



Pakistan Nuclear Regulatory Authority

Presentation 2.3

National strategy on building and sustaining capacity in nuclear and radiation safety in Pakistan

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**Regional Meeting on the
Management of Training Systems for Nuclear and Radiological Safety
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Outline

- Introduction to the **main governmental organizations (PNRA and PAEC) responsible for peaceful application and ensuring nuclear safety and radiation protection in Pakistan**
- **Licensed nuclear installations and radiation facilities in Pakistan**
- Building and sustaining competence of **regulatory body in nuclear and radiation safety**
- Development and sustaining competence **of licensees and other national institutions** in order to ensure **nuclear and radiation safety**
- **Competence building of response organizations**



Nuclear Stakeholders

Following are the Nuclear stakeholders:

- **Nuclear Regulators** to ensure that operation of nuclear Installations and Radiation facilities pose no harm to the public and environment
- **Promoters** of Nuclear Installations and Radiation Facilities
- **Government entities** tasked with physical protection of nuclear installations, radioactive materials and response to nuclear and radiological emergencies



Nuclear Regulators (PNRA) and its Competence Development

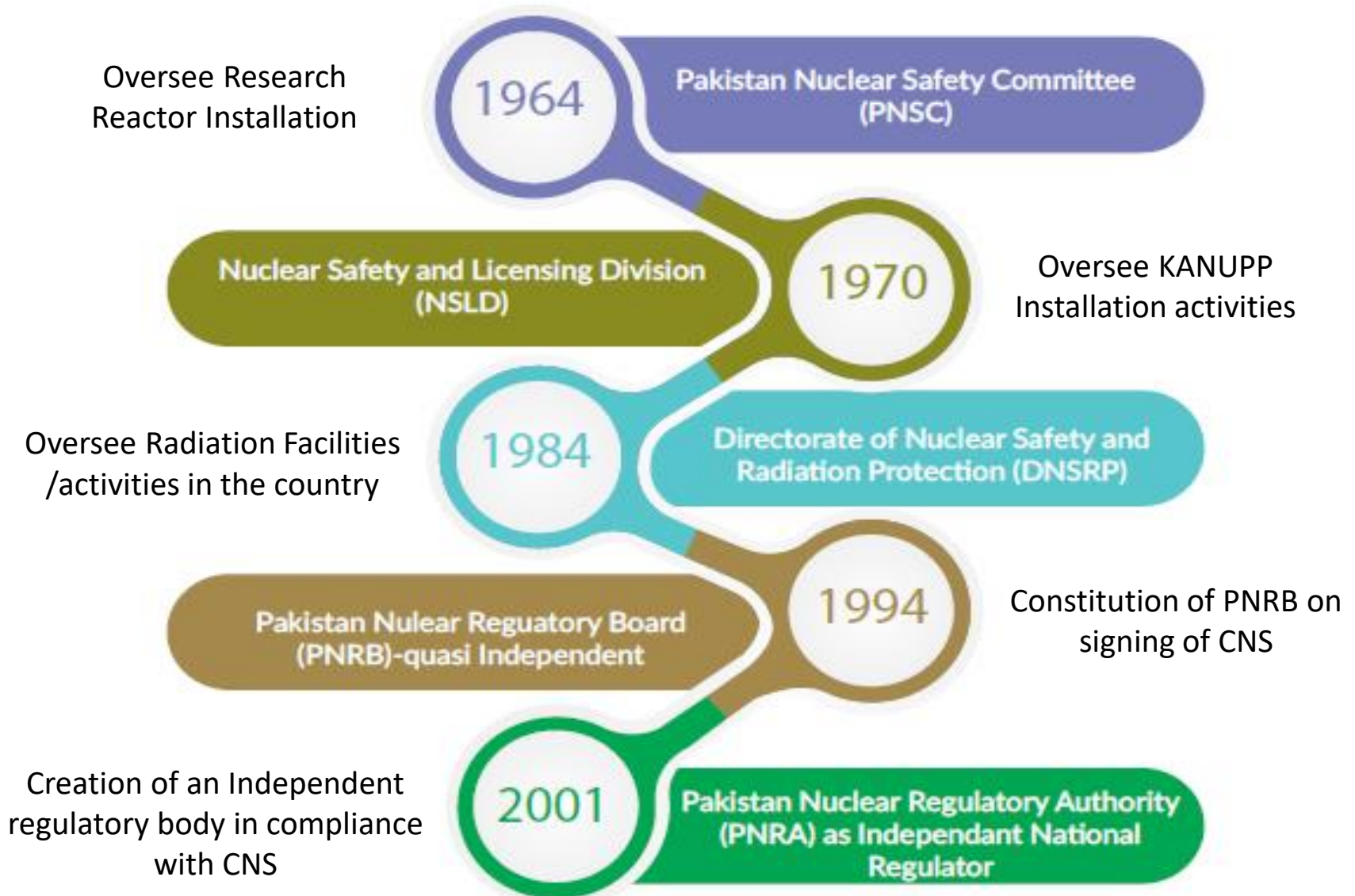


Nuclear Regulator

- The Govt established PNRA in 2001 as the national competent authority with the mandate **to regulate Nuclear Safety and Radiation Protection** in order to ensure protection of human being and the environment from the harmful effects of ionizing radiation.



History of Nuclear Safety





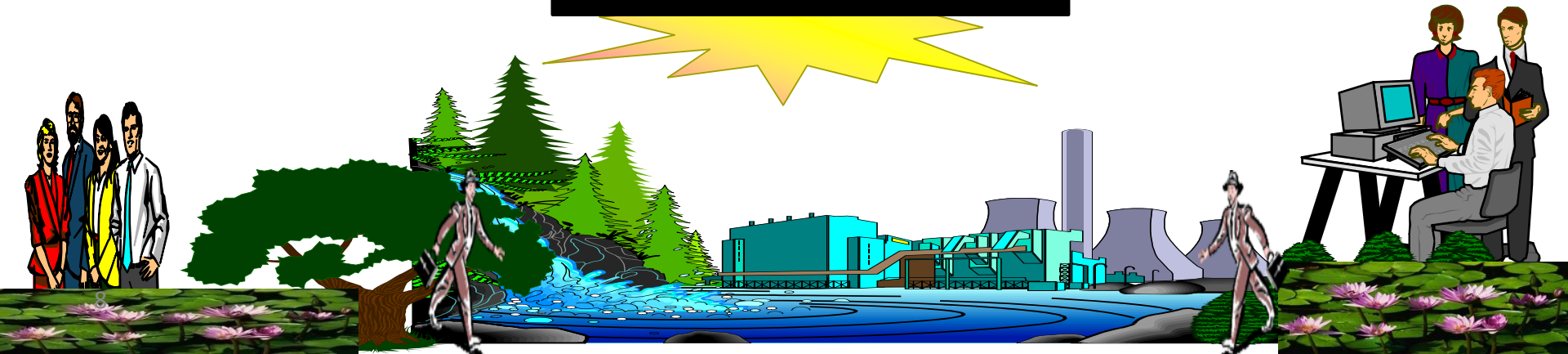
Vision of PNRA

- To become a world class regulatory body with highly trained, competent and dedicated personnel working in unison with a zeal to ensure nuclear safety
- To foster a positive safety culture in the licensees and regulate nuclear facility in a manner that wins the confidence of all the stakeholders



Mission of PNRA

To protect the **radiation workers, general public**
and environment from the harmful effects of
ionizing radiations





Major Functions of PNRA (1/2)

- Make and implement Rules and Regulations
- Regulate Nuclear Installations and Radiation Facilities
- Grant license and authorization to NIs & RF
- Perform review and assessment of licensee submissions
- Conduct regulatory inspections of nuclear installations and radiation facilities
- Take enforcement actions in case of violations or non compliance



Major Functions of PNRA (2/2)

- Ensure that adequate **emergency preparedness plans** are in place for radiological emergency
- Ensure that the **licensee has provided appropriate physical protection measures** at nuclear installations
- Implement **environmental monitoring program** to check any build-up of radioactivity in the environment
- Establish **the extent of insurance for an operator** incase of nuclear accidents
- Advise Government Departments regarding nuclear safety & radiation protection



Licensed Nuclear Installations

- Nuclear power plants / Research Reactors
- Manufacturers of nuclear safety class equipment and containers for transport and spent fuel storage, Designers, Service Providers
- Molybdenum production facility/ waste disposal facilities
- Nuclear medical centers - diagnostic and therapeutic radiology (including x-ray machines)
- Irradiators used for sterilization of medical equipment and food preservation
- Agriculture centers using radioactive sources
- Industries and Research facilities using radiation sources



Licensed Nuclear Facilities



Research Reactors
Molybdenum plant
Waste disposal



C-Series Plants



K-Series Plants



Manufacturers



Licensed Radiation Facilities

- **Radiation Facilities**

– N. Medical Centers	88
– Industries	229
– Research/Education	84
– Diagnostic X-rays	5286
– Others (importers Scanners, calibration)	347

Total = 6034

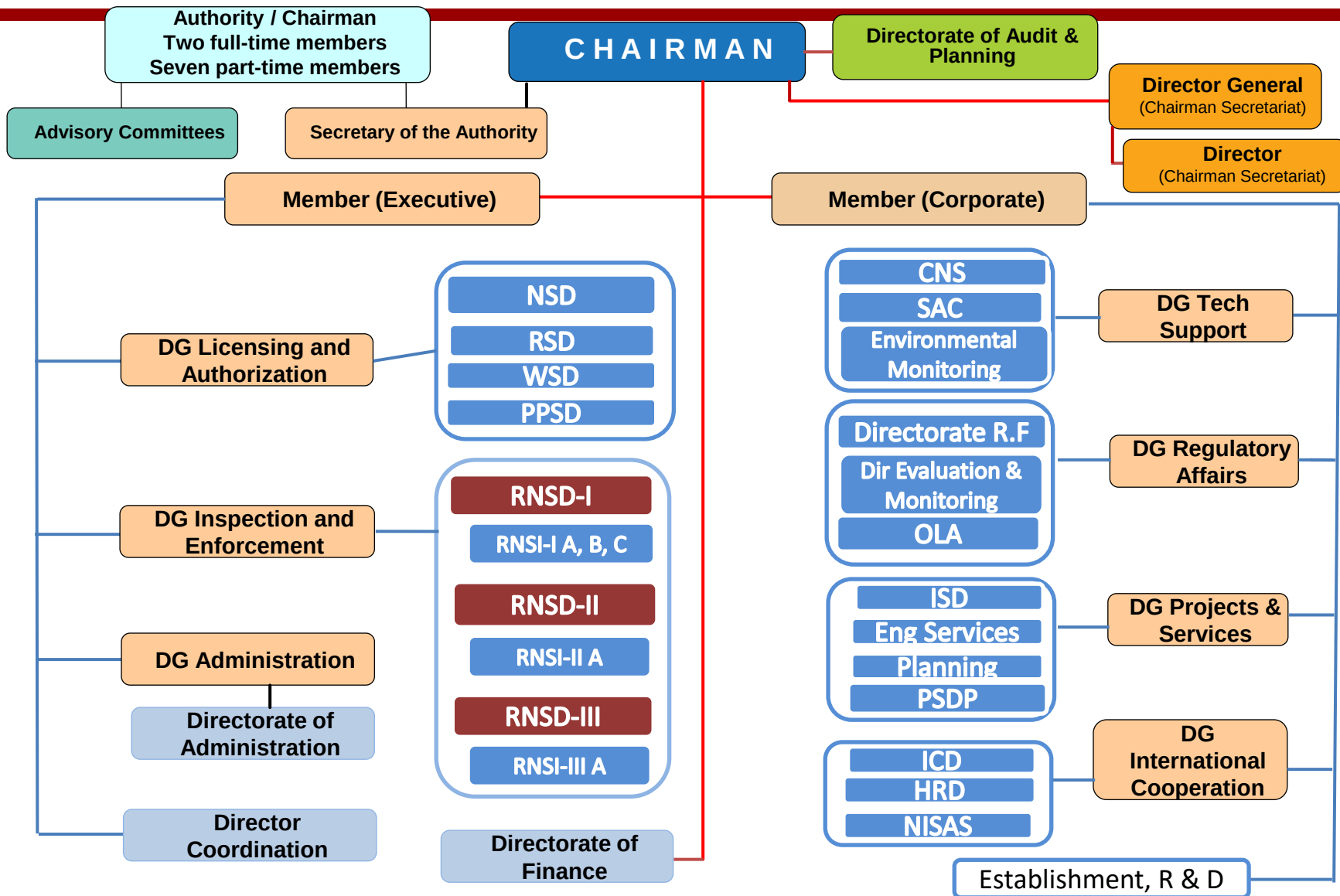
- **Sealed Radioactive Sources**

– N. Medical Centers	604
– Industries	1373
– Research / Education	772
– Calibration	1148
– Others	19

Total = 3916

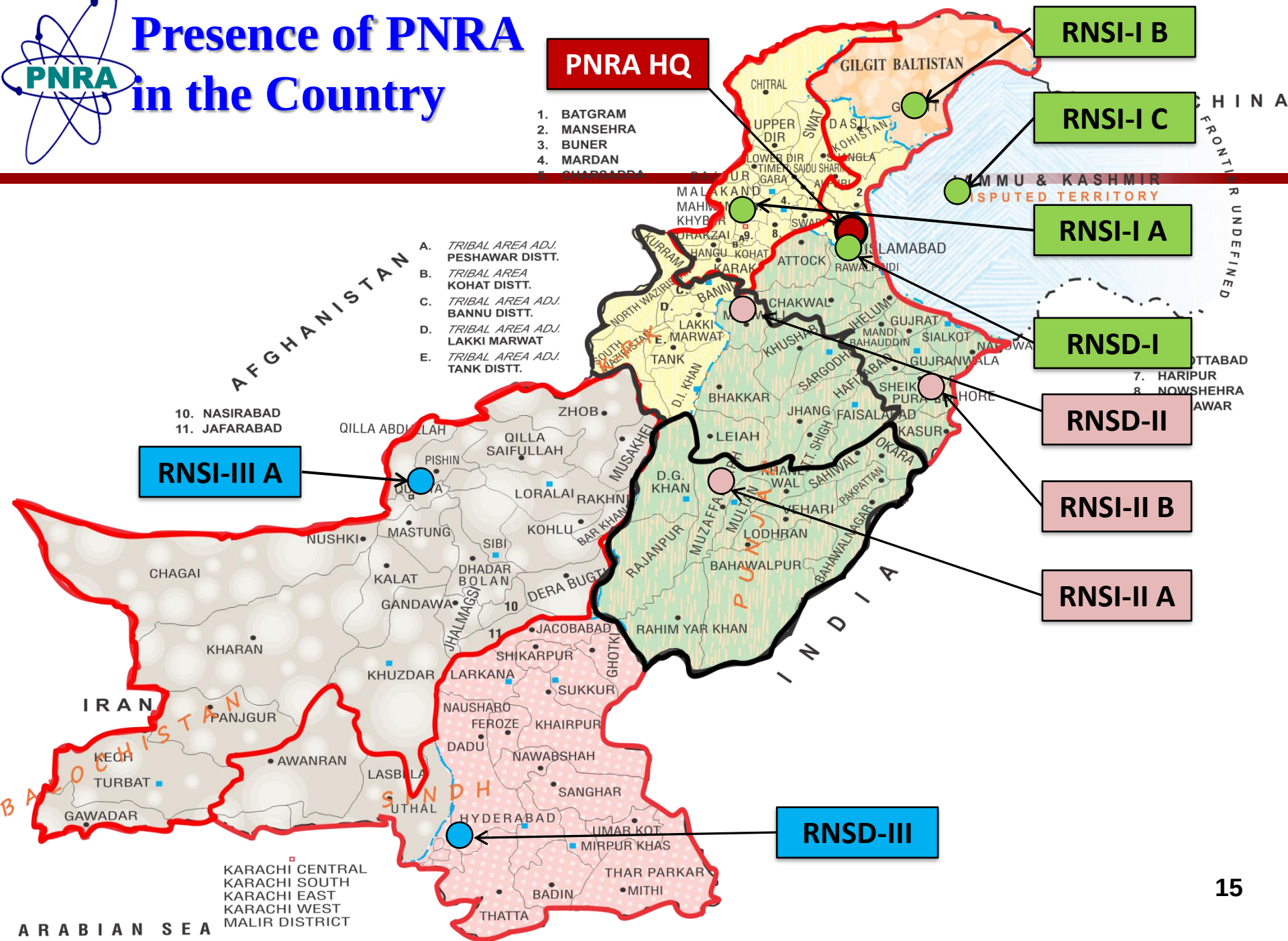


Organization Structure of PNRA





Presence of PNRA in the Country





Early Challenges for PNRA

- PNRA was working with 40 technical officers at the time of establishment. Following were the main challenges:
 - **Shortage of manpower**: there was an urgent need for recruitment of more scientists and engineers
 - **Lack of expertise in specific technical areas**: training of the newly inducted officers and existing regulatory staff was required for enhancing their capabilities to cope with future needs.
 - **Need of adequate Regulatory Framework**: to identify the regulatory requirements necessary for regulating nuclear installations and radiation facilities.



Recruitment of Manpower

- PNRA adopted **2-pronged** approach for recruitment:
 - **Direct induction** of:
 - **Fresh university graduates**; and
 - **Experienced professionals** having industry experience
 - Induction **through fellowship programs** at PIEAS and KINPOE
 - Graduates were selected for Master degree programs in nuclear/ power/system engineering and medical physics at PIEAS and KINPOE – they joined after completion of Master's degrees



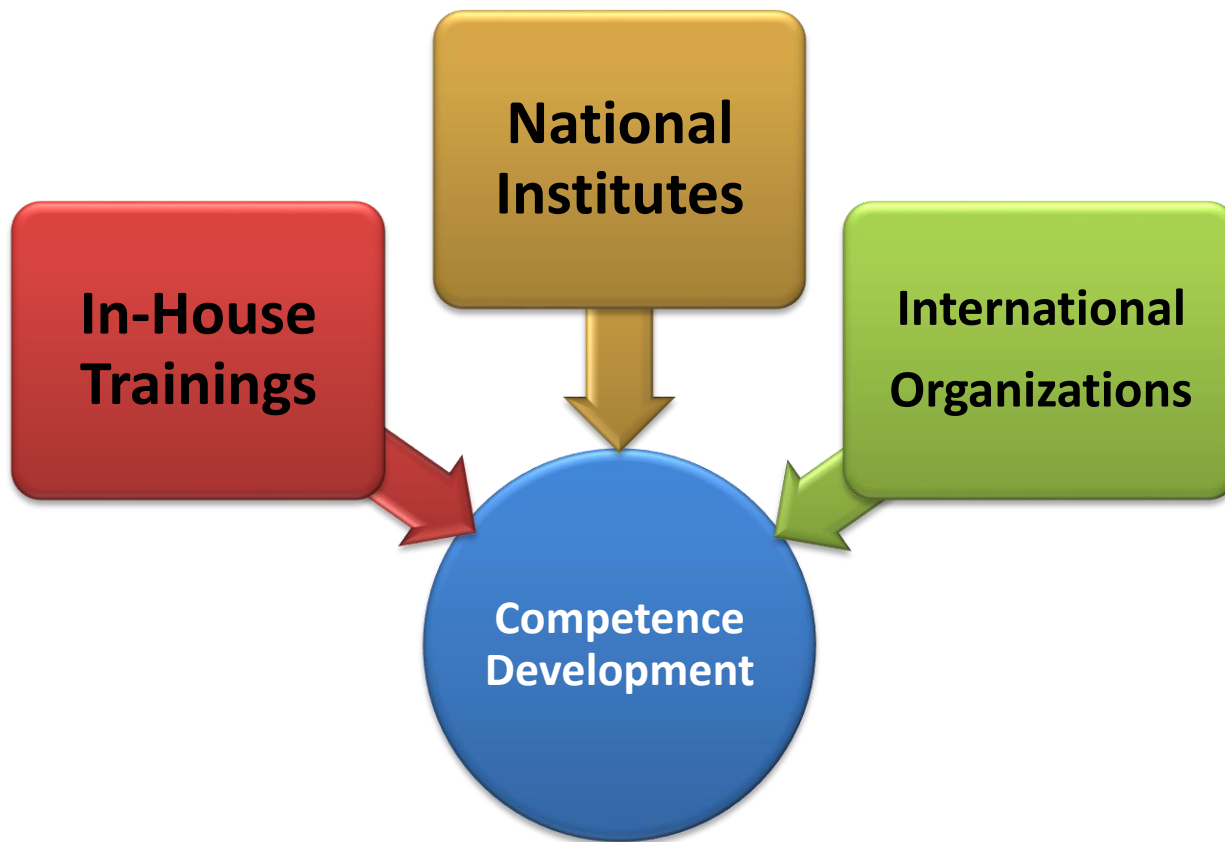
Requirements for Competence of RB Officials

- The requirements for competence is embedded in PNRA vision statement which states that its manpower should be highly trained, competent and dedicated
- PNRA Management System Manual (MSM) requires that each department should assess and determine its need of necessary human resources to perform assigned activities.
- HRD conducts competence need assessment and to identify the training requirements for PNRA manpower.
- Senior management ensures the availability of necessary human resources and competencies at PNRA



Competence Development of R.B

- PNRA followed a three-pronged strategy for competence development of regulatory staff





Competence Development of R.B

In-house Training

- PNRA conducted Training Needs Assessment (TNA) in 2004-05 which identified around **fifty** training courses.
- PNRA established “**National Institute of Safety and Security (NISAS)**” for implementation of professional training courses
- NISAS **designs, develops and conducts** training courses to fill the gaps. PNRA’s licensees and other stakeholders also benefit from its training program.
- It possesses state-of-the-art training infrastructure and labs for hands on training.



Competence Development of R.B

In-house professional trainings are categorized as follows:

- **Level-1:** Basic professional training course, **mandatory for newly inducted officers.**
- **Level-2:** Slightly advanced level courses on PWR, PHWR NPP Systems, R.P and P.P **(are mandatory)**
- **Level-3:** Arranged for **middle level officers** in specialized areas like PSA, stress analysis, seismic/ structure, tsunami analysis
- **Level-4:** These are arranged for **senior officers** on the management and interpersonal skills development



Infrastructure for In-House Training



National Institute of Safety and Security

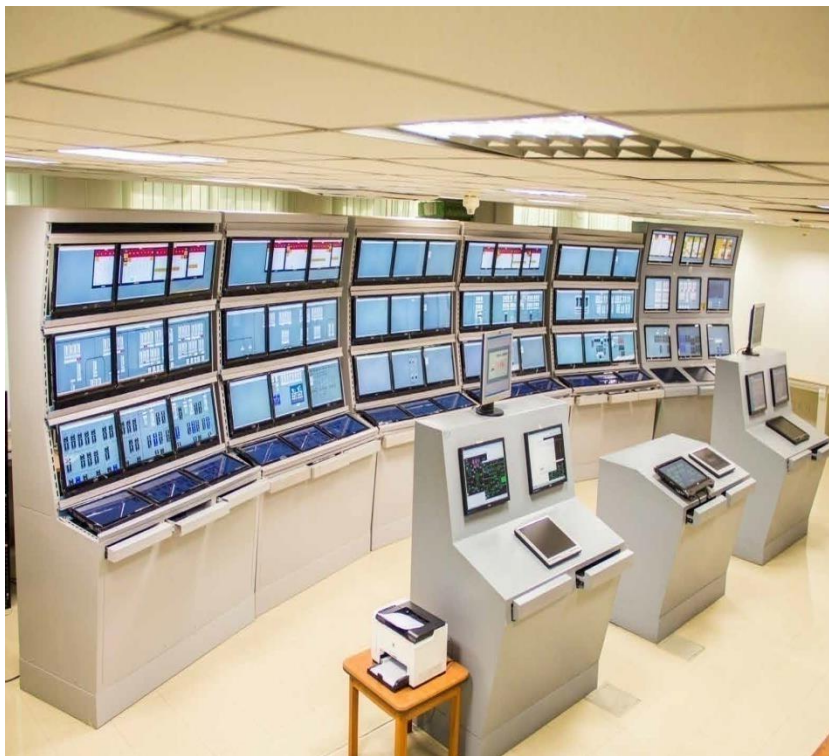


Inauguration by DG IAEA





NPP Physical Model and Simulator Labs



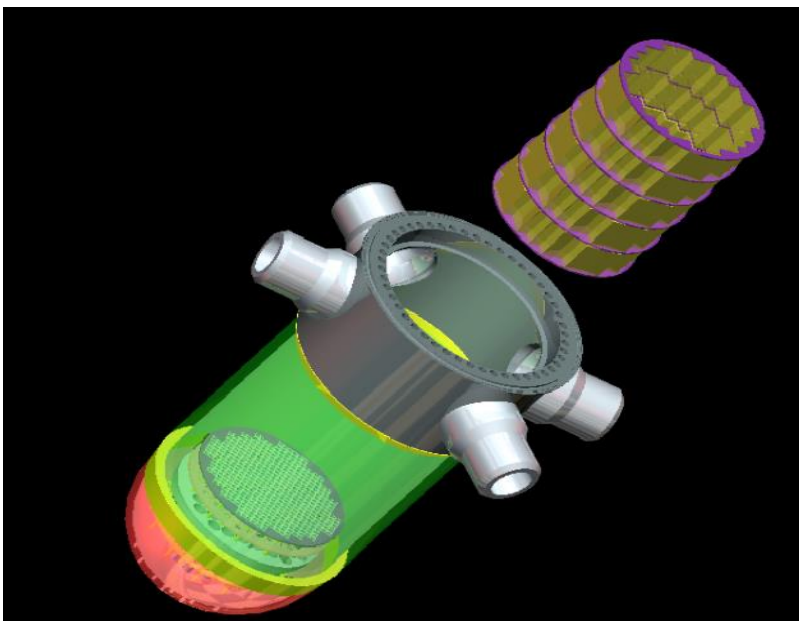
Soft Panel Training Simulator



Physical Models of NPP Equipments



Scale Down Models of NPP Equipment



RPV Virtual Model



RPV scale down model



Radiation Detection Equipment Lab



Back pack Radiation Scanner



PRD



HPGe



RID



RDE Lab



Competence Development of R.B

Training at National Institutions

Staff is nominated in various national training Institutes including:

- Pakistan Institute of Engineering and Applied Sciences (PIEAS) – **Master Program**
- Karachi Institute of Power Engineering (KINPOE) – **Master Program**
- CHASCENT and KANUPP In-Plant Training Centre (IPTC) – **Diploma programs/ plant operation**
- National Centre for Non Destructive Testing (RT, PT, VT, MT)
- Pakistan Manpower Institute – **Managerial skills**
- Secretariat Training Institute – **Interpersonal skills**



Competence Development of R.B

Training at International Organizations

- **Bilateral agreements** - PNRA signed bilateral agreements for training with the Chinese regulatory body (NNSA) and China Nuclear Power Operation Technology Corporation (CNPO), a research Institute.
- **IAEA TC Program** - Officers attend trainings held under the TC program and other IAEA events
- **On-the-Job Training**
- Trainings from China under PAEC umbrella



Competence Development Programs of Promoters



Promoters of Atomic Energy

- In mid 50's, the Govt established Pakistan Atomic Energy Commission (PAEC) to promote the peaceful uses of atomic energy in the fields of medicine, industry, agriculture and generation of electricity from nuclear power stations.
- Operates 6 Nuclear power plants, and One is shutdown for permanent decommissioning
- Operates 2 Research Reactors
- 1 Molybdenum production facility – produces isotopes for nuclear medical centers in the country (20 are owned by PAEC)



Regulatory Requirements for CB of NPPs manpower

- PNRA Regulations PAK/912 and PAK/913 require that the nuclear installations are staffed with competent managers and qualified personnel having knowledge of regulatory requirements for safety.
- These regulations specify qualification, training and experience requirements for operating personnel, shift supervisors and shift engineers
- These define qualifications and training requirements for external personnel performing safety related duties
- PAK/923 describe training and retraining requirements for operating personnel and other staff of research reactor.



Regulatory Requirements for CB of RPOs

Designation of Radiation Protection Officer (RPO)

- Regulations on Radiation Protection - (PAK/904) (Rev.1)" require that the licensee shall designate a Radiation Protection Officer (RPO) at R.F
- **Schedule-I of these regulations provide** the qualification criteria and training period for RPOs.



Regulatory Requirements for Competence of Radiation Workers

Designation of Workers:

- Regulations PAK/904 requires that the licensee shall designate workers who must fulfill the qualification criteria given in **Schedule-II** of these regulations.
- These regulations also require that the licensee shall prepare and implement training and retraining program for workers.
- **Schedule-III** of these regulations provide contents of the training program.



Regulatory Requirements for Competence of RWMOs

Designation of Radioactive Waste Management Officer (RWMO):

- Regulations on Radioactive Waste Management - (PAK/915) (Rev.1) requires that **the licensee shall designate RWMO** for the implementation of these regulations.
- The RWMO shall work under the administrative control of a person responsible for safety.
- The RWMO shall meet the basic **qualification criteria given in Schedule I** of these regulations.



Institutes for Competence Development of Promoters of Nuclear Energy



Competence Development Institutes

- Pakistan Institute of Engineering and Applied Sciences (PIEAS), is a prominent federal university for higher education in nuclear sciences and engineering.
- It offers BS, MS, M Phil and PhD degree programs.

Affiliated Institutes with PIEAS

- Karachi Institute of Power Engineering (KINPOE) offers **Master of Science degree in Nuclear Power.**
- Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad (**Radiation Safety in Agriculture**)
- National Institute of Biotechnology & Genetic Engineering (NIBGE), Faisalabad



Nuclear Medicine & Oncology Centers

- PAEC has established around 20 nuclear Medicine Centers (NMCs) in the country.
- These hospitals provide on the job training (OJT) to its own employees as well as to doctors, technicians and paramedical staff of other National hospitals in the field of Radiology, Nuclear Medicine and Radiotherapy.



CHASCENT

- The CHASNUPP Center for Nuclear Training (CHASCENT) provides training to fresh engineers and technicians and also provide certification and licensing training to plant personnel.
- It conducts one year Post Graduate Training Program (PGTP) for engineers in the design / operations of plant and one year Post Diploma Training (PDT) for plants technicians.
- It is equipped with a Full-Scope Training Simulator (FSTS). MCR engineers undergo mandatory training for shift personnel license.
- Licensed operation engineers receive retraining on FSTS twice a year. Field operators also undergo two months retraining a year.
- This center is extremely useful for plant operation crew



NCNDT offerings

The National Centre for Non-Destructive Testing (NCNDT) is PAEC entity for NDT trainings in various fields/ Levels

- Conducts certification courses on Radiographic testing (RT), Ultrasonic testing (UT), Magnetic particle testing (MT), Liquid Penetrant testing (PT), Eddy current testing (ET), Visual testing (VT) and Leak testing (LT).
- Conducts trainings on [mechanical testing](#) of materials.
- Arranges training for [welder qualification](#).
- Conducts research and development (R & D)



Competence in Radiation Safety

- Radiation sources are widely used in **health and industries in private** sectors in the country.
- It is essential that radiation protection officers, supervisory staff and technologists/ technicians of radiation facilities should have knowledge of application of ionizing radiation, radiation protection fundamentals and regulatory requirements.
- PNRA arranges various certification courses for these individuals



Competence in Radiation Safety

Courses on Radiation Safety:

- QA in Medical Imaging/Radiotherapy
- Radiation Shielding of Facilities
- Exposure Control in Medical Facilities
- Radioactive Waste Management and transportation safety
- Certification courses for Industrial Radiographers
- Certification Courses for RPOs of Industrial/ Medical Facilities.
- Level-II Professional training course is arranged for Regulators (specialized: Nuclear, Radiation, Transport and Waste Safety and Physical Protection)



Competence Development of Manpower Responsible for Physical Protection of Nuclear Material and Radiation Sources



Competence in Nuclear Security (1/3)

- Thousands of radiation sources are used in worldwide for the benefit of human being in various sectors.
- In view of 9/11 event, the world community strongly recognized the importance of the protection of sources to prevent its intended use for malicious purposes.
- PNRA realized the need for establishment of a nuclear security infrastructure for physical protection and competence building of its employees and response organizations.
- PNRA initiated a project in 2006 for strengthening nuclear security regime under which five working areas were identified



Competence in Nuclear Security (2/3)

- Capacity Building in nuclear security was an important area of the project.
- **Nuclear Security Training Centre** (NSTC) was establishment to provide trainings to regulatory professional, promoters response organizations (frontline officers, medical team, fire brigade, law enforcing agencies, customs and rescue organizations).
- PNRA **established 3 new offices** and strengthened the existing offices with radiation detection and protective equipment.



Competence in Nuclear Security (3/3)

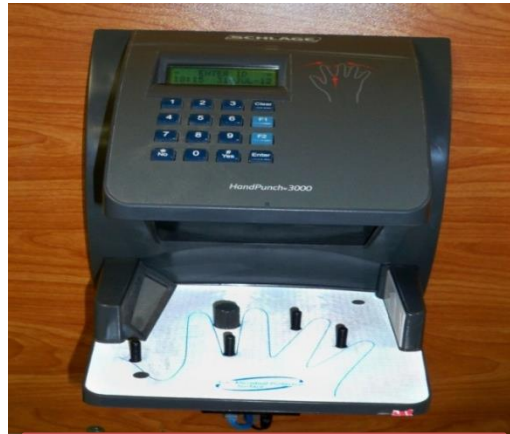
- Established a network of 6 mobile radiation monitoring labs (MRMLs), access control, interior and exterior labs for hands on training
- Trainings are arranged on the application of technologies used for prevention, detection and response to a nuclear security related event; locating and securing orphan radioactive sources; threat assessment and physical protection.
- NSTC was merged in NISAS in 2014 which regularly arranges trainings for concerned stakeholders to strengthen the national nuclear security regime.



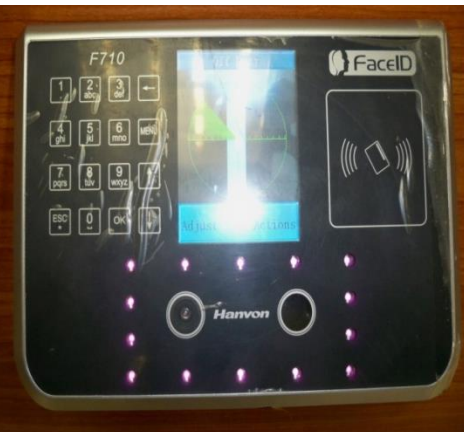
Access Control Lab



Half height turnstile



Hand Geometry Scanner



Face Geometry Scanner



Iris Scanner



Full height turnstile



Physical Protection Interior Lab





Physical Protection Exterior Lab



Physical Protection Exterior Lab



Conclusion

- Different training institutes having robust national engineering and scientific education program including specialization in nuclear science and engineering are available in Pakistan for sustainable supply of competent manpower for performing jobs impacting nuclear and radiation safety.
- The regulatory body and operating organization possess appropriate training institutes, staffed with experience manpower for job-specific trainings to ensure nuclear and radiation safety and nuclear security.

A scenic view of a city, likely Islamabad, Pakistan, featuring the Faisal Mosque with its four minarets and modern skyscrapers. The city is nestled at the foot of lush green mountains under a dramatic, cloudy sky. The foreground is filled with dense green foliage.

Thank You