

Regulatory Framework for Occupational Exposure Management in Pakistan



Bushra Nasim
Pakistan Nuclear Regulatory Authority

2009 ISOE International ALARA Symposium
13-15 October, 2009, IAEA HQ, Vienna, Austria



Scheme of Presentation

- **Evolution of Regulatory frame work for nuclear and radiation safety**
- **National regulations and guides**
- **Implementation of regulatory requirements**
- **Occupational exposure at CNPP-Unit 1**

PAKISTAN

Administrative Divisions

km 100 50 0 100 200 300 km

Scale 1:7 500 000

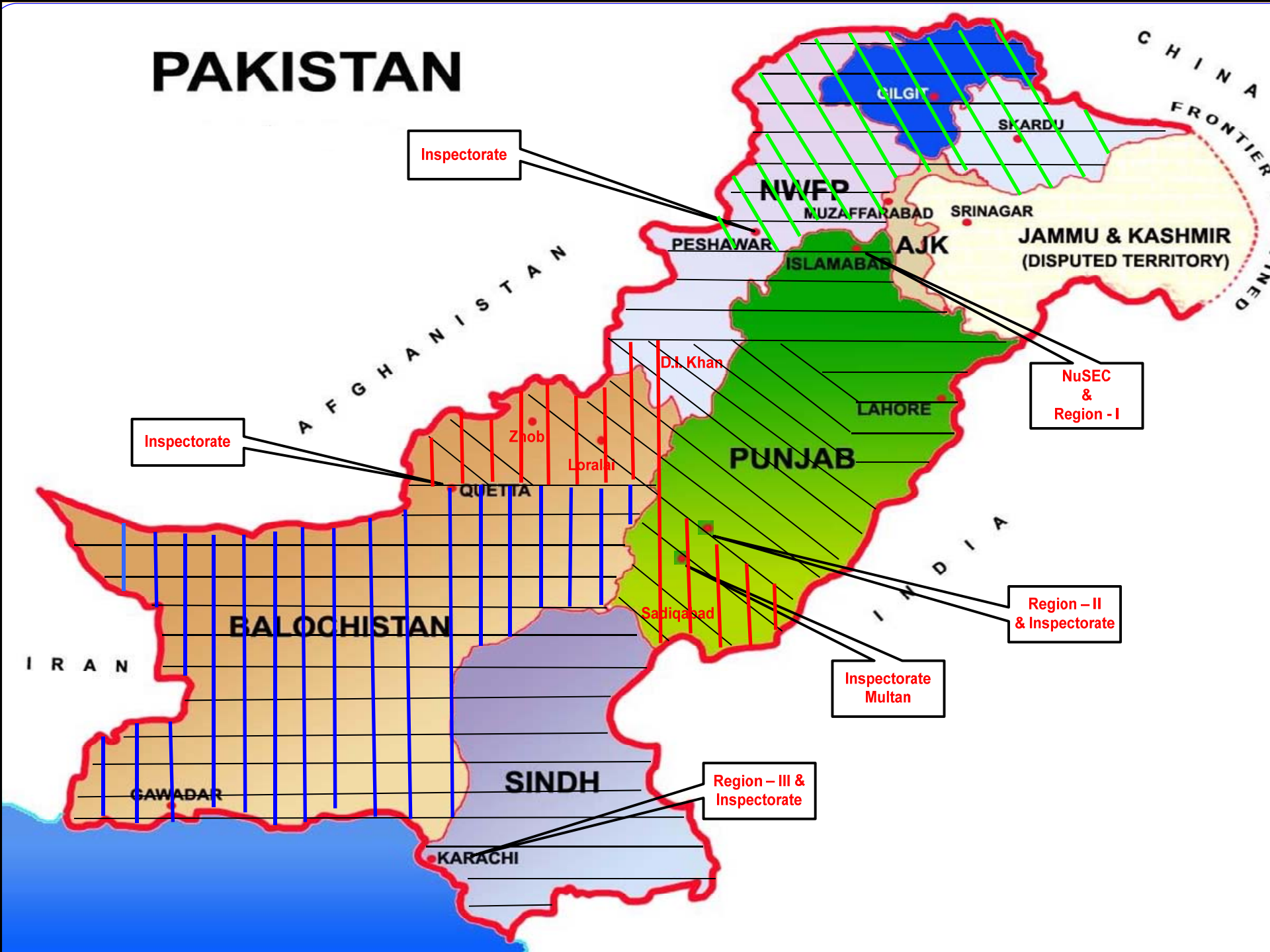
- International boundary
- Provincial boundary
- Divisional boundary
- District boundary
- National capital
- Provincial capital
- Divisional capital
- District / Tribal area capital



Centrally administrated area



PAKISTAN





Evolution of Regulatory Framework

1965 – Commissioning of first research reactor

1970 – Establishment of Nuclear safety and licensing division (NSLD) within PAEC

1972 – First nuclear power plant started operation

1984 – NSLD became Directorate of Nuclear Safety and Radiation Protection (DNSRP)



Evolution (cont..)

1994 - Signed the International Convention on Nuclear Safety

1994- Pakistan Nuclear Regulatory Board

1997 - Ratified Convention on Nuclear Safety

2001 - Pakistan Nuclear Regulatory Authority



Pakistan Nuclear Regulatory Authority (PNRA)

- **PNRA is established by the Government of Pakistan to regulate and supervise all matters related to Nuclear Safety and Radiation Protection**
- **The primary safety objective is to protect human health and the environment from harmful effects of ionizing radiation.**

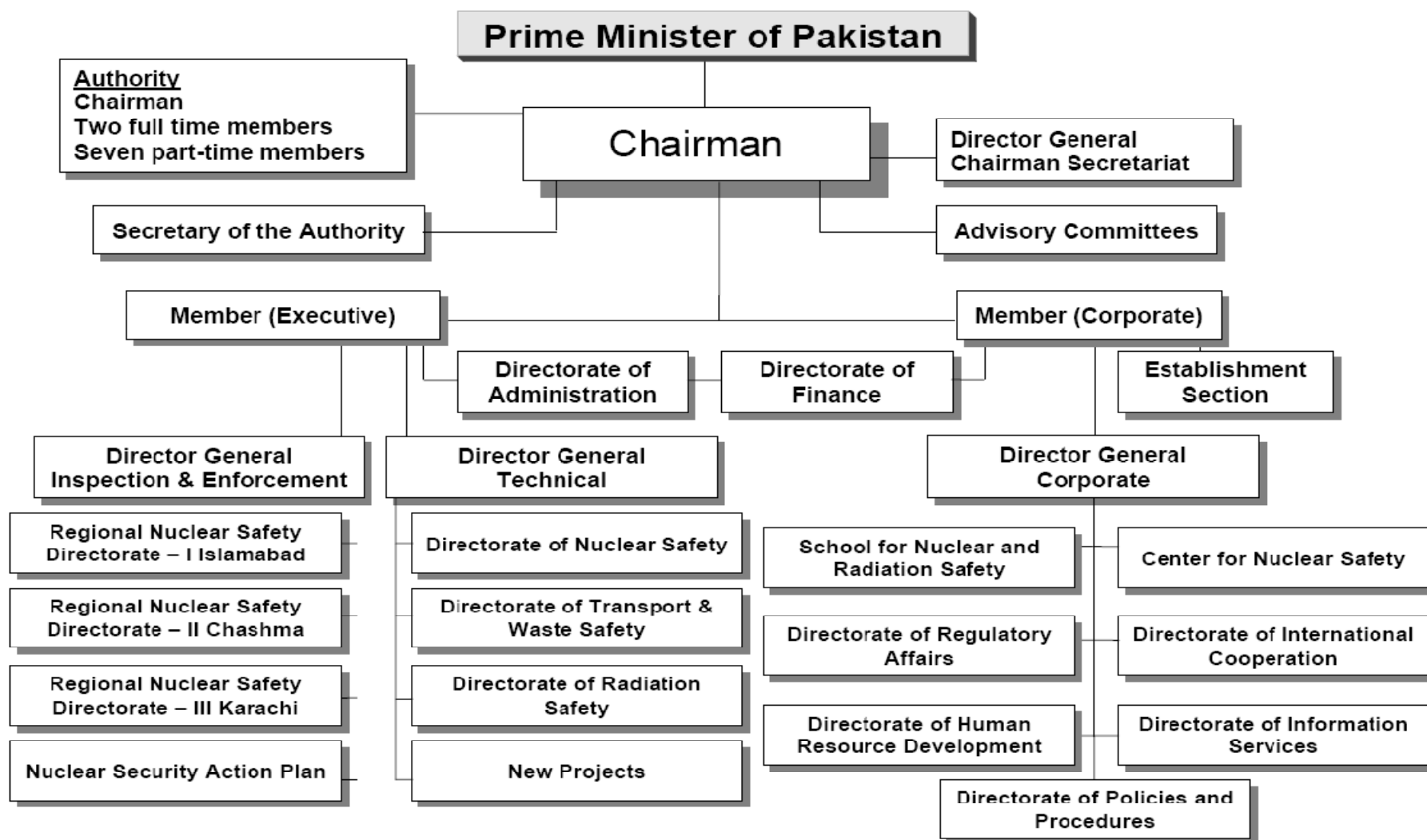


Mission of PNRA

The mission of PNRA is “to ensure safe operation of nuclear and radiation facilities, and to **protect the radiation workers, general public and the environment** from the harmful effects of ionizing radiation by **formulating and implementing effective regulations and building a relationship of trust with the licensees and maintaining transparency in actions and decisions taken by it.**”



Organizational Structure





Composition of Authority

Seven part time members are from:

- 1. 2 Scientists/ Engineers from universities**
- 2. 1 Medical doctor (Radiologist)**
- 3. 1 Ministry of Health**
- 4. 1 Environmental Protection Agency**
- 5. 1 PAEC**
- 6. 1 D-G (SPD), JSHQ (ex-officio)**



Functions of PNRA

- **Registration and Licensing of Facilities**
- **Preparation of Regulations, Regulatory Guides, Procedures**
- **Implementation and Enforcement of Regulatory requirements**
- **Safety Reviews and assessments**
- **Regulatory surveillance and inspections**
- **Physical Protection of nuclear facilities and materials**
- **National and International coordination**
- **Licensing of Operating Personnel**



Types of Facilities Regulated by PNRA

- **Research Reactors**
- **Nuclear Power Plants**
- **Radiotherapy centers**
- **Nuclear Medical centers**
- **Diagnostic Radiology**
- **Irradiators**
- **Industrial Radiography**



Current Nuclear Power Program

- **KANUPP** 137 MWe –re licensed for operation till 2010 after completing design life of 30 years in 2002
- **C1** 325 MWe - operating since 2000
- **C2** 325 MWe - in commissioning stage, expected to be in operation by 2011



Responsibilities Functions and Powers of the Authority under the Legislation

- Authority shall have the responsibility for **controlling, regulating and supervising** all matters related to **nuclear safety and radiation protection** in Pakistan. The following shall be the powers and functions of the Authority: to **devise, adopt, make and enforce rules, regulations, orders or codes of practice for nuclear safety and radiation protection** and to plan, develop and execute comprehensive policies and programs for the protection of life, health and property against the risk of ionizing radiation.



Regulations

- Regulations on Radiation Protection (PAK/904)
- Regulations for the licensing of Radiation Facilities other than nuclear installations (PAK/908)
- Regulation for Licensing of Nuclear Installation (s) (PAK/909)
- Regulations on Safety of Nuclear Power Plants - Design (PAK/911)
- Regulations on Safety of Nuclear Power Plants - Quality Assurance (PAK/912)



Regulations

- Regulations on Safety of Nuclear Power Plants – Operations (PAK/913)
- Regulations on Management of a Nuclear or Radiological Emergency (PAK/914)
- Regulations on Radioactive Waste Management (PAK/915)
- Regulations for Safe Transport of Radioactive Material (PAK/916)



Radiation Protection Regulations (PAK/904)

- Regulations were issued in 1990, updated in 2004
- Current regulation are based on BSS 115 and National Experiences
- Set requirement for registration and licensing of facilities using radiation apparatus/ material
- Set management and technical requirements for occupational exposure protection, medical exposure protection, public exposure protection
- Set annual dose limits, guidance levels for medical procedures, exemption levels



Regulation for Licensing

- **PAK/908: the licensing procedure for radiation facilities comprise of following stages:**
 1. Registration of premises
 2. Licensing for operation
- **PAK/909: Licensing procedure for nuclear installations comprise of following stages:**
 1. Registration of site
 2. Issuance of construction license
 3. Issuance of operating license



Documentation in Licensing Procedure for NPPs

Application for introduction of nuclear material into the system should be supported by

- **Radiation protection program**
- **Emergency preparedness program**
- **Operating policies and procedures**
- **Environmental monitoring program**
- **Radioactive waste management program**

On approval of these documents, fuel loading permit is granted. Before start of operation licensee demonstrates emergency preparedness program.



Regulation on Safety of NPP Design(PAK/911), on the Safety of NPP Operation (PAK/913)

- **The design shall have as an objective the prevention or, if this fails, the mitigation of radiation exposures resulting from design basis accidents and selected severe accidents. Design provisions shall be made to ensure that potential radiation doses to the public and the site personnel do not exceed acceptable limits and are as low as reasonably achievable.**
- **The licensee shall establish and implement a program to ensure that, in all operational states doses due to exposure to ionizing radiation in the plant or due to any planned releases of radioactive material from the plant are kept below prescribed limits and be as low as reasonably achievable. This program shall meet the requirements of regulations on radiation protection (PAK/904) and shall be approved by the Authority.**



Regulations on Management of a Nuclear or Radiological Emergency (PAK/914)

- These regulations apply to all those practices and sources that have the potential for causing radiation exposure or environmental radioactive contamination warranting an emergency intervention.
- These regulations establish the requirements for an adequate level of preparedness and response for a nuclear or radiological emergency linked with the hazard associated with the practice.
- These regulations include requirements on protection of emergency workers, guidelines for intervention and action levels in emergency exposure situations



Mechanism to Regulate Radiation Protection

Review of Preliminary and Final Safety Analysis Reports

- **Policy, Design and operational considerations for radiation protection and ALARA implementation**
- **Contained, air born and accident source term**
- **Radiation Protection Design Features**
- **Dose Assessment Methodology**
- **Health Physics Program**



Inspections

- **Radiation protection & Dose assessments program**

Biannual inspections are conducted to evaluate licensee RP/ALARA/dosimetry program. PNRA is maintaining data base for dose record of all radiation workers.

- **Evaluation of RFO program/ reports**

Inspections during RFOs are conducted by a combined team from regional and HQ inspectors. An evaluation report on RFO is issued and discussed with the licensee for future planning.

- **Emergency planning and preparedness program**

Annual inspection is conducted by a joint team of regional/ HQ inspectors. On site inspectors observe different drills etc.,



PNRA Inspection Program

- **Planned Inspections**
- **Reactive Inspections**
- **Announced inspections**
- **Un-announced Inspections**
- **Periodic Inspections**

Inspections by on site inspectors at regional directorates

Special inspections include inspectors from Headquarter



Licensee Submissions, PNRA Review Reports

- **Submission of documents from NPPs**

Annual Dose reports, ASRs, MTRs, RFO documents, ambient dose levels around NPPs, environmental operating report, and other special documents/procedures/plans etc

- **PNRA Internal Reports based on data from NPPs related to RP.**

Occupational Exposure at NPPs, Radiation Safety/ ALARA at NPP, Post RFO Report, Ambient Dose levels around NPPs . for Authority meetings, Inspection Recommendations, Follow-up, etc



Promotion of Relationship with Licensee

In order to promote good relationship with the licensee, Quarterly meetings are conducted with the NPPs licensee in a more open environment to discuss different issues related to nuclear and radiation safety. Mostly these issues are coming from continuous regulatory oversight by on site inspectorate, different regulatory requirements of PNRA etc.,



Occupational Exposures at CNPP-1



Chashma Nuclear Power Plant-I

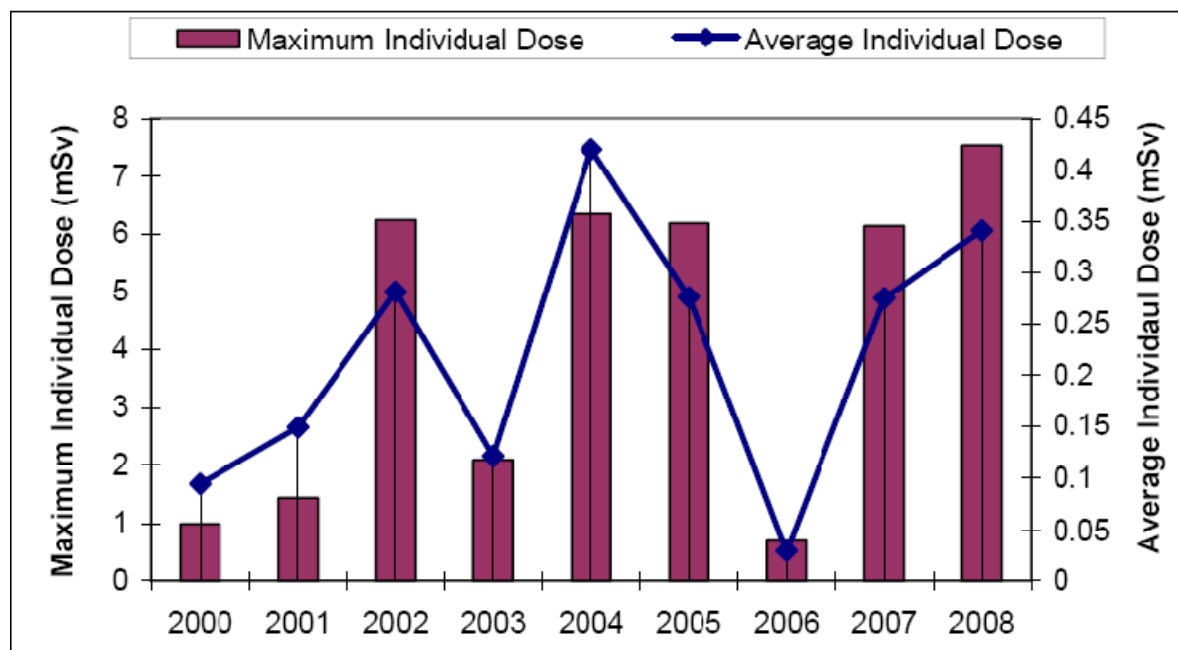
- 325 MWe Two loop PWR
- Design Life 40 years
- Completed nine years of operation in September 2009
- Five Refueling Outages (2002, 2004, 2005, 2007, 2008-09)





Trend of Occupational Exposures at C1 2000-2008

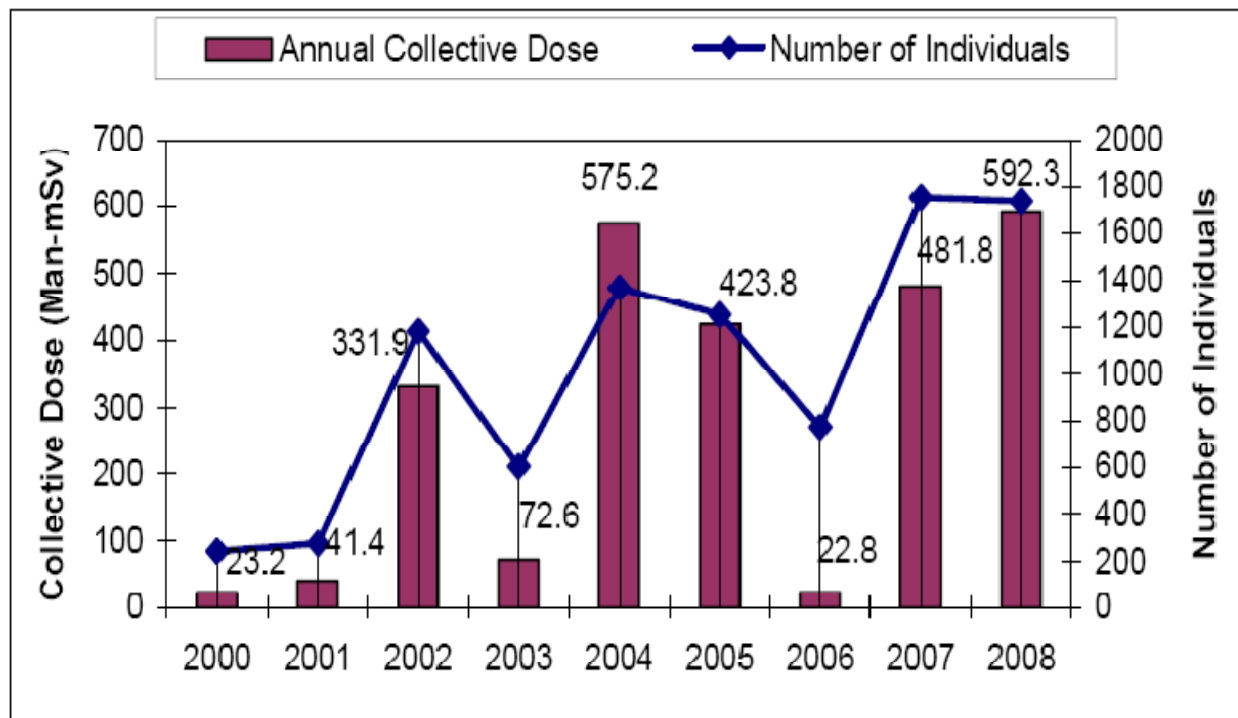
- Max Individual Dose (RFO) :
7.5 mSv
- Max Individual Dose (Non RFO):
2.1 mSv
- Annual Avg. Individual Dose:
<0.5 mSv





Trend of Occupational Exposures at C1 2000-2008

- Annual Collective Dose:
20-70 man-mSv
(Non RFO Years
2000, 2001, 2003,
2006)
- Annual Collective Dose:
330-590 man-mSv
(RFO years 2002,
2004, 2005, 2007,
2008)





Conclusion

- **PNRA has established a functional radiation protection regulatory framework in the country and has developed a comprehensive mechanism for implementation of this framework.**



Thank you all!