong leadership for safety and a commitment to a strong safety culture;
- Strong evidence of clear and open communication through all levels of the organization;
- The establishment of the Quality Management Division;
- Periodic maintenance and surveillance inspection programme;
- Aging management;

SWOT Analysis

A detailed strength(S), weakness(W), Opportunity(O) and Threat(T) analysis matrix has been developed on the basis of existing physical protection system of the facility.

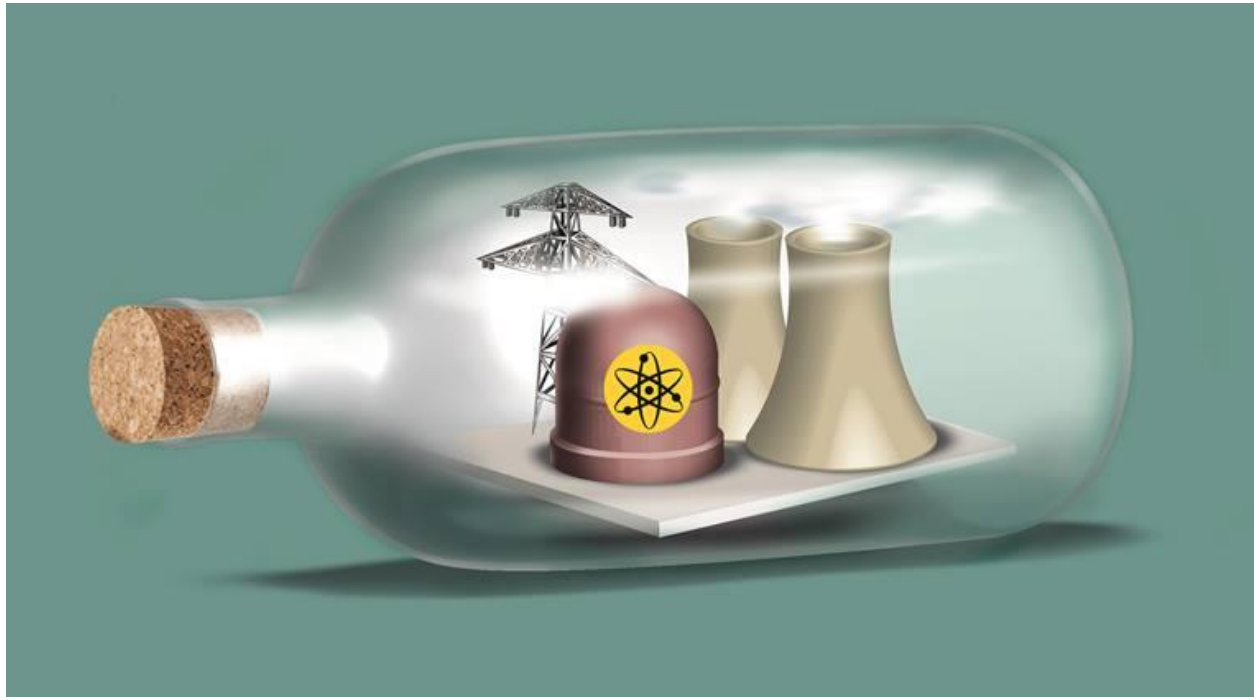
Strength (S)	Weakness (W)
• Defense in Depth design • Safety and security culture • Standard operating procedures • Personal accountability • Trustworthiness	• Ensuring physical security was less important at the time of installation • Lack of detection, delay and response elements • Several access points to the facility • Co-location with other facility

SWOT Analysis

A detailed Strength(S), Weakness(W), Opportunity(O) and Threat(T) analysis matrix has been developed on the basis of existing physical protection system of the facility

Opportunity (O)	Threat (T)
• Upgrade the physical security systems • Develop specialized human resources in the security field • International cooperation	• Funding • Lack of knowledge • Old technology • Ageing of the facility • Demography change around the location

Regulatory Authority



According to IAEA milestone approach one of the key issues is to establish an effective independent and competent body responsible for safety and security

The Government of the People's Republic of Bangladesh has established BAERA under section 4 of Bangladesh Atomic Energy Regulatory Act-2012 on 12th February 2013.

Regulatory Authority

Previously Nuclear Safety and Radiation control Division (NSRCD) of BAEC was performing the regulatory activities to control all kinds of nuclear and radiation related activities throughout the country.

BAERA oversee every activity related to safety and security of the research reactor.

Safeguard Activities

The NPT was signed in August 1979

Bangladesh signed the CTBT in October 1996

IAEA
International Atomic Energy Agency

"Safeguards Agreements" was signed with the IAEA in June 1982

Safeguard Activities

"Protocol Additional to the Safeguards Agreements" with the IAEA in March 30, 2001

Human Resource Development & Future Plan

An ADP has been primarily selected and under the process of approval in Planning Ministry of the Government of Bangladesh;

Under this project, a new spent fuel storage will be built; a new heat exchanger will be installed; a new electrical sub-station with higher capacity will be installed in the facility; all electrical, mechanical, instrumentation labs & store will be shifted to separate building; facility entry point is planned for sole access to the reactor; up gradation of physical protection system; up gradation of area monitoring system; up gradation of digital control console system; renovation of civil structures; human resource development;

Human Resource Development & Future Plan

- In-house training is a continuous process to develop the facility personnel in the field of physical security
- Emergency drill organized periodically for developing safety and security culture
- Government has bilateral agreement with other country and organization to enhance the physical security
- Continuous support from IAEA regarding human resource development in the field of physical security

Along with safety security regulatory training and cultures, the facility personnel needs more technical training in the field of physical security planning, designing and equipment.

Conclusion

- The reactor facility is in general designed to be intrinsically safe to achieve high degree of operational safety independent of mechanical, electrical and instrumental failures as well as human error.
- Bangladesh emphasizes on Safety and security culture and good practices for ensuring safe operation of the research reactor.
- The facility needs certain development in the area of physical protection, ageing management, human resource development etc.
- BAEC welcomes help and cooperation of its strategic partners in this regard.

Thank you