An integrated approach for securing a nuclear power plant for electricity generation

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Introduction

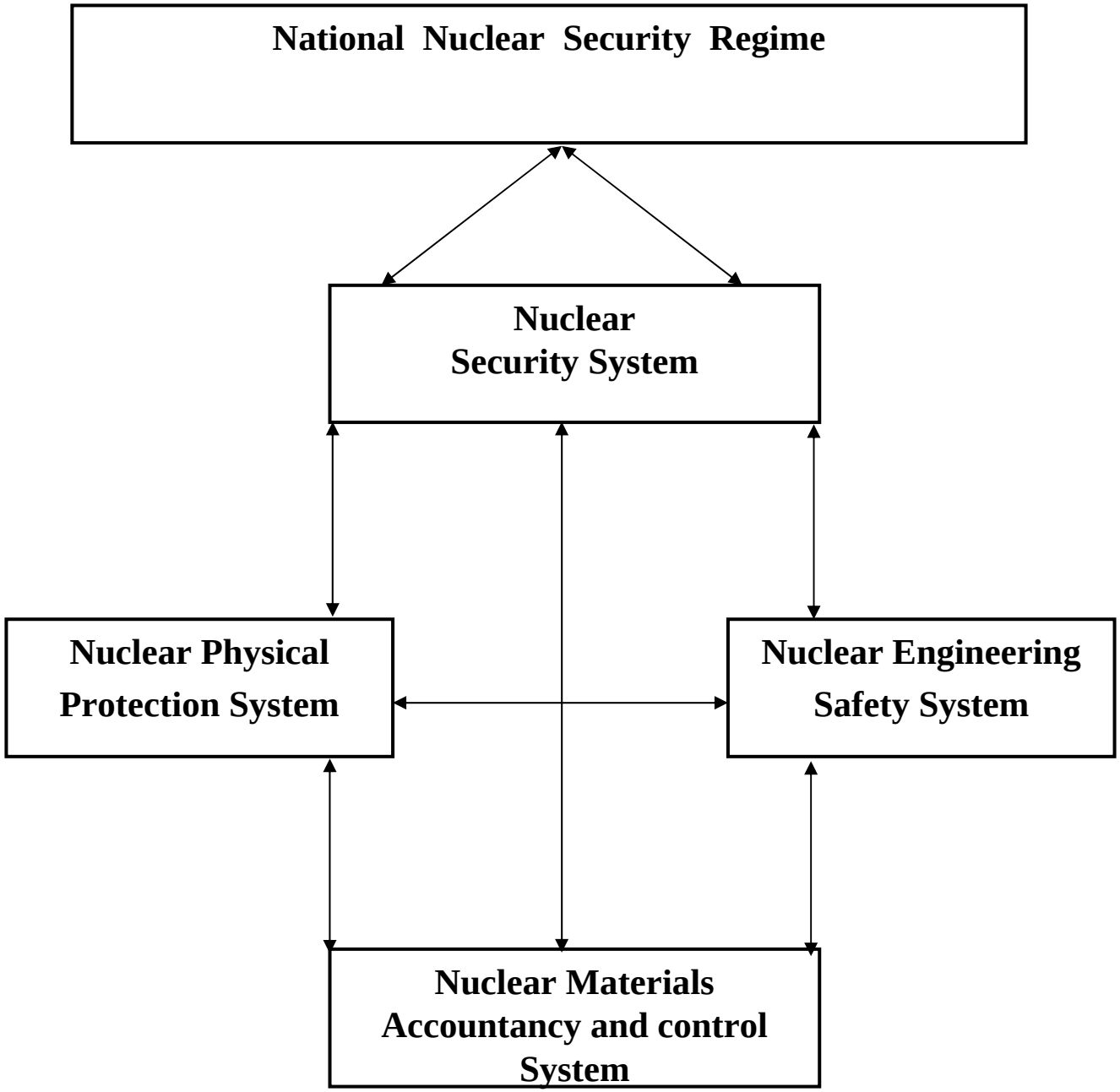
- **The services of electric energy is needed and will continue to increase in the world.**
- **In the next decades, it is expected that the nuclear fission energy would be one of the mostly needed options for electric power generation due to the high operating performance of nuclear power plants.**
- **With significant improvements in reliability and enhanced levels of nuclear safety. This would help to meet the increase in energy demand, enhance the security of energy supplies and avoid impacts of carbon emissions from fossil fuels and decrease environmental concerns**

- In recent years, nuclear security has become a major concern in the world.

. Re-evaluation of security in the nuclear industry sector is becoming an extremely important task in order to achieve better control and protection of NMs and RMs and higher level of protection for their associated facilities .

Approach

The approach developed in the present work focuses on investigating measures of some fundamental nuclear safety parameters in a NPP for electricity generation together with measures of the nuclear security system of the nuclear facility, and how such measures could ensure the nuclear security of the NPP.


National Nuclear Security Regime
Nuclear
Security System
Nuclear Physical
Protection System
Nuclear Engineering
Safety System
Nuclear Materials
Accountancy and control
System

National nuclear security regime

All nations need to activate their commitments to:

- **Nuclear non-proliferation;**
- **Nuclear disarmament;**
- **Nuclear test ban;**
- **Widening nuclear weapons free zones [NWFZs] worldwide;**
- **Combating of illicit trafficking of NMs and RMs.**

Concerned Government would take the responsibilities of:

(i) The State legislative and regulatory framework to govern the nuclear activities in the country.

(ii) The State evaluation and/or re-evaluation of the "Threat Assessment";

(iii) The establishment, maintenance and development of a State's system of accounting for and control of NMs (and RMs) [SSAC], a State's system of physical protection [SSPP] of NMs, RMs and nuclear facilities; and a State's system of combating illicit trafficking [SSCIT] of NMs and RMs;

(iv) State's systems for boarders guard, police guard and customs system;
(v) Sectors of State's national security system and intelligence system – specialized in nuclear security;
(vi) State's system for establishment and development of "specialized" human resources, technical capabilities and effective nuclear security culture.

NPP security system

The nuclear security system of a NPP facility would consider:

(a) Security measures around the outer fences and installations of the NPP premises;

(b)Security measures for transport of NMs and RMs inside and outside the NPP premises;

(c) Security measures with regard to NPP personnel and visitors;

(d) Security measures with regard to information and communications

NPP physical protection system

Measures:

(i)To control access of personnel and flow of NMs, RMs and equipment in/or/out of the nuclear facility;

(ii) To protect against unauthorized removal of NMs and RMs (theft, forcible seizure, acts of terrorism or other criminal activities) in use, storage, and during transport;

(iii) To ensure the implementation of rapid and comprehensive measures by the State to locate and recover missing or stolen NMs or RMs;

(iv) To protect against sabotage of nuclear installations and sabotage of NMs and RMs in use, storage and during transport;
(v) To enable effective security response and police actions;
(vi) To mitigate or minimize the radiological consequences of sabotage; and
(vii)To promote security culture within the nuclear facility.

NPP nuclear engineering safety system

- **The general nuclear safety objective is to protect individuals, society and the environment by establishing and maintaining an effective defense against radiological hazard in NNPs.**
- **The objective of technical safety is to prevent accidents with high confidence in NPPs.**

- **Accident mitigation by the use of prepared and available technical measures.**

Application of nuclear safety technology for NPPs may include:

– Proven engineering practices are reflected in approved codes and standards;

– Quality assurance is applied throughout activities at a NPP as a part of a comprehensive system in order to ensure with high confidence that all items delivered, services and tasks performed meet specified requirements;

– Personnel engaged in activities bearing on NPP safety are sufficiently trained and qualified to perform their specified duties; and

– Safety assessment is made before beginning of construction and operation of the NPP.

Nuclear materials accountancy and control system

- **The strategy of nuclear safeguards [SG] in a State is based on the control of NMs (and RMs), nuclear technologies, nuclear facilities, equipment, information and activities in a State within its territory, or under its jurisdiction.**
- **In fact, SG is considered a major instrument of nuclear non-proliferation in the world .**

- **The NMs accountancy and control [ACC/C] system depends on the principle of "Conservation" of NMs and the principle of "Verification" of NMs and activities.**

. Then, the implementation of a control system is based on an effective verification technique.

. This requires knowledge of the flow and inventory of the NMs; and the compilation of periodic NM balances in the nuclear facility

• An effective ACC/C system should be capable to ascertain quantitatively "what, where and how much" NM is present in a specific nuclear facility, and how much NM may be missing from that facility at any given time.

. Also, the system should ascertain that the type category and location of the NMs in that facility are conformal to the national nuclear regulations and the instructions of the SSAC

Conclusion

- **The present work has shown that in order to achieve sustained and consistent nuclear security of NMs and RMs and associated installations in a NPP for electricity generation, measures of the nuclear security system of the facility would be integrated to measures of the nuclear engineering safety system, nuclear physical protection system and the system of nuclear materials accountancy and control.**
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- **Such measures would be implemented in real time mode- from the start of design phases of the NPP to the phases of full operation, up to the decommissioning phases of the NPP, with well coordinated manner and consistently**

Thank You!