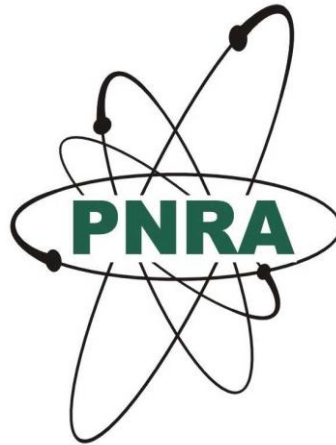


# Regulatory Perspective on New Nuclear Power Plants

05th Multinational Design Evaluation Programme (MDEP) Conference  
on New Reactor Design Activities  
International Co-operation: Past, Present and Future  
24-25 April 2023, Antalya, Turkiye



**Mr. Uzman Habib**

**Pakistan Nuclear Regulatory Authority (PNRA)**



# Contents

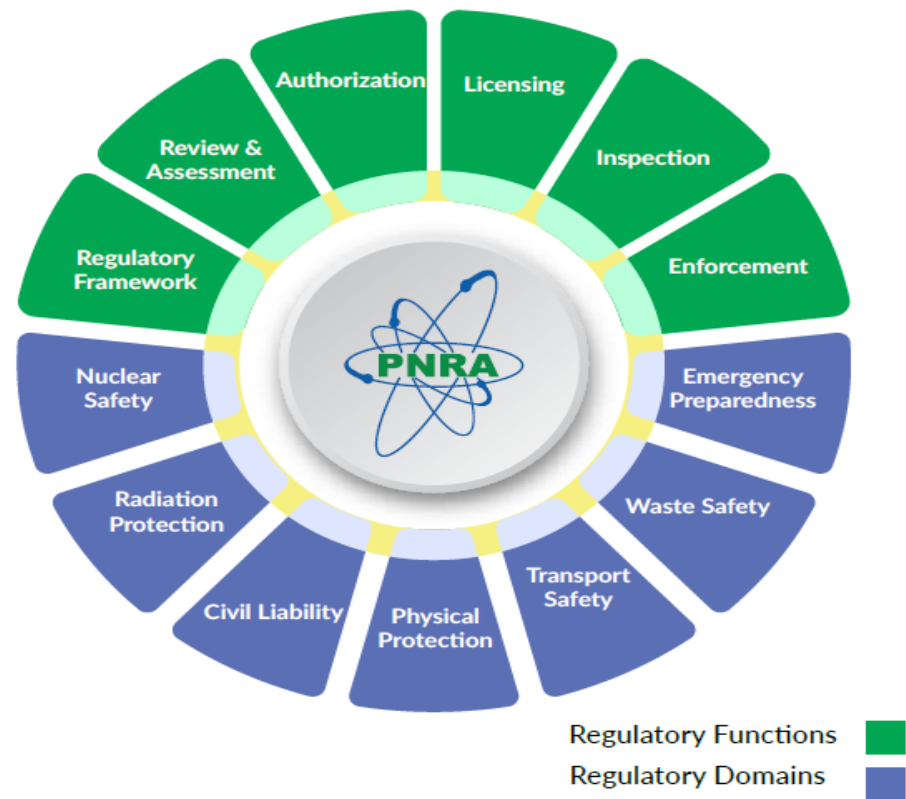
- ❑ PNRA Regulatory Functions and Domains
- ❑ PNRA Regulatory Framework
- ❑ Licensing Stages of Nuclear Installations
- ❑ Regulatory Experience in New NPPs Design
- ❑ PNRA's Regulatory Practices During Licensing of K-2/K-3 NPPs
- ❑ Feedback and Expectations from MDEP



# PNRA Regulatory Functions and Domains

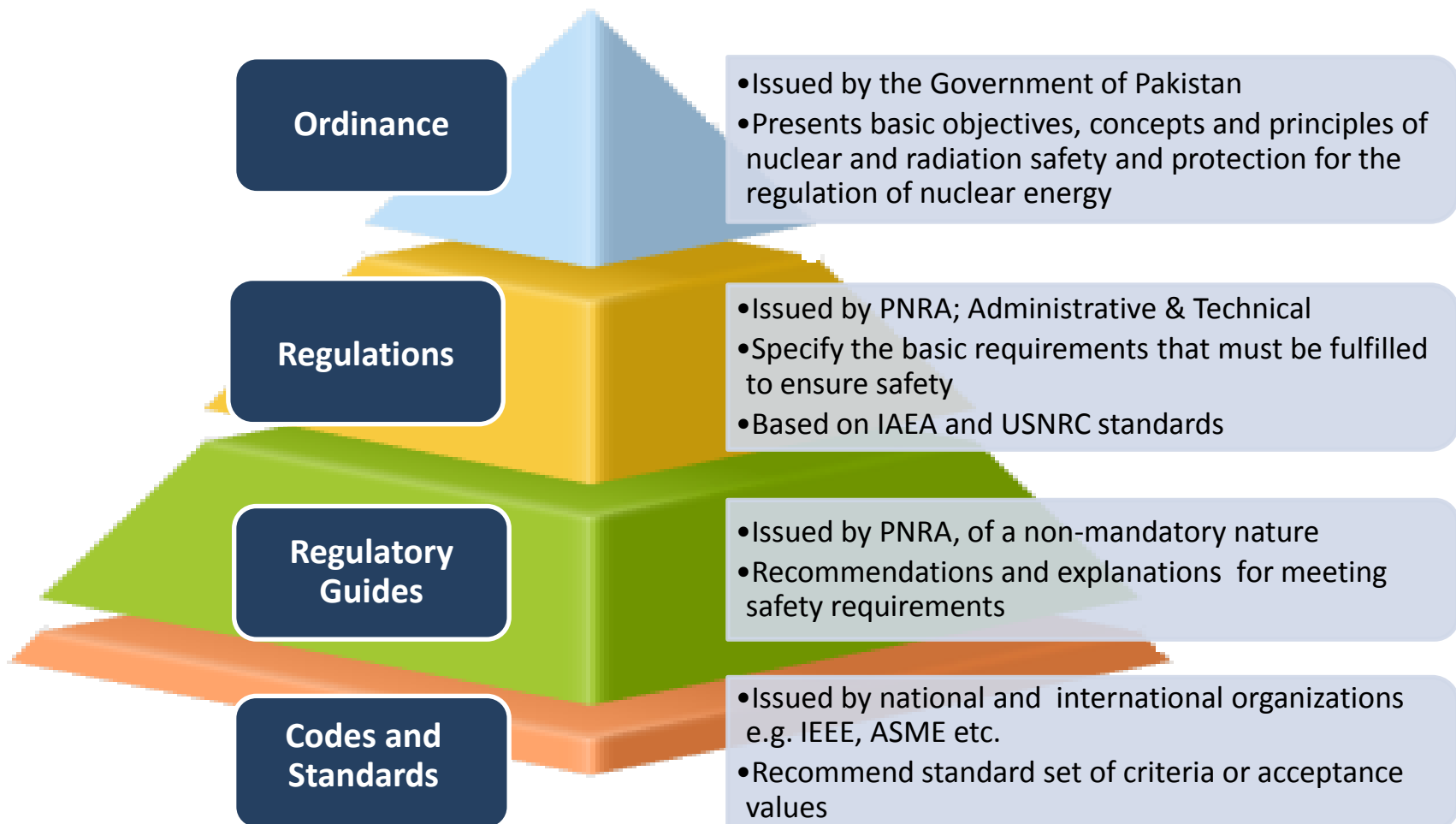
- Pakistan Nuclear Safety Committee -1965
- Nuclear Safety and Licensing Division-1970
- Directorate of Nuclear Safety & Radiation Protection -1984
- Pakistan Nuclear Regulatory Board -1994
- Pakistan Nuclear Regulatory Authority-2001

**Established as an independent regulatory body to ensure protection of workers, public and environment from harmful effects of ionizing radiation.**





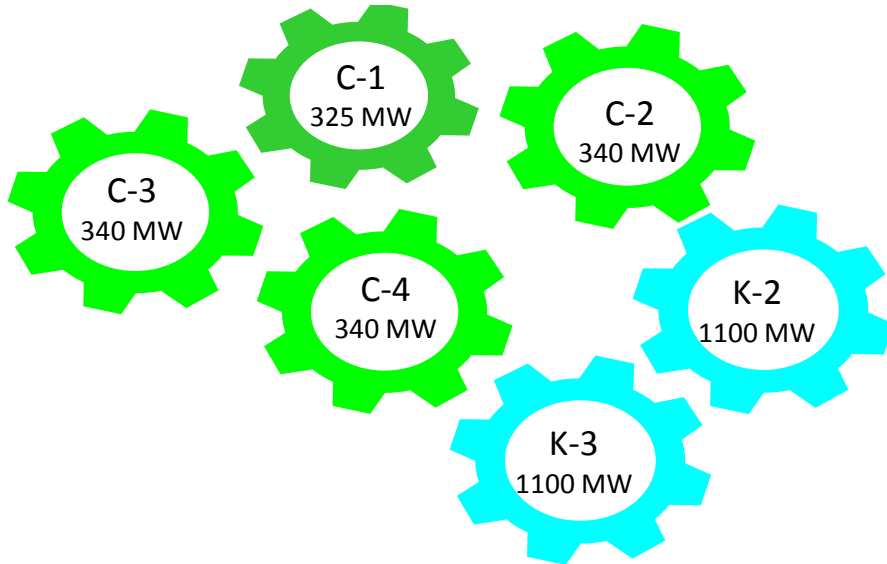
# PNRA Regulatory Framework



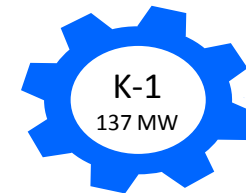


# Nuclear Power Plants (NPPs) in Pakistan

## Operational

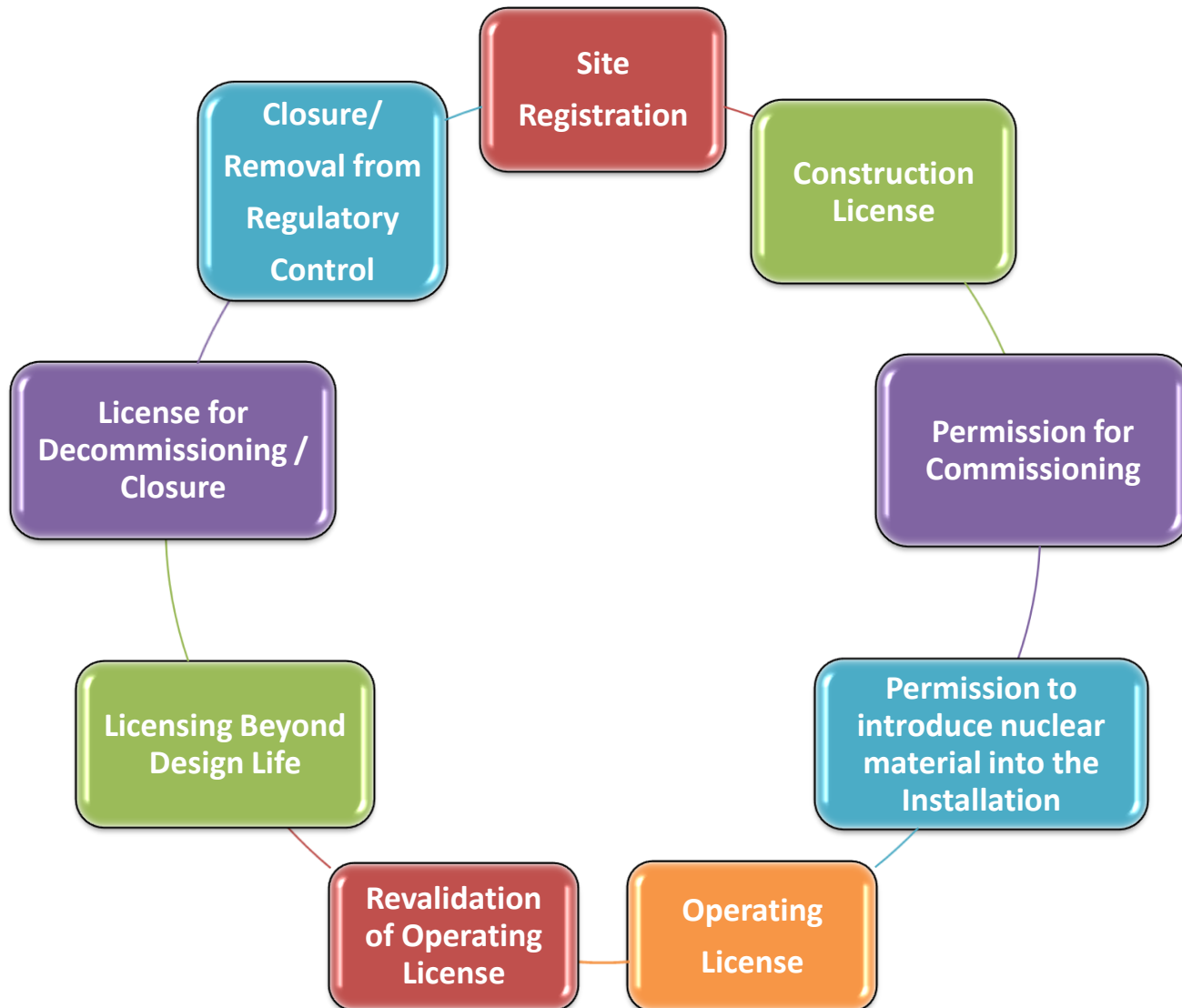


## Permanent Shutdown for Decommissioning





# Licensing Stages of Nuclear Installations





# Regulatory Experience in New NPPs Design (1/3)

## Background

- Previously, PNRA Regulations on Safety of NPP Design (PAK/911) and Safety of NPP Operation (PAK/913) were based on IAEA safety standards NS-R-1 and NS-R-2 respectively,
  - These regulations address the basic design objectives of Defence-in-Depth (DID), Common Cause Failures (CCF) and criteria to prevent accidents during commissioning and operation of NPP,
- Both these regulations have been revised on the basis of revised IAEA Specific Safety Requirements SSR-2/1 & SSR-2/2,
- These regulations address lessons learnt from the Fukushima Daiichi accident.



# Regulatory Experience in New NPPs Design (2/3)

## Major Requirements

- Practical elimination of plant event sequences that could result in large or early radioactive releases to the environment,
- Inclusion of removal of heat from the fuel storage in the fundamental safety functions,
- Use of passive safety features in design,
- Enhancing plant's capability to withstand design extension conditions without unacceptable radiological consequences,
- Use of non-permanent equipment for restoring the capability to remove heat from the containment and spent fuel pool,
- Establishment of an accident management program that covers all plant states.





# Regulatory Experience in New NPPs Design (3/3)

## □ Enhanced Safety Requirements in Regulatory Framework (PAK/911)

- Safety of the Plant Design
- Fundamental Safety Functions
- Application of Defense in Depth
- Nuclear Safety and Security Interface
- Features to Facilitate Radioactive Waste Management and Decommissioning
- Internal and External Hazards
- Design Extension Conditions



# New Design Features of K-2/K-3 NPPs

- ❑ Double Shell Containment
- ❑ H4 line (Connection between SIS and CSS)
- ❑ Cavity Injection and Cooling System
- ❑ Passive Containment Heat Removal System
- ❑ Passive Residual Heat Removal System of Secondary Side
- ❑ Containment Filtered Ventilation System
- ❑ Digital Based Control Room
  - Advanced Alarm System
  - Graphic Information Display System
  - Computerized Procedure Systems



# PNRA's Regulatory Practices During Licensing of K-2/K-3 NPPs (1/2)

- ❑ Participation as an observer in IAEA Generic Safety Review (GSR) of K-2/K-3,
- ❑ PNRA took on-board other government organizations, held discussions, acquired technical data, utilized their knowledge and updated assessment in *Site Registration*,
- ❑ Inclusion of *Review and Assessment* phase namely “OEF and Fukushima Insights” in the evaluation of SARs,
- ❑ Participation of PNRA inspectors in *Commissioning* stages amid the COVID-19 pandemic.



# PNRA's Regulatory Practices During Licensing of K-2/K-3 NPPs (2/2)

- ❑ Comprehensive review meetings were conducted for resolution of PNRA queries on Final Safety Analysis Report (FSAR) of K-2/K-3
- ❑ For TROs (requirements for SSCs to be used during DECAs), system design manuals were used for review and commissioning tests were witnessed with the intent to verify the feasibility of Surveillance Requirements,
- ❑ PNRA has developed its own regulator's Level 1 PSA model of K-2/K-3 to enhance the effectiveness and efficiency of regulatory oversight.



# Feedback and Expectations from MDEP

- ❑ PNRA appreciates the efforts of MDEP for increasing cooperation among existing regulatory frameworks and establishing mutually agreed common positions on safety significant issues
- ❑ PNRA expects to benefit from international experience in regulatory oversight of HPR1000 NPPs and share our national experience with global community
- ❑ Regulatory cooperation in new areas like software reliability, issues in digital I&C, cyber security and application of AI, regulatory framework for SMRs, etc.

**Thank You**

