

Safety and Security Interfaces during Lifetime of a Nuclear Power Plant – National Experience



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Presentation Outline

- Pakistan's Nuclear Power Sector
- Nuclear Safety and Nuclear Security
- National Safety and Security Regimes
- National Experience towards Safety of Nuclear Installations
- National Experience towards Security of Nuclear Installations
- Safety-Security Synergy at Nuclear Installations in Pakistan
- Conclusion

Pakistan's Nuclear Power Sector

- In Pakistan, five nuclear power plants viz; C-1, C-2, C-3, C-4, and K-1 are operational under the umbrella of Pakistan Atomic Energy Commission (PAEC) and under the regulatory control of Pakistan Nuclear Regulatory Authority (PNRA)
- Two more power plants i.e. K-2 and K-3 are currently in construction phase
- Safety and Security is of utmost importance during the lifetime of these Nuclear Power Plants (NPPs). A great deal of challenges are, however, involved in the application of nuclear technology including safety, security and safeguards

Nuclear Safety and Nuclear Security

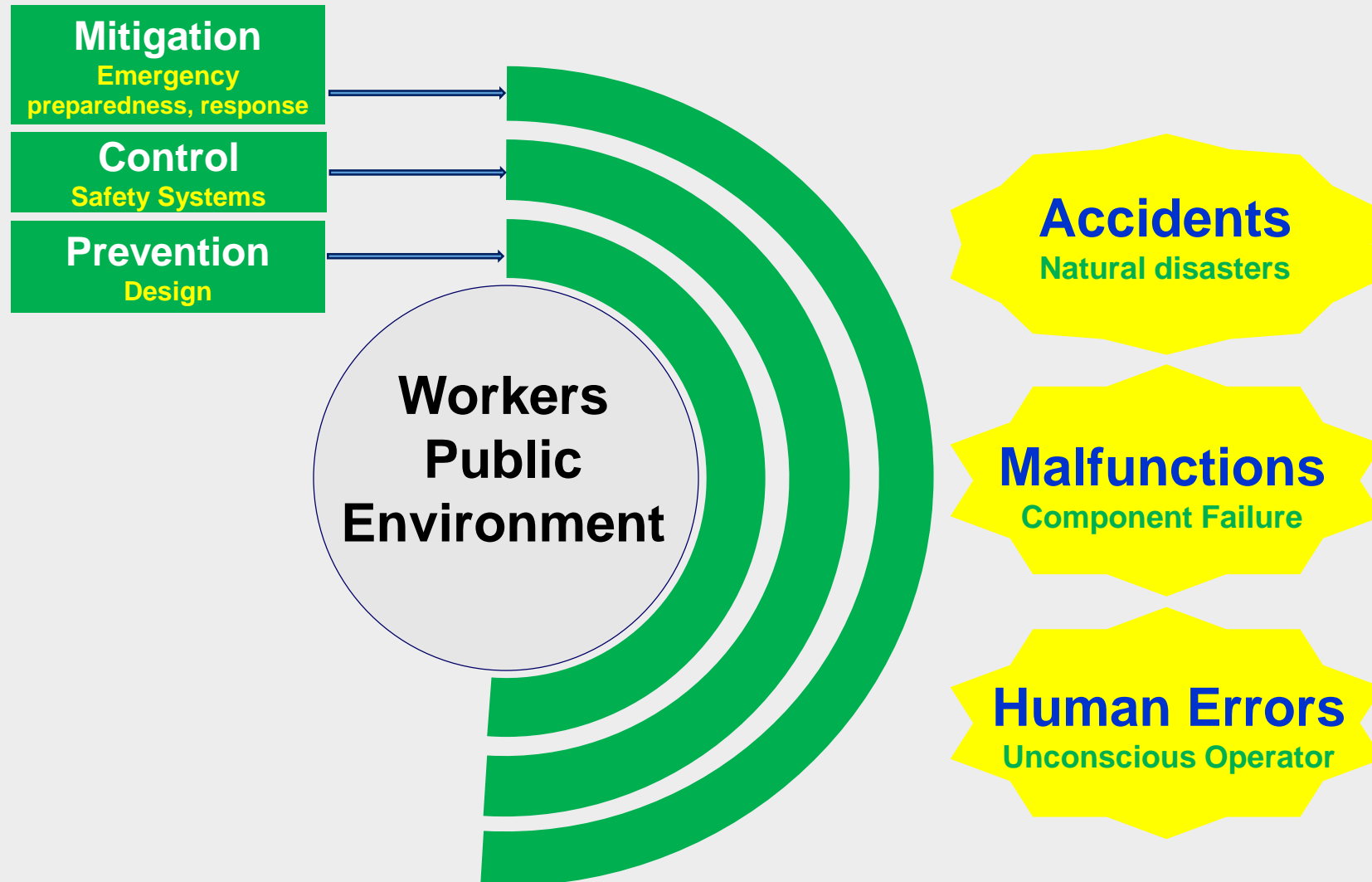
Nuclear Safety

The achievement of proper operating conditions, prevention of accidents or mitigation of accident consequences, resulting in protection of workers, the public and the environment from undue radiation hazards

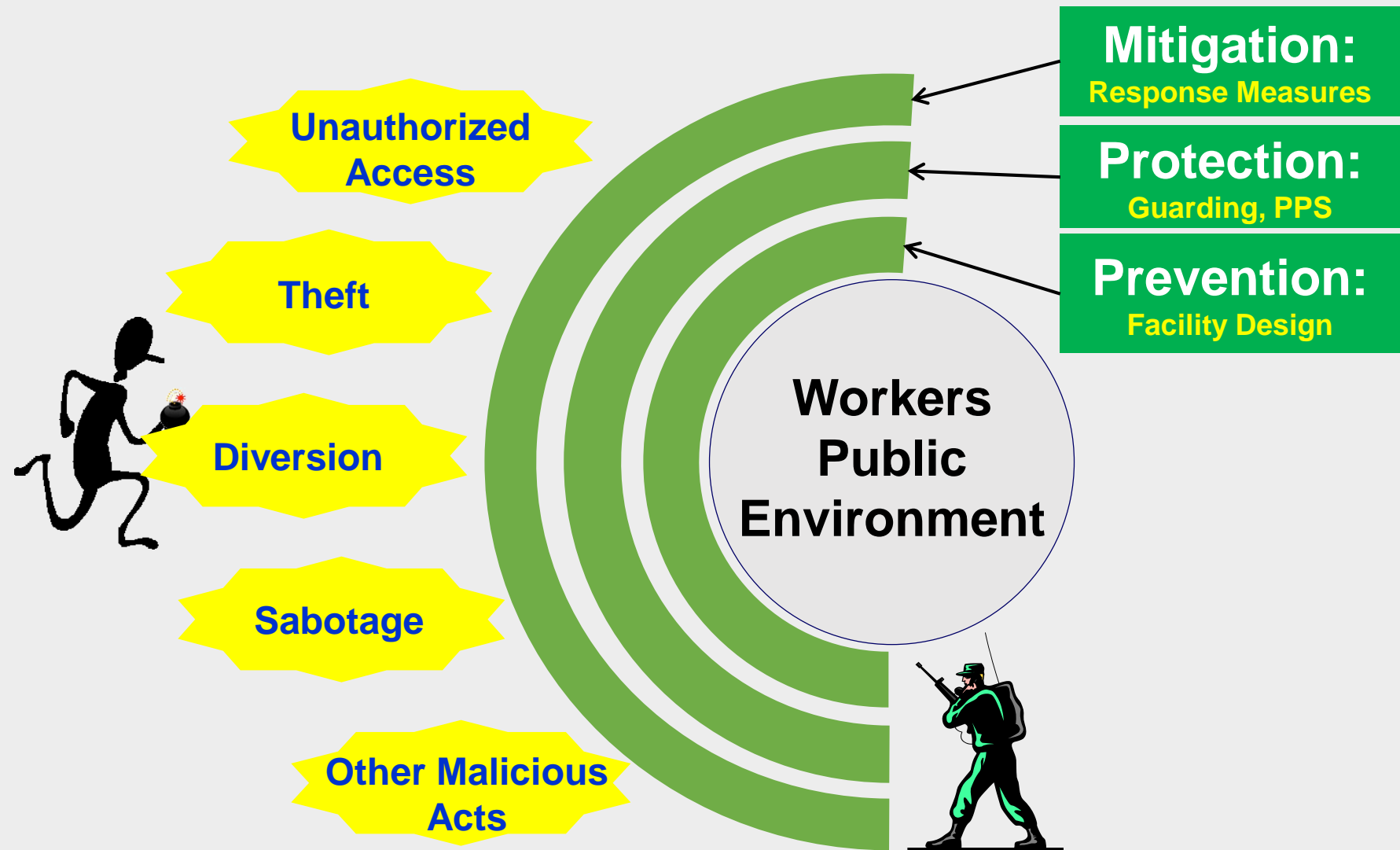
Nuclear Security

The prevention and detection of, and response to, theft, sabotage, unauthorized access, illegal transfer or other malicious acts involving nuclear materials, other radioactive substances, or their associated facilities

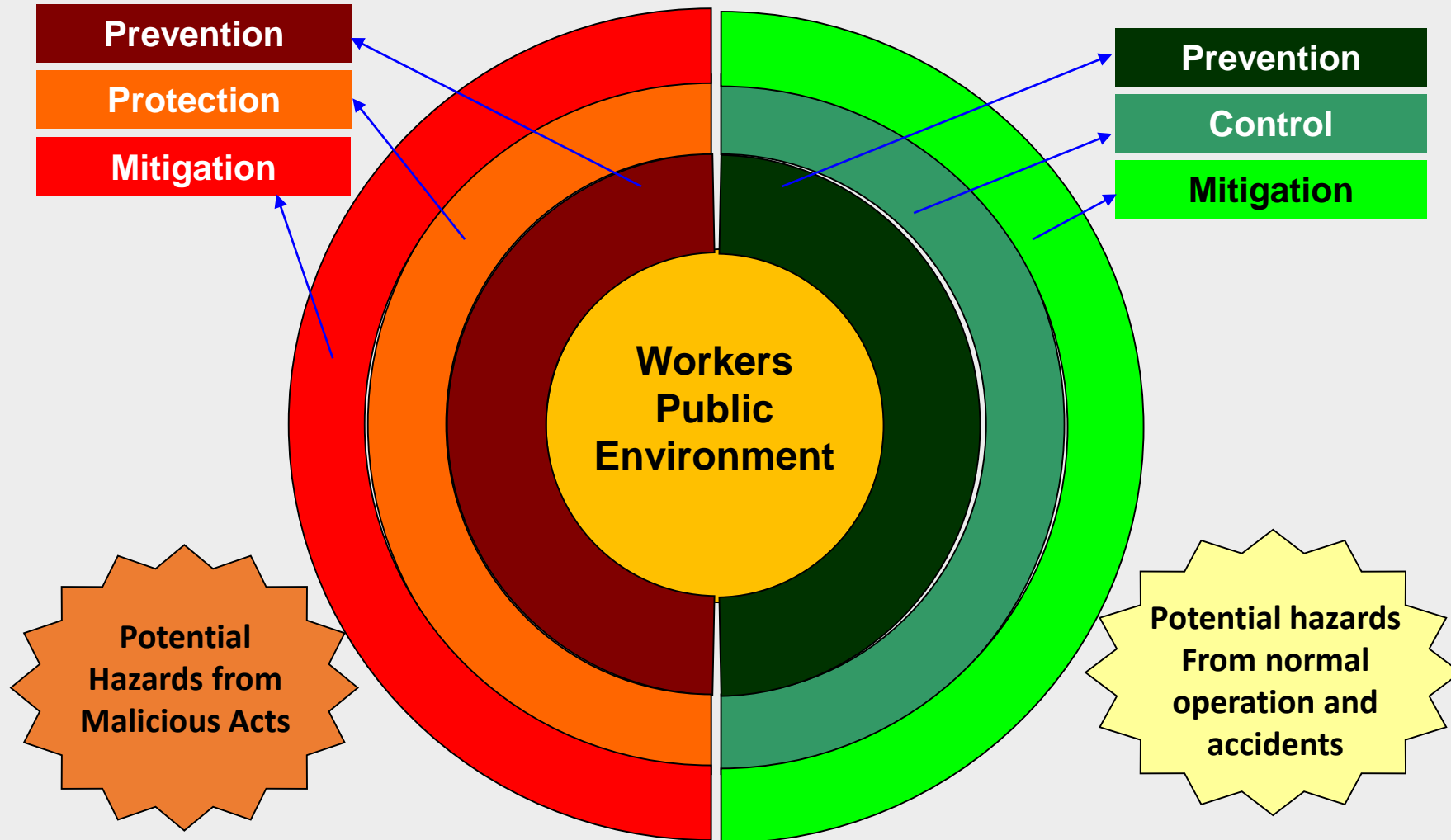
Goal of Nuclear Safety



Goal of Nuclear Security



Nuclear Safety and Nuclear Security Side by Side



Safety and Security Regimes

- Nuclear safety and nuclear security regimes are based on a number of international legal instruments viz;
 - Conventions
 - Resolutions and
 - Codes of conduct
- Pakistan is the party of Convention on Nuclear Safety as well as to the Convention on Physical Protection of Nuclear Material (CPPNM) and 2015 amendment
- PAEC has also implemented national regulations on safety and security during the lifetime of nuclear installation(s)

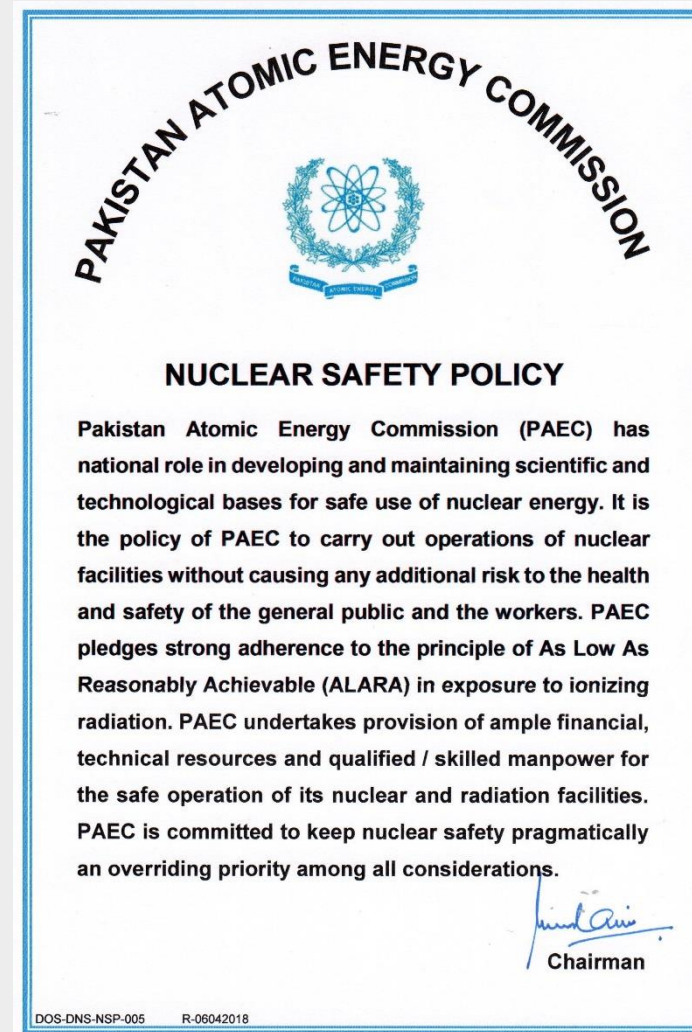
National Experience towards Safety of Nuclear Installations

- Nuclear Safety Policy
- Safety in Nuclear Power Plants Operation
- PAEC Corporate Safety Oversight Program

Nuclear Safety Policy

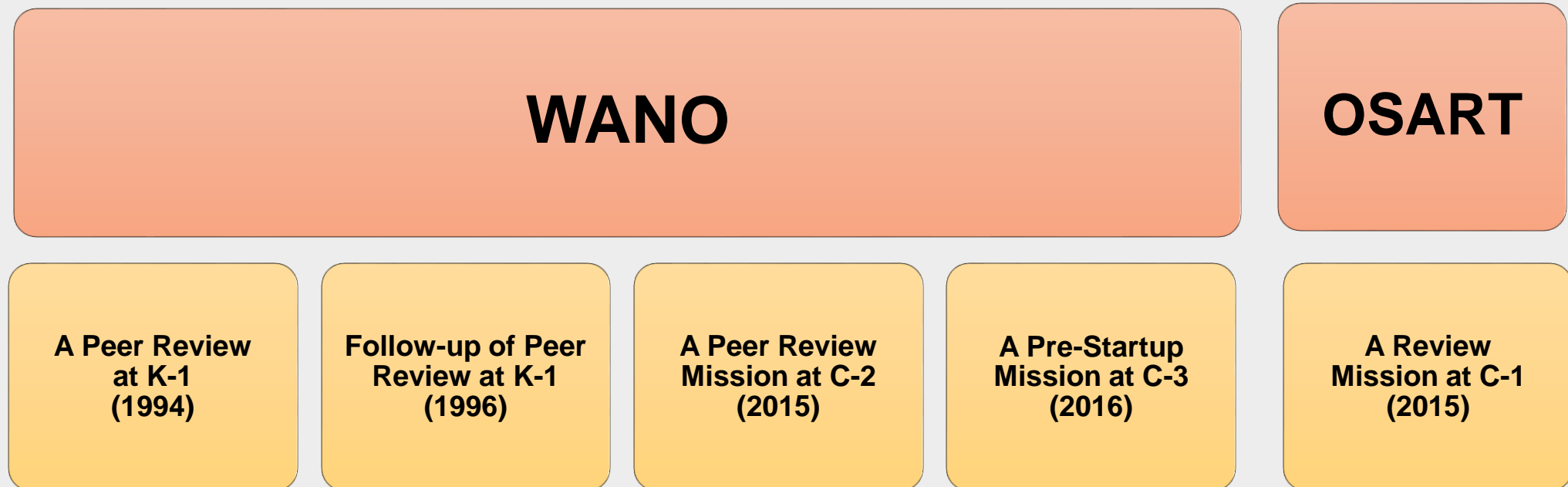
Pakistan Atomic Energy Commission (PAEC) is the operator of Nuclear Power Plants in Pakistan. PAEC has national role in developing and maintaining scientific & technological bases for safe use of nuclear energy.

PAEC has formally established and implemented a ***Nuclear Safety Policy*** from which specific safety rules, procedures and other requirements are derived to ensure the safety of general public and workers.



Safety in Nuclear Power Plants Operation

In addition to national programs and committees (CAP, SAP, SPI etc.), international commission such as WANO and OSART also visit Pakistan, periodically, for conducting Peer reviews and pre-start up reviews.



PAEC Corporate Safety Oversight Program

- Directorate General of Safety (DOS), a corporate office of PAEC, is aimed to oversee the implementation of safety standards at NPPs through various directorates
- Directorate of Physical Protection and Emergency Management (PP&EM) oversee the physical protection of NPPs, radiological emergency preparedness and response plans.
- DOS has also established PAEC Emergency Response Coordination Center (PERCC) which is responsible to communicate among all stake holders, in the event of emergency

National Experience towards Security of Nuclear Installations

- Security in Design and Construction of NPPs
- Security in Operation of NPPs
- PAEC Corporate Security Oversight Program

Security in Design and Construction of NPPs

During the design and construction phase(s) of K-2 and K-3, following security measures are incorporated:

- Nuclear security and Physical Protection (PP) is included in initial phases of siting, layout and design
- Design of Physical Protection System (PPS) are based on graded approach consistent with Nuclear Security Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225) and the concept of defense in depth is also incorporated as per Amended CPPNM

Security in Operation of Nuclear Power Plants

Following Physical Protection (PP) measures are taken at NPPs:

- At C-series, an integrated PPS is designed, implemented and maintained. A robust Central alarm Station (CAS) is established for monitoring and assessment of alarms and communication to response force. A Backup Alarm Station (BAS) is also established in case of unavailability of CAS
- At KANUPP, the concept of defense in depth is incorporated in design and installation of PPS. Adequate physical protection measures for access control, personnel search, vehicle search etc. are incorporated at various protection layers i.e. limited access area, protected area and core area

PAEC Corporate Security Oversight Program

- PAEC Corporate office, oversee the physical protection of NPPs and radiological emergency preparedness response
- The physical protection plans are reviewed under PAK/925 and PAK/926. As per national regulation (PAK/913), a physical protection plan must be in place before introduction of nuclear material in to the facility
- Physical Protection/Security drills are also conducted periodically and officials from corporate office also participate to observe and suggest Areas for Improvements (AFIs).

Safety-Security Synergy at Nuclear Installations in Pakistan

Safety and security interfaces during the lifetime of NPPs in following areas:

- Establishment, implementation and maintenance of nuclear safety regime
- Establishment, implementation and maintenance of nuclear security regime
- Identification of areas where nuclear safety and security share similarities;
- Identification of areas where nuclear safety and security differ;
- Identification of safety concepts & operational practices to enhance protection
- Integration of safety and security measures such that implementation of one does not compromise the other;
- Awareness of safety and security synergy

Areas Where Nuclear Safety and Security Share Similarities

Nuclear Safety and Security Share Similarities in various areas e.g.

- Placement of reactors inside containment structures
 - To keep radiation from reaching the environment
 - To provide a robust structure against terrorist attacks
- Controlled access to NPPs
 - To ensure authorized access only
- Use of Electronic Pocket Dosimeter (EPD) to access containment building
 - To ensure radiation protection and controlled access to vital area
 - Synergy is achieved by interlocking the turnstile gate with EPD reader

Areas Where Nuclear Safety and Security Differ

Nuclear safety and security differ in following areas:

- Access Control
 - Safety ensures knowledge based movement
 - Security requires need based movement
- Information sharing
 - Safety requires information sharing for free and for all
 - Security emphasizes on need to know principle
- Communication channel
 - Safety establishes wide outreach for communication channels
 - Security emphasizes on secure network

Safety Concepts And Operational Practices Which Enhance Protection

Certain design criteria imposed for safety purposes may serve to reinforce security, e.g.

- Single failure criterion applied to safety systems requires the nuclear installation to be designed with a sufficient level of redundancy and/or diversification to ensure that safety functions are maintained
- Redundancy in safety design also serves as security layers against adversaries' actions i.e. adversaries must compromise several safety layers in order to cause a radiological release
- Several layers of protection reinforce safety as the adversary needs to by-pass these layers for accessing the safety systems/controls

Integration of Safety and Security Measures without Compromising Either

One such example is emergency exit door having following features:

- Emergency exit doors are installed in vital/inner area so as to provide unhindered egress in case of emergency with push bars installed on secure/inner side only
- The doors are under surveillance in CAS through an integration software. In case of intrusion, CCTVs will automatically pop-up in CAS for the assessment of alarm
- The doors are designed and installed such that they enhance the intruder penetration time

Areas to Improve Synergy

Following measures have been taken to improve synergy:

- Safety people are made aware of the security arrangements e.g. location of barriers, access points, secure channels
- Security personnel are provided with basic knowledge of safety e.g. TDS principle, targets locations and emergency services at NPPs
- Moreover, to improve synergy following actions are also taken:
 - Plant operations review committee is made functional
 - Work planning and control committee is made functional
 - Design control and configuration management is in place
 - Quality assurance audits are conducted periodically

Conclusion

- Nuclear Safety and Nuclear Security have **common goals** but **different approaches** and culture which must not be pitted against each other so as to avoid:
 - Delays of scheduled activities
 - Unintended security vulnerabilities
 - Unintended impacts to safety systems
 - Unintended impacts to emergency response activities
- Table talks and interface platforms should be promoted to share the commonalities and differences
- A common glossary of terminology should be developed covering the key concepts within each field

Thank You