



REPORT
2010



PAKISTAN NUCLEAR REGULATORY AUTHORITY

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MESSAGE FROM THE CHAIRMAN



This is a momentous occasion; Pakistan Nuclear Regulatory Authority (PNRA) has completed ten (10) years. These ten (10) years have been a period of remarkable success in which we have grown from a small organization to a vibrant organization consisting of highly competent manpower with offices in Islamabad, Kundian, Karachi, Quetta, Peshawar and Bahawalpur providing regulatory oversight to nuclear power plants, research reactors and numerous agricultural, research, medical, industrial facilities all over the country. Although much has been done during the past years but I would like to mention the issuance of construction licence to C-2 and the relicensing of K-1 as the major achievement during the last ten years. This is only achieved because of the hard work, dedication and commitment of our staff members as well as co-operation of the stakeholders. On this occasion, I would like to commend all stakeholders and the staff members of PNRA and look forward for their continued support in future.

The key milestones of 2010 were the issuing of the fuel load permit to C-2 and the revalidation of operating licence of C-1 till 2020 after ten years of safe operation. I would also like to remind my colleagues that although we have made remarkable progress during the last ten (10) years but the challenges ahead are multifaceted. We cannot afford to be complacent and the best way to avoid complacency is to do a critical self assessment which I intend to conduct at regular interval. Our biggest challenge is to bring all radiation facilities of the country in the licensing net. We have made some stride this year especially with the promulgation of regulations on enforcement. The initial steps have been taken and I assure you that in the next few years all radiation facilities will be in the net.

The other challenge is to maintain the quality and quantity of manpower in PNRA to meet the challenges of providing regulatory oversight to the envisaged increase in the nuclear generation capacity by 2030. The pace has been slow this year because of budgetary constraints. However, I am committed to provide the best working and social environment to our staff. The School for Nuclear and Radiation Safety and National Nuclear Security Training Centre of PNRA have performed well by efficient use of resources while training its staff and stakeholders. In addition, PNRA is gearing it up for providing training opportunities and facilities for regulators of developing countries.

On the international front, PNRA continues to fulfil its international obligations under the Convention on Nuclear Safety on behalf of the Government of Pakistan. Pakistan's Fifth National Report for the next review meeting of this Convention, to be held in April 2011, has already been submitted to the IAEA. PNRA is also contributing in the endeavours for establishment of Global Nuclear Safety and Security Regime (GNSSR) by assisting IAEA in its expert missions to other countries for building a reliable and sustainable regulatory infrastructure. In 2010, PNRA officials assisted IAEA in twenty (20) such missions and I am committed to enhance our contribution towards these efforts.

In the end, I would like to assure that PNRA would continue to discharge its statutory responsibilities to protect the workers, public and the environment with full zeal and commitment.

(Mohammad Anwar Habib)

ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
Bq/m ³	Becquerel /cubic meter (3.7×10^{10} Bq = 1 Curie)
C-1	Chashma Nuclear Power Plant Unit 1
C-2	Chashma Nuclear Power Plant Unit 2
C-3	Chashma Nuclear Power Plant Unit 3
C-4	Chashma Nuclear Power Plant Unit 4
CNS	Centre for Nuclear Safety
COMTEX	Communication Test Exercise
ConvEx	Conventional Exercise
DNSRP	Directorate of Nuclear Safety and Radiation Protection
DPP	Document Preparation Profile
DSRS	Disused Sealed Radioactive Sources
FBR	Federal Board of Revenue of Pakistan
FSAR	Final Safety Analysis Report
Gbq	Giga Becquerel (10^9 Becquerel)
IAEA	International Atomic Energy Agency
K-1	Karachi Nuclear Power Plant Unit 1
KBq/m ³	Kilo Becquerel /meter ³ (10^3 Bq/m ³)
KOFREP	KANUPP Offsite Radiological Emergency Plan
MRML	Mobile Radiological Monitoring Laboratory
mSv	mili Sievert (unit of dose)
NDMA	National Disaster Management Authority
NERSP	National Environmental Radioactivity Surveillance Programme
NPP	Nuclear Power Plant
NRECC	National Radiation Emergency Coordination Centre
NSAP	Nuclear Security Action Plan
NSTC	Nuclear Security Training Centre
NuSECC	Nuclear Security Emergency Coordination Centre
PAEC	Pakistan Atomic Energy Commission
PARR-I	Pakistan Research Reactor - I
PARR-II	Pakistan Research Reactor - II
PDMA	Provincial Disaster Management Authority
PNRA	Pakistan Nuclear Regulatory Authority
PSDP	Public Sector Development Programme
PSR	Periodic Safety Review
SAT	Self Assessment Tool
SNRS	School for Nuclear and Radiation Safety, PNRA

Contents

1	INTRODUCTION AND BACKGROUND.....	1
	Major Activities in 2010	1
	Targets for 2011	2
2	REGULATORY FRAMEWORK	4
	Regulations	4
	Regulatory Guides.....	5
	Central Registry.....	5
3	NUCLEAR SAFETY	6
	Review and Assessment	6
	Licensing of Operating Personnel	9
	Inspections of Nuclear Installations	9
	Equipment Manufacturer.....	11
4	RADIATION SAFETY	12
	Review and Assessment	12
	Radiation Safety at Nuclear Installations	12
	Radiation Safety at Radiation Facilities	13
	Inspections of Radiation Facilities	15
	Authorization of Import and Export of Radiation Sources and Generators.....	15
5	WASTE AND TRANSPORT SAFETY.....	17
	Radioactive Waste Safety at Nuclear Facilities	17
	Management of Disused Sealed Radioactive Sources	20
	Decommissioning of Nuclear Facilities	21
	Safe Transport of Radioactive Material.....	21
6	EMERGENCY PREPAREDNESS.....	22
	Emergency Plans and Drills.....	22
	National Radiation Emergency Coordination Centre.....	23
	Training of Trainers for First Responders to a Radiological Emergency.....	24
	Training of Medical Professionals in Handling of Radiation Injuries.....	24
7	PUBLIC SECTOR DEVELOPMENT PROJECTS	26
	Institutional Strengthening and Capacity Building of PNRA Regarding Regulatory Activities Related to Licensing of NPPs.....	26
	Capacity Building of PNRA to Implement National Nuclear Security Action Plan	28
	PNRA's School for Nuclear and Radiation Safety	30
	National Dosimetry and Protection Level Calibration Laboratory	33
	National Environmental Radioactivity Surveillance Programme	33
	Safety Analysis Centre	33
8	NATIONAL AND INTERNATIONAL COOPERATION.....	35
	National Linkages	35
	International Cooperation	36
	Research and Analysis in International Affairs.....	41
9	PERFORMANCE REVIEW.....	42
	Qualitative Assessment of Performance	42

VISION

To become a world class regulatory body with highly trained, competent and dedicated personnel working in unison with a zeal to foster a positive safety culture in their licensees and to regulate nuclear safety to protect the public, the workers and the environment from the harmful effects of radiation and in a manner that wins the confidence of all the stakeholders viz. the public, the Government and the licensees.

MISSION

To ensure the safe operation of nuclear facilities and protect the radiation workers, general public and the environment from the harmful effects of 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 the regulatory body.

CORE VALUES

PNRA staff members work in an atmosphere of openness and trust. They observe the following core values while continuously assessing the quality of their work and directing their efforts towards excellence in performance.

- *Integrity*
- *Transparency*
- *Independence in Decision Making*
- *Competence and Professionalism*
- *Mutual Respect*
- *Caring and Compassionate Attitude*

1 INTRODUCTION AND BACKGROUND

The Pakistan Nuclear Regulatory Authority (PNRA) was established in 2001 as an independent regulatory body to regulate and supervise all matters affecting the safety of nuclear installations and radiation facilities in the country. Under the Pakistan Nuclear Regulatory Authority Ordinance 2001, PNRA is tasked with regulating the safety of nuclear installations and radiation facilities in the country, ensuring protection against risks arising from ionizing radiations, establishing the extent of insurance to be carried by a licensee against the risk of nuclear damage to the public, fixing the extent of civil liability for nuclear damage resulting from any nuclear accident and ensuring existence and implementability of emergency preparedness and physical protection plans of the facilities. To perform its functions PNRA is empowered to formulate and implement regulations related to nuclear safety and radiation protection, issue licences and authorizations for facilities and activities involving ionizing radiation and carry out inspections to verify compliance with the regulations and directives issued by the Authority.

Prior to the formation of PNRA, nuclear regulatory activities were carried out by the Directorate of Nuclear Safety and Radiation Protection (DNSRP). The DNSRP had been established in 1984 within the Pakistan Atomic Energy Commission (PAEC), the primary role of which is promotion of nuclear energy. In 1994, the Government of Pakistan signed the Convention on Nuclear Safety, a key obligation under which it is ensuring effective separation between the functions of the regulatory body and those of any other body or organization connected with the promotion or utilization of nuclear energy. As a first step to meet this obligation, the Government of Pakistan established the Pakistan Nuclear Regulatory Board in 1994. In 2001, Pakistan achieved full compliance with this aspect of the Convention on Nuclear Safety through the establishment of an independent nuclear regulatory authority—PNRA.

Figure 1 presents the organizational structure of PNRA. The Authority consists of a Chairman, two full-time Members and seven part-time Members, including representatives of the PAEC, Ministry of Health, Pakistan Environmental Protection Agency

and Strategic Plans Division of the Joint Staff Headquarters, as well as eminent professionals from the science, engineering and medical sectors.

During 2010, two part-time members completed their second four-year terms with the Authority, thus completing the maximum duration of membership allowed under the Ordinance. Dr. Inam-ur-Rahman, Scientist Emeritus, PAEC and Dr. Mohammad Ali Maud, Professor at the University of Engineering and Technology (UET), Lahore, are succeeded by Dr. Muhammad Nuruddin Qazi, the Director of Women's Institute of Science and Humanities (WISH) and Mr. Hussain Ahmad Siddiqui, a former Chairman and Chief Executive of State Engineering Corporation (SEC), Ministry of Industries and Production.

Major Activities in 2010

Major activities of PNRA during 2010 are summarized as follows:

1. Regulatory monitoring of safety at two operational NPPs, Karachi Nuclear Power Plant Unit 1 (K-1) and Chashma Nuclear Power Plant Unit 1 (C-1) continued. The plants' releases to the environment and radiation doses to workers remained well below the regulatory limits.
2. Monitored the sixth refuelling outage of C-1. After completion of refuelling, C-1 was put into operation in June 2010. Subsequent operational activities at the plant were closely reviewed and inspected by PNRA and the plant's performance was found to be satisfactory throughout the year.
3. Periodic Safety Review (PSR) of C-1 was conducted and the operating licence was renewed upto 2020.
4. Final Safety Analysis Report (FSAR) of C-2 was reviewed. Based on this review, a Final Safety Evaluation Report (FSER) was prepared. A conditional Fuel Load Permit was granted to the plant.
5. The Site Evaluation Report (SER) for registration of the site for planned Chashma Nuclear Power Plant Units was received from PAEC, which is under review at PNRA.
6. The Periodic Safety Review of Pakistan Research

INTRODUCTION AND BACKGROUND

- Reactor – I (PARR-I) remained in progress.
7. Licensing of Heavy Mechanical Complex-3 for manufacture of safety class components remained in progress.
 8. Enhanced the licensing net of diagnostic radiation facilities by another four (4) percent.
 9. Pakistan Nuclear Regulatory Authority Enforcement Regulations (PAK/950) were approved by the Authority and notified in the official Gazette of Pakistan.
 10. Work remained in progress on the revision of the following regulations as a result of periodic review:
 - Regulations for Licensing of Nuclear Installation(s) in Pakistan (PAK/909); and
 - Regulations on the Safety of Nuclear Power Plant Design (PAK/911).
 11. The following regulatory guides were issued:
 - Quality Assurance in Nuclear Medicine;
 - Probabilistic Safety Assessment (Level 1) for Nuclear Power Plants; and
 - Dosage and Distribution of Potassium Iodide Tablets in Radiation Emergencies.
 12. The PNRA Management System Manual was approved.
 13. A regulatory audit of PNRA directorates located in Islamabad was conducted.
 14. Self Assessment of regulatory activities using IAEA SAT Tool was initiated.
 15. Established Radiation Detection Equipment and Repair/Maintenance laboratories at PNRA in collaboration with IAEA.
 16. PNRA, under the IAEA technical assistance programme, provided equipment to upgrade the security of twelve (12) medical centres using Category-1 radioactive sources.
 17. The sixth Regional Inspectorate was established at Bahawalpur for enhancing regulatory effectiveness.
 18. Nineteen (19) training courses were conducted by PNRA in the area of nuclear security for the capacity building of first responders, emergency response personnel and front line officers. About 340 personnel from the law enforcement agencies and other organizations participated in these training courses.
 19. Twenty five (25) training courses and twenty eight (28) one day seminars in nuclear safety, radiation protection and safety management were conducted in which a total of 1,077 officials from PNRA, PAEC and other stakeholder organizations participated.
 20. 244 PNRA officials participated in 127 international events such as workshops, training courses, meetings and seminars organized by IAEA under the IAEA technical assistance programme.
 21. PNRA officials assisted IAEA in twenty (20) expert missions to other countries.
 22. Fifth Steering Committee meeting of PNRA and National Nuclear Safety Administration (NNSA) of China was held in Haikou, China to discuss areas of mutual cooperation. In this meeting, an agreement for future cooperation and exchange of personnel and safety related information was finalized.

Targets for 2011

The targets set for 2011 are summed up as follows:

1. Continuously monitor licensees' activities to avoid major incidents, overexposure to workers and releases to the environment.
2. Enhance the licensing net for diagnostic radiation facilities by another 7 percent.
3. Issue Regulations on Safety of Nuclear Research Reactor(s) Operation (PAK/923).
4. Issue the following regulatory guides:
 - Radiation Safety in Industrial Radiography;
 - Guidance for the Users of I-131.
5. Conduct self assessment of regulatory activities using the IAEA self assessment tool.
6. Develop centralized database for national and international operating feedback.
7. Conduct about 40 training courses on nuclear safety and security; providing training to about 500 officials from PNRA and other stakeholders.
8. Establish Interior Physical Protection Laboratories at PNRA.
9. Setup Whole Body Counting (WBC) Laboratories at Karachi and Chashma.
10. Complete the NERSP laboratories at Karachi.

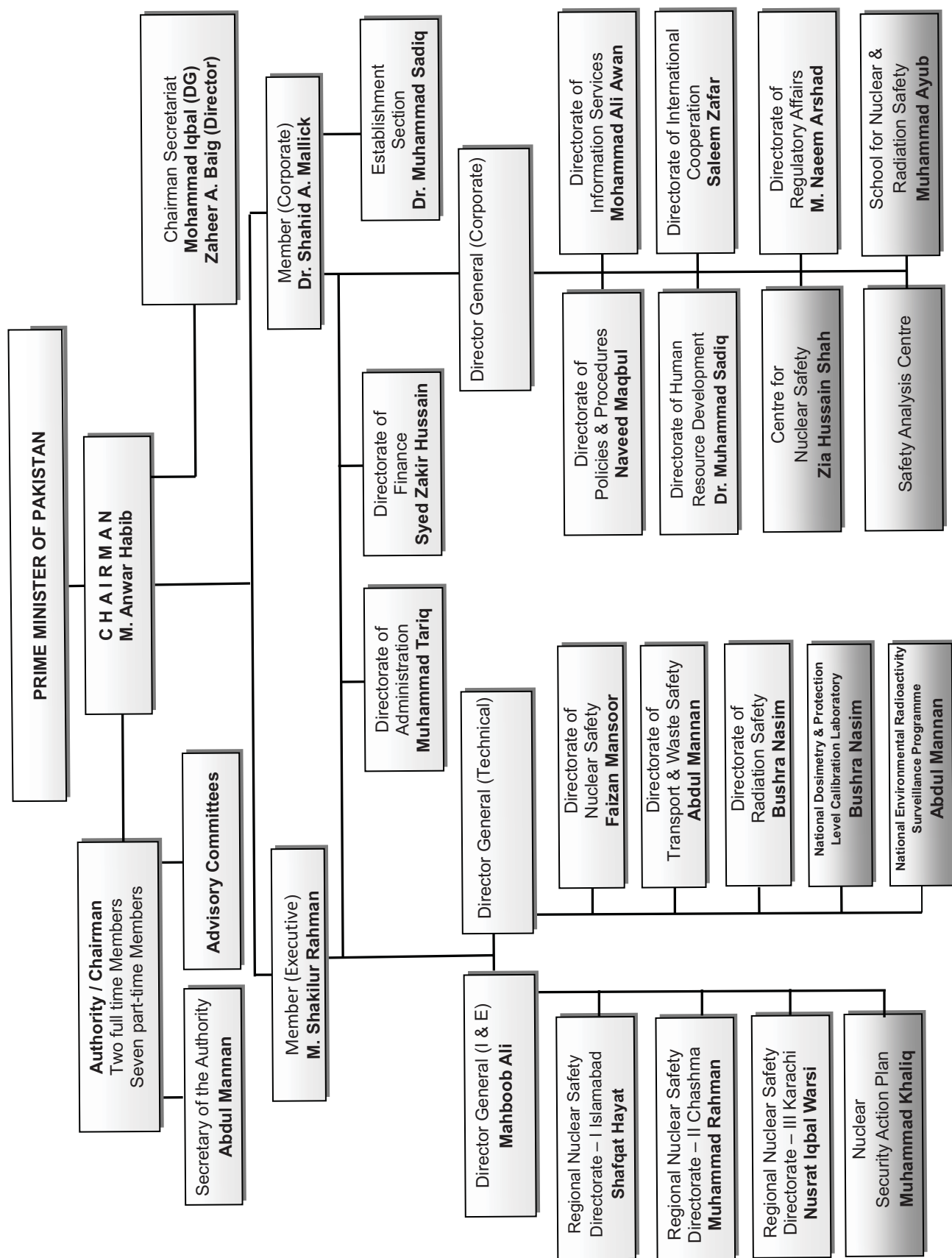


Figure 1: Organizational Structure of PNRA

2 REGULATORY FRAMEWORK

As mandated by the Pakistan Nuclear Regulatory Authority Ordinance 2001, PNRA has established a regulatory framework for nuclear installations and radiation facilities in the country. This framework, which is developed, supervised and maintained by PNRA, comprises of national regulations and regulatory guides, which are developed in accordance with the provisions of the Ordinance. Compliance with the requirements of national regulations and conditions attached with specific licences and authorizations are verified through review and assessment of licensees' submissions and regulatory inspections. Non-compliance is controlled through enforcement actions, such as warning notices, suspension, modification or revocation of a licence in extreme cases when persuasion fails.

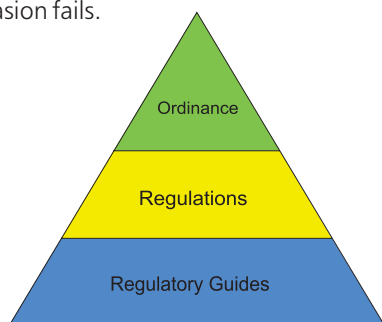


Figure 2: Regulatory Framework

The pyramid shown in Figure 2 depicts the regulatory framework of PNRA. At the highest level is the PNRA Ordinance. The aims and objectives of the Ordinance are translated for implementation by developing national regulations, shown as the second tier in the regulatory pyramid. Compliance with national regulations is mandatory for the licensees. The third level of the regulatory framework consists of regulatory guides, which are non-mandatory and describe acceptable methods for meeting the requirements of regulations. For areas where PNRA regulations and regulatory guides are not available nationally, the regulations refer to international guidance documents for licensees to follow.

Regulations

Regulations provide the basis for PNRA to perform

its functions of protecting radiation workers, the public and the environment from harmful effects of radiation. PNRA develops regulations in a transparent manner. In the course of its development, each set of regulations undergoes extensive internal review at different levels within the Authority and the opinions of all stakeholders, including licensees, the Government and the general public, is actively sought and incorporated. The entire process of developing a regulation, depicted in the flow chart in Figure 3, takes around two years.

According to the procedure for preparation, revision and adoption of regulations, all regulations

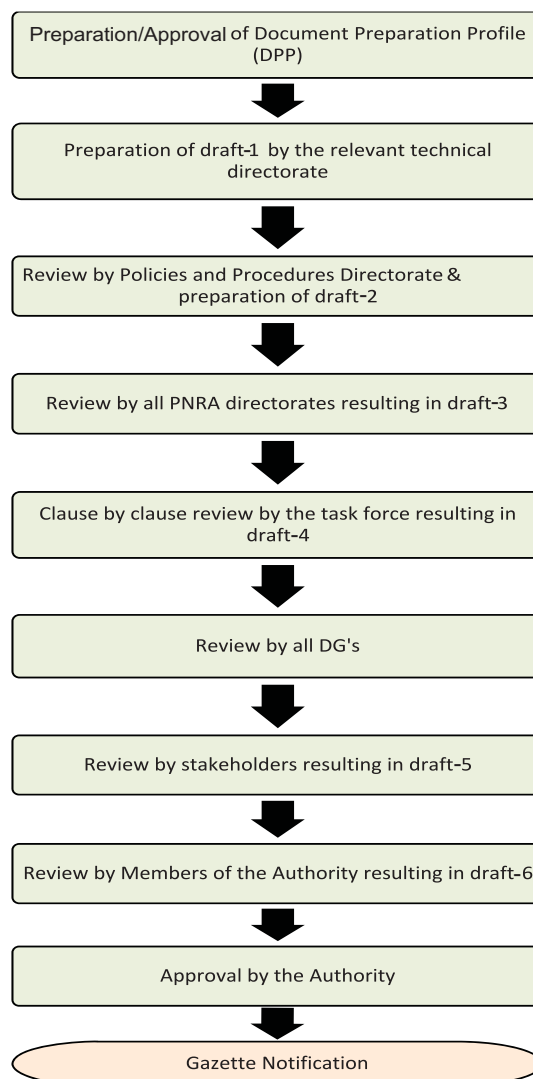


Figure 3: Regulations Development Process

are subject to periodic review at an interval of five years. If required, these may be revised on the basis of licensing and regulatory experience, feedback from stakeholders, or current international practices.

National regulations that have been gazette-notified so far are available at the PNRA website (www.pnra.org).

During 2010, the following regulations were approved and Gazette-notified:

- Pakistan Nuclear Regulatory Authority Enforcement Regulations (PAK/950); and
- Amendment in Regulations on Radioactive Waste Management (PAK/915).

Work remained in progress on revision of the following notified regulations as a result of periodic review:

- Regulations for Licensing of Nuclear Installation(s) in Pakistan (PAK/909): Draft 4 of the Regulations has been circulated for comments from stakeholders; and
- Regulations on the Safety of Nuclear Power Plant Design (PAK/911): Draft 4 of the Regulations is under preparation after completion of internal review within PNRA.

In addition, development of the following new regulations remained in progress during 2010:

- Regulations on Transaction of Business of the Authority (PAK/901): Draft 2 has been circulated within PNRA for internal review;
- Regulations on Safety of Nuclear Research Reactor(s) Operation (PAK/923): Draft 5 is being developed after completion of internal and external reviews;
- Regulations on Physical Protection of Nuclear Material and Facilities (PAK/925): Draft 2 is under preparation; and
- Regulations on Decommissioning of Facilities using Radioactive Material (PAK/930): Draft 4 is being developed after internal review within PNRA.

Regulatory Guides

Regulatory guides are developed to facilitate the licensees in understanding the requirements of national regulations and providing guidance for their implementation. As mentioned earlier, these guides are non-mandatory.

During 2010, the following regulatory guides were issued:

- Quality Assurance in Nuclear Medicine;
- Probabilistic Safety Assessment (Level-1) for Nuclear Power Plants; and
- Dosage and Distribution of Potassium Iodide Tablets in Radiation Emergencies.

Work remained in progress on the development of the following new regulatory guides:

- Aging Management of Nuclear Power Plants;
- Guidance for the Users of I-131;
- Radiation Safety in Industrial Radiography; and
- Format and Contents of Request for Design Modifications for NPPs.

Central Registry

PNRA has developed a system to register all the regulatory documents, including regulations, guides, policies and procedures, in a Central Registry. In all, thirteen regulations, five guides, four policies and ninety-seven working procedures have been registered so far (Figure 4). In 2010, one regulation, three guides, two policies and sixteen procedures were issued and registered.

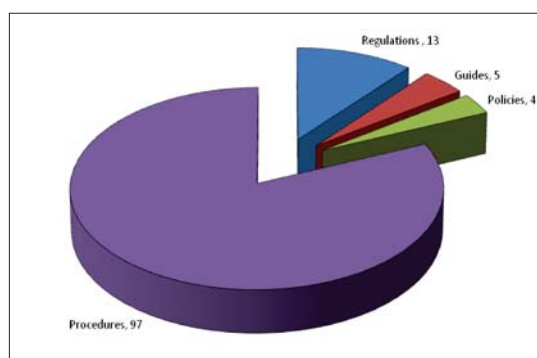


Figure 4: Status of PNRA Central Registry

3 NUCLEAR SAFETY

At present, there are four operational nuclear facilities in the country, including two nuclear power plants, i.e. Karachi Nuclear Power Plant Unit 1 and Chashma Nuclear Power Plant Unit 1 and two research reactors i.e. Pakistan Research Reactor -I and -II. Various other facilities are planned or under construction. Details are provided in Table 1.

The safety of all nuclear facilities in the country is regulated by PNRA. The licensing process ensures regulatory oversight by PNRA in all stages from siting to decommissioning and site rehabilitation. PNRA registers the site and issues Construction Licence, Fuel Load Permit, Operating Licence and various other authorizations to nuclear facilities after review and assessment of documents submitted by the utility for these purposes. PNRA also issues licences to the personnel responsible for operating nuclear power plants; no nuclear facility is permitted to operate unless it is staffed by required strength of licensed operating personnel.

In addition to authorization and licensing, review and assessment of licensees' documents, verification through inspections, audit calculations and various other activities are undertaken to

ensure that licensees fulfil the obligations of national regulations and maintain an acceptable level of safety at nuclear facilities. Quarterly meetings are held with the licensees to identify and resolve potential safety issues and develop a better understanding. Where safety provisions fall short of regulatory requirements, PNRA is empowered to use enforcement measures, such as issuance of directives, curtailing activities, etc. to ensure that corrective actions are taken and minimum safety level is maintained.

Presently, two operational nuclear power plants, K-1 and C-1 and two research reactors, PARR-I and -II, are operated in compliance with the national regulations and approved operating policies and principles and technical specifications.

Review and Assessment

PNRA reviews and assesses the submissions made by licensees and applicants in support of their applications for licensing, modifications in their facilities and other tasks for which authorization is necessary under national regulations. In addition, PNRA also reviews and assesses routine and non-

Table 1: Nuclear Facilities Under PNRA's Purview

S. No.	Installation/Facility	Status	Type	Capacity	Commercial Operation
1	Karachi Nuclear Power Plant Unit 1 (K-1)	In operation	Pressurized heavy water reactor	137 MWe	1972
2	Chashma Nuclear Power Plant Unit 1 (C-1)	In operation	Pressurized light water reactor	325 MWe	2000
3	Chashma Nuclear Power Plant Unit 2 (C-2)	Under commissioning	Pressurized light water reactor	340 MWe	2011 (expected)
4	Chashma Nuclear Power Plant Unit 3 (C-3)	Planning phase	Pressurized light water reactor	340 MWe	2016 (expected)
5	Chashma Nuclear Power Plant Unit 4 (C-4)	Planning phase	Pressurized light water reactor	340 MWe	2016 (expected)
6	Pakistan Research Reactor-I (PARR-I)	In operation	Research reactor	10 MWt	1965
7	Pakistan Research Reactor-II (PARR-II)	In operation	Research reactor	30 KWt	1991
8	Heavy Mechanical Complex-3	Production	Manufacturer of mechanical equipments	Safety Class-2 and -3 vessels and heat exchangers	2006

routine reports submitted by licensees as per regulatory requirements. The objective of review and assessment is to verify the compliance of licensees' activities with regulatory requirements (i.e. national regulations, licence conditions, applicable codes and standards and proven engineering practices). Where there is non-compliance with regulatory requirements or an adverse trend in safety performance, PNRA issues directives for necessary corrective actions.

Operating Nuclear Power Plants

K-1 completed its design life of 30 years in 2002. It was granted Licence to operate beyond its design life along with certain licensing conditions till December 2009. In October 2009, K-1 applied to PNRA for extension in the Operating Licence for the next 10 years, i.e., up to 2019 based on completion of certain actions required under the licence conditions (such as demonstrating the capacity of its alternate emergency control centre; demonstrating its physical protection plan through drills; finalizing and implementing its offsite radiological emergency plan (KOFREP); and installing an intrusion detection system, including Closed Circuit Television (CCTV)) and with the request to extend the time for completion of some licence conditions. Based on review and assessment made by PNRA, the Operating Licence was extended till 31 December 2010 and any further extension in the licence required completion of assessments of main equipment (such as steam generators and fuel channels) to determine their

remaining useful life. K-1 is now undergoing a long outage to conduct necessary evaluations, maintenance, surveillance and modifications so that an assessment for further operation of the plant can be made. The activities will be under PNRA regulatory oversight of review & assessment and inspection to facilitate its regulatory decision making process to allow any further operation or otherwise. Accordingly, PNRA has amended the operating licence of K-1, requiring K-1 to start operation only after completing the necessary actions and approval from PNRA.

In April 2010, C-1 completed its sixth cycle of operation and the plant was shut down for refuelling. PNRA conducted reviews of various documents submitted by the licensee for criticality permission following the sixth refuelling. In addition, PNRA conducted 78 control point inspections and number of general surveillances during the refuelling outage. Based on the outcome of reviews and inspections and upon satisfaction with the completion of all necessary activities, PNRA allowed C-1 to make the reactor critical. Accordingly, C-1 started operating again in June 2010.

C-1 was granted an Operating Licence for ten years ending on 31 December 2010. As per regulations PAK/909, revalidation of the Operating Licence requires submission of latest periodic safety review reports to PNRA. C-1 submitted one-hundred and ninety-three reports with the application to extend its Operating Licence for another 10 years, i.e. until 2020 which were reviewed by PNRA. Based on the review of PSR reports and satisfaction that no safety issue remained unresolved, the operating licence of C-1 was revalidated up to 2020.

In 2010, PNRA issued 7 directives to K-1 and 21 to C-1. K-1 has completed actions on 5 and C-1 completed actions on 14. PNRA reviewed 7 design modifications and 7 event reports submitted by K-1 and 9 design modifications and 3 event reports by C-1. In addition, PNRA also reviewed a number of routine reports which are submitted monthly, biannually and annually.



PNRA Inspectors at Chashma Site

Under Construction Nuclear Power Plant

On November 26, 2009, PAEC submitted Final Safety Analysis Report (FSAR) of C-2, along with an application for Fuel Load Permit (FLP). Other submissions required for FLP were also submitted following the FSAR. PNRA conducted a year-long safety review of these submissions. It took about 800 man-months to complete this review.



PNRA Internal Meeting on Review of C-2 Final Safety Analysis Report

Shortcomings identified during the review were discussed with the licensee (C-2), its designer and vendor in review meetings and the course of action was agreed upon by all parties. Based on the findings of the review, PNRA has prepared a Final Safety Evaluation Report, which is one of the bases for issuance of FLP to C-2.

After completion of review and assessment of the documents required under the national regulations PAK/909, successful completion of commissioning tests, demonstration of implementation of



1st FSAR Safety Review Meeting for C-2 at Shanghai



PNRA/PAEC/CZEC/SNERDI Discussing Issues on C-2 FSAR at Shanghai

emergency preparedness plan in an exercise covering onsite and offsite emergency measures and completion of physical protection measures, Fuel Load Permit was issued to C-2 on 21 December, 2010 and first fuel assembly was loaded on 22 December, 2010.

In 2010, PNRA issued 14 directives to C-2; and C-2 has completed actions on 9 directives.

Nuclear Power Plants in Planning Stage

As mentioned earlier, among planned nuclear power plants in the country are Chashma Nuclear Power Plant Units 3 and 4 (C-3 and C-4). In 2009, PAEC submitted an application for the registration of site for C-3, along with Site Evaluation Report (SER). This was followed by a similar submittal in 2010 for C-4. During the reporting period, PNRA reviewed the SER and supporting documents for C-3, while review of the SER for C-4 is in progress.

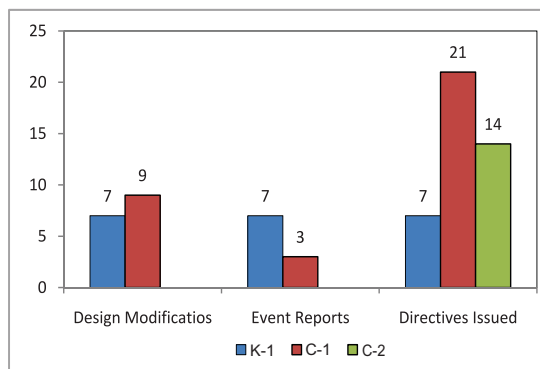


Figure 5: Review and Assessment of NPPs

Figure 5 summarizes the review and assessment activities carried out by PNRA for the nuclear power plants during 2010.

Research Reactors

The Operating Licence of PARR-I was valid until 31 December 2010. PARR-I submitted Periodic Safety Review (PSR) reports along with an application for renewal of its Operating Licence for the next ten years, as per licensing requirements. The PSR reports are currently under review at PNRA, along with the other safety related documents.

Licensing of Operating Personnel

PNRA ensures that appropriately qualified and trained operating personnel remain available throughout the life span of each nuclear installation. According to national regulations (PAK/913), operating personnel who require a licence from PNRA include the shift supervisors, shift engineers and reactor operators. PNRA conducts oral and practical operating examinations for award of licences to operating personnel fulfilling the criteria. The licences are required to be renewed annually.

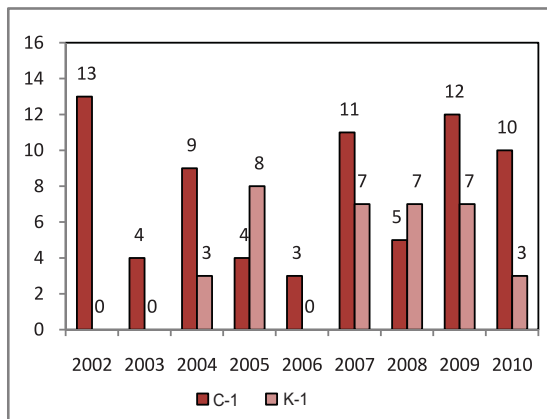


Figure 6: Issuance of New Operator's Licences for NPPs

During the reported period, 3 new personnel at K-1, 10 at C-1 and 20 at C-2 were granted Operators' Licence (Figure 6). The case for renewal of licences of 33 existing plant operating personnel at K-1 and 46 at C-1 are in progress (Figure 7).

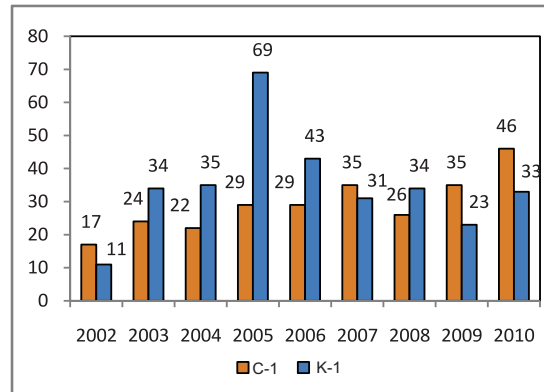


Figure 7: Renewal of Operator's Licences for NPPs

No new Operator's Licence was issued to either of the research reactors in 2010, although 21 licences of supervisors and operators were renewed (Figure 8).

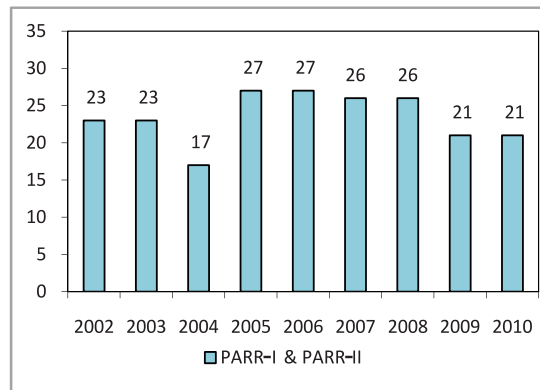


Figure 8: Renewal of Operator's Licences for Research Reactors

Inspections of Nuclear Installations

PNRA conducts regulatory inspections during the construction, commissioning and operation phases



30th Meeting of the Authority at Chashma Site

of nuclear installations. The main purpose of regulatory inspections at nuclear installations is to ensure that the licensees are conducting their operations in accordance with national regulations, licence conditions and the directives issued from time to time. It is also verified that appropriate measures are being taken by the licensee to promote a safety culture. The deficiencies observed during these inspections are communicated to the licensees in the form of inspection reports along with the requirements for taking necessary corrective actions which are then followed up for satisfactory completion.

To carry out inspection activities, PNRA has established three Regional Nuclear Safety Directorates (RNSDs) in Islamabad, Kundian and Karachi, namely RNSD-I, RNSD-II and RNSD-III respectively. In addition, resident inspectors have been posted at the nuclear power plants, K-1, C-1 and C-2. The RNSDs conduct regulatory inspections of nuclear installations and radiation facilities in their respective regions.

The technical directorates located at PNRA Headquarters and the Technical Support Organization of PNRA i.e. Centre for Nuclear Safety provides technical support during the inspections, if needed by the regional directorates. PNRA also conducts inspections during manufacturing of equipment for nuclear installations at the manufacturers' sites. The inspections during equipment manufacturing are controlled by the Nuclear Safety Directorate of PNRA located at its Headquarters.

Various types of routine, planned, unplanned and reactive inspections of nuclear installations are carried out in accordance with the PNRA Inspection Programme. In addition Control Point Inspections comprising of Hold, Witness and Record Point are carried out at under construction plants. In hold point inspections, the licensee requires explicit permission of PNRA for proceeding beyond this point.

In 2010, PNRA conducted a total of 74 inspections at K-1 and 80 at C-1, as per the annual inspection

plans (Figure 9). These inspections were in addition to daily inspections and surveillance of different plant areas.

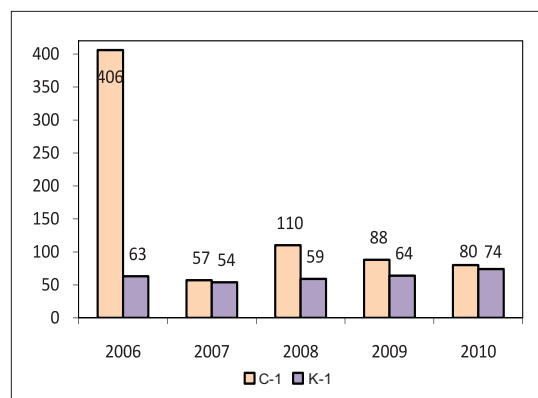


Figure 9: Regulatory Inspections of K-1 and C-1

PNRA performed 379 control point inspections of C-2 (Figure 10) in addition to general surveillance during the reported year.

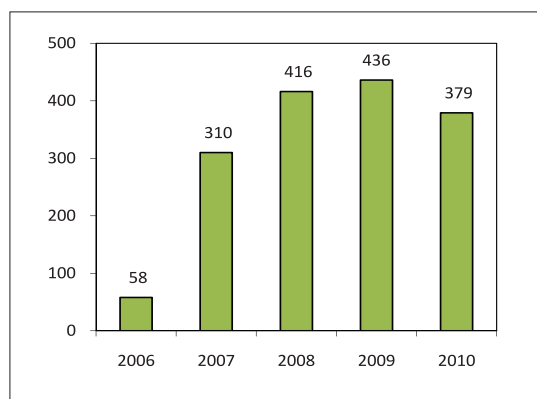


Figure 10: Control Point Inspections of C-2

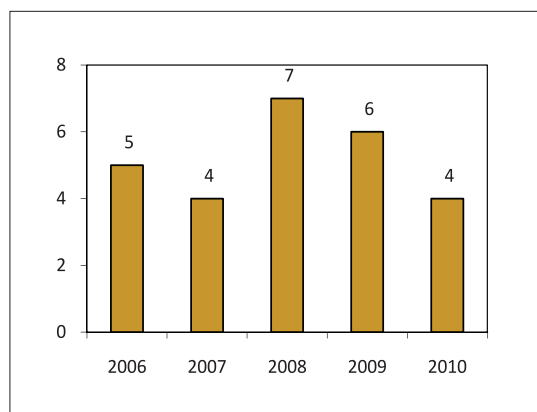


Figure 11: Regulatory Inspections of PARR-I and -II

Three safety inspections were conducted at PARR-I, including a special inspection regarding irradiation of uranium for Mo-99 production and one at PARR-II to check compliance with regulations in the areas of operation, radiation protection, quality assurance and environmental monitoring (Figure 11).

Equipment Manufacturer

The Heavy Mechanical Complex-3 was licensed by PNRA in 2005 to manufacture Nuclear Safety Class-2 (NSC-2) and Nuclear Safety Class-3 (NSC-3) mechanical equipment for nuclear power plants in Pakistan. Under the licence, the Complex has been authorized to manufacture pressure vessels, storage tanks and heat exchangers. The licence was granted for a period of five years which expired in

July 2010. The Complex applied for an extension of its Manufacturing Licence along with the necessary updated documents required under national regulations (PAK/907). The licence was revalidated accordingly.

Heavy Mechanical Complex-3 has also submitted a request to upgrade its licence to allow manufacturing of Nuclear Safety Class-1 (NSC-1) equipment. The request was accompanied by the submissions required under regulations PAK/907. PNRA has completed the review of the submissions. Heavy Mechanical Complex-3 is to demonstrate its manufacturing capabilities by preparing a mock-up of the target equipment. A decision to upgrade the licence will be taken after the assessment of capabilities of the Complex during the mock-up.



Members of the Authority Visiting C-2 Main Control Room

4 RADIATION SAFETY

PNRA is mandated to control, regulate and supervise all matters related to radiation safety in Pakistan. To effectively discharge its regulatory obligations, PNRA develops and enforces regulations for radiation safety and executes comprehensive policies for the protection of life, health and property against ionizing radiation. PNRA regulates the radiation safety aspects of nuclear installations, e.g. nuclear power plants and nuclear research reactors, as well as radiation facilities, e.g. diagnostic radiology and radiotherapy centres, nuclear medicine facilities, irradiators and industrial & agricultural radiography units. In order to fulfil its obligations, PNRA conducts review and assessment, carries out inspections and undertakes enforcement actions in the area of radiation safety.

Review and Assessment

PNRA has developed a mechanism to regulate radiation protection at nuclear installations in Pakistan. This mechanism is based on evaluation of the licensee's submissions and a comprehensive inspection programme. A summary of radiation safety performance at nuclear installations during the reported period is presented below.

Radiation Safety at Nuclear Installations

Karachi Nuclear Power Plant Unit 1 (K-1)

Radiation safety at K-1 is ensured through review and assessment of the plant's submissions and regulatory inspections conducted at regular intervals. All inspections of K-1 especially emphasize radiation safety and implementation of the ALARA (as low as reasonably achievable) principle. K-1's revised radiation protection and dosimetry programme were the major submissions reviewed at PNRA during reported period.

Annual Safety Report of K-1 for previous year was evaluated in detail which revealed that radiation exposure to plant workers remained within prescribed regulatory limits. 94.6 % of workers received less than 10 mSv annual dose. A very small

fraction of workers (0.11%) received dose between 20-30 mSv though they were still within regulatory limit of average of 20 mSv in five years. It is noted that this small fraction is experienced and trained manpower deputed to conduct specialized jobs and their comparatively higher doses with respect to rest of the manpower is understandable. However K-1 is pursued to consider dose equity as a good radiation safety practice. Dose distribution of K-1 workers is detailed in Figure 12.

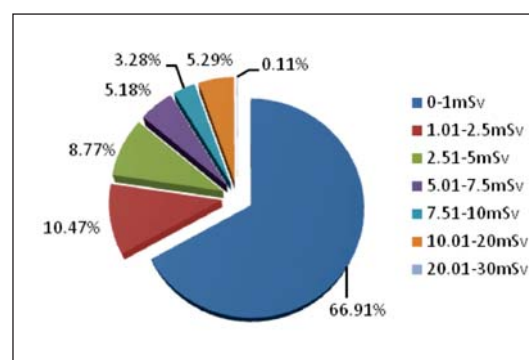


Figure 12: Annual Radiation Doses to K-1 Workers

For evaluation of radiation levels in the vicinity of K-1, ambient radiation levels at K-1 and in the city are continuously assessed. Over the last three years ambient radiation levels at K-1 were found to be generally at the same level as the natural background in the city (Figure 13).

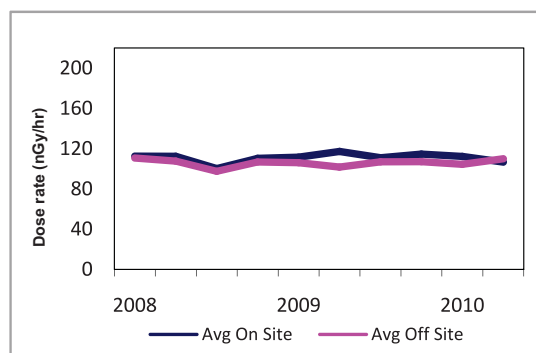


Figure 13: K-1 Onsite and Offsite Average Ambient Dose Level Trend

Chashma Nuclear Power Plant Unit 1 (C-1)

Radiation safety at C-1 is also ensured through review and assessment of the plant's submissions and regulatory inspections conducted at regular intervals. C-1's annual dose report of previous year

was reviewed in detail and radiation exposures to plant workers were assessed. Radiation exposure of all plant workers was found to be well within prescribed regulatory limits; in fact, doses to about 95 percent of workers remained below 1 mSv during the reported period while the remaining 5% also remained well below the regulatory limit (Figure 14).

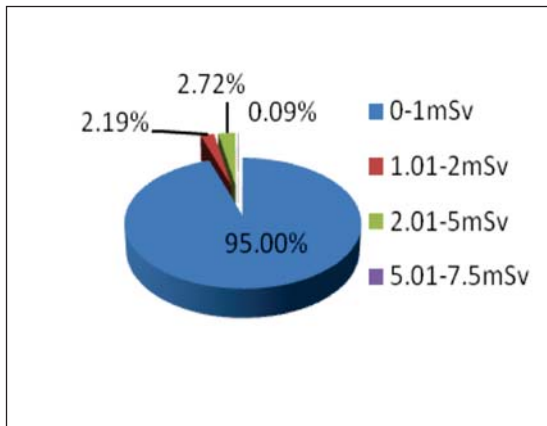


Figure 14: Annual Radiation Doses to C-1 Workers

C-1 performed sixth Refuelling Outage (RFO) during the reported period. All activities of RFO were closely evaluated and monitored. Dose estimates and ALARA plans were reviewed and verified against previous experiences, actual results and performance. Collective dose received by 1374 radiation workers during this RFO was 558 man-mSv against the estimated collective dose of 500 man-mSv. Maximum dose received by an individual during this RFO was 7.3 mSv which was within



PNRA Inspecting the Dual Head Gamma Camera

estimated dose of 10 mSv for maximum individual dose.

Ambient radiation levels at C-1 are monitored continuously and these are compared to natural background of surrounding city. Assessment of three years records reveal that ambient dose levels at C-1 are generally at the level of the natural background of surrounding city (Figure 15).

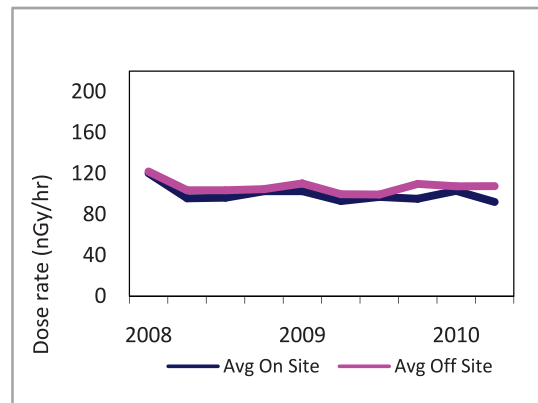


Figure 15: C-1 Onsite and Offsite Average Ambient Dose Level Trend

Radiation Safety at Radiation Facilities

It is the responsibility of PNRA to ensure that all radiation facilities in the country operate safely so that workers and the public do not face undue risk of radiation exposure and their doses remain within regulatory limits. The radiation facilities being monitored by PNRA include therapeutic and diagnostic radiology centres; nuclear medicine centres; industrial radiography services; blood, food and material irradiators; baggage scanners; oil well logging units; educational and research establishments; agricultural centres; etc. These facilities use radioactive sources or radiation generators for medical, industrial, or educational purposes.

Licensing of Radiation Facilities

Radiation facilities in the country are not authorised to operate without a valid licence from PNRA. Licences to radiation facilities are issued after detailed review and assessment of the licensees submissions required under the provisions laid out

in national regulations for using radioactive material and radiation generators. Periodic inspections of radiation facilities are performed to monitor continued compliance with safety provisions. The licences issued to radiation facilities are renewed annually. PNRA has been working systematically to bring all radiation facilities in the country within its licensing net. All radiation facilities in the country have been licensed by PNRA except the diagnostic X-ray facilities. It is estimated that a number of diagnostic X-ray facilities are still out of licensing net while the number of previously licensed X-ray facilities not renewing their licences i.e. default rate in the valid X-ray licence holders is also increasing. By the end of 2010, more than 2090 facilities came into the licensing net. Out of these more than 580 facilities defaulted till 2010. The majority of the defaulters are the diagnostic X-ray facilities. In order to enhance the licensing net and reduce the number of defaulters, PNRA has initiated a national survey to assess the total number of X-ray units in the country and to inform their owners to get into the licensing net otherwise enforcement action will be taken against them. This survey is being carried out in all the 27 divisions of the four provinces of Pakistan and is expected to be completed in early 2011.

During the reported period, 64 new facilities were licensed while 1,503 licences were renewed by the three regional directorates of PNRA. Currently, facilities which were ever licensed during the last ten years include 55 large medical centres, 137 industrial users, 57 research institutes, 98 importers and 1,691 diagnostic X-ray facilities and 54 other facilities.

Occupational Exposure at Radiation Facilities

PNRA has developed a database of the occupational exposure record of radiation facilities. All radiation facilities are required to provide radiation exposure data on annual basis of their workers who are involved in radiation work. The dose record of around 6400 radiation workers is available in the database which among others



Participants of a PNRA Seminar at King Edward Medical University/ Mayo Hospital, Lahore

includes about 1350 radiation workers in medical sector, 1400 radiation workers in industrial sector, 430 workers in research and education and more than 2700 workers in diagnostic X-ray centers. The database helps in assessing compliance with regulatory dose limits, control of itinerant workers and ALARA implementation. According to the record, doses to 95% workers remained less than 5 mSv while 4.4 % received doses between 5-20 mSv. A small fraction (0.66%) received dose above 20 mSv. Though these workers remained within the regulatory limit of five year annual average of 20 mSv, the licensee was advised to conduct investigation of receiving this high dose and take corrective actions for prevention of such practice in future (Figure 16).

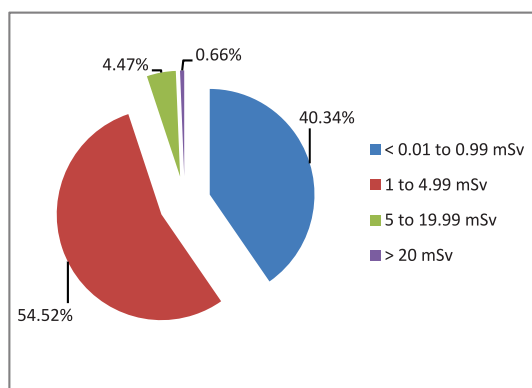


Figure 16: Doses to Workers at Radiation Facilities

Radiological Protection of Patients

Radiological protection of patients is an integral part of radiation protection in medical facilities. A

program to assess radiation doses to patients at diagnostic and therapeutic radiological facilities remained in progress during the reporting year. The central objective of this program is to evaluate the implementation of guidance levels as described in "Regulations on Radiation Protection – PAK/904" for diagnostic medical procedures and to prepare guidelines for achieving better clinical output with minimal radiation hazard at medical practices involving ionizing radiations.

According to the plan, PNRA initiated a national survey for the evaluation and assessment of radiation doses in diagnostic and therapeutic radiology. Plan is divided in several phases and in its first phase, data is being collected from interventional and mammographic procedures at different medical facilities in major cities of Pakistan. During the reported period, data was collected from three medical centres. By the end of reporting period, data collection from other medical centres was in progress and will continue in coming year. This data will be evaluated and analysed to prepare appropriate guidelines for radiological protection of patients.

Inspections of Radiation Facilities

As mentioned earlier, inspections to verify compliance with safety requirements are a core regulatory activity of PNRA. Regulatory inspections of radiation facilities are carried out to verify the compliance of requirements and provisions of PNRA Ordinance, regulations made thereunder and any other conditions imposed by the Authority from time to time.



Participants of a PNRA Training course on Radiation Protection

Periodic inspections of all radiation facilities are incorporated in the Authority's annual inspection program and there are provisions for special inspections where required. Keeping in view the annual inspection plan, 1785 inspections of different type of radiation facilities in medical, industrial, research and educational and agricultural setups were performed during reported year in order to maintain regulatory surveillance which led to improvements in safety/security status of radiation practice (Figure17). Recommendations for improvement and compliance to regulations were provided to inspected facilities in inspection reports and these were appropriately followed-up. It is worth mentioning that along with facility design, functioning, work practices and ALARA implementation; attention is also being paid for enhancement of security regime of radiation facilities. In this regard, 6 special inspections were carried out to verify and ensure the adequacy of security measures being taken by the licensee during use, transportation and storage of the sources.

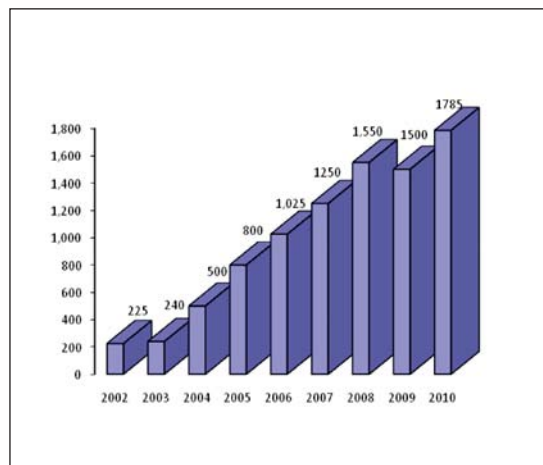


Fig 17: Regulatory Inspections of Radiation Facilities

Authorization of Import and Export of Radiation Sources and Generators

National regulations require that all import and export of radioactive sources or generators be authorized by PNRA through a "No Objection

RADIATION SAFETY

Certificate" (NOC). This NOC is issued after verification of intended end use and the technical specifications of radiation source or generator. During the reported period, PNRA issued 1028 NOCs. The details of the number of NOCs issued for import and export of radioactive sources or generators with a comparison to previous year is given in Figure 18.

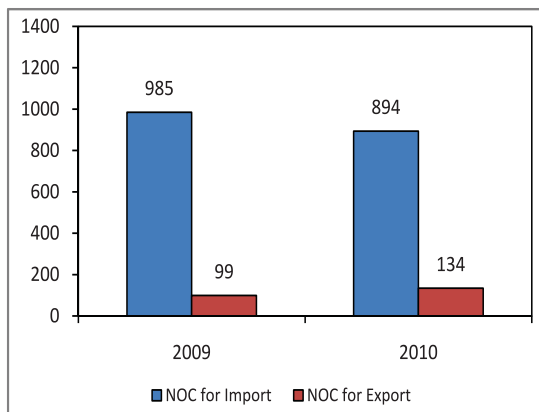


Figure 18: Issuance of NOC for Export-Import of Radiation Sources and Equipment

Maintaining cradle-to-grave control on all radioactive sources used in country is a regulatory obligation of PNRA. During reported period, PNRA updated its record of sealed radioactive sources being used in the country. According to this record, 2688 sources are currently in use at various radiation facilities. The detailed distribution of these sources in different categories is shown in Figure 19.

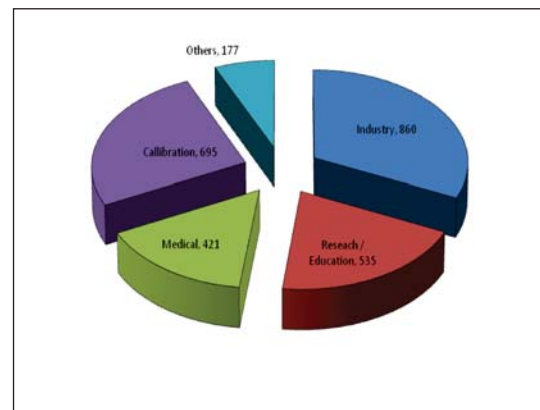


Figure 19: Distribution of SRS by Usage



Participants of a PNRA Seminar at Shifa International Hospital, Islamabad

Radioactive waste is generated as a result of operation of nuclear facilities and application of radionuclides by radiation facilities. Such waste emits ionizing radiation, posing a hazard to human health and the environment. The safe management of radioactive waste is therefore essential to protect the public and the environment from present and future harms. The long-term safety of radioactive waste cannot be ensured until it has been emplaced in a disposal facility isolated from the biosphere.

As with other areas involving nuclear and radiation safety concerns, PNRA has issued regulations to ensure that safety is maintained in the transportation of radioactive materials and in the management of radioactive waste in the country. The implementation of these regulations is ensured through review and assessment, inspections, authorizations and where needed, enforcement actions.

Radioactive Waste Safety at Nuclear Facilities

The main source of radioactive waste is nuclear power plants. PNRA ensures that both the activity and the volume of radioactive waste generated at NPPs is minimized through suitable design, operation and other measures and the discharge of radioactivity is kept as low as reasonably achievable so that doses to the public and the environment are minimal. PNRA also ensures that the operator maintains round-the-clock monitoring of gaseous effluents through stack and liquid effluent discharges to sea/river.



Gamma Spectrometry Laboratory at PNRA

Karachi Nuclear Power Plant Unit 1 (K-1)

PNRA ensures that K-1 maintains round-the-clock monitoring of gaseous emissions such as tritium, radioiodine, radioactive noble gases, and radioactive particulates released through the stack and the liquid effluent discharged to the sea. To limit discharges to the environment to an acceptable level, K-1 has established its derived release limits (DRLs) for liquid and gaseous effluents on the recommendation of PNRA and PNRA ensures that the plant's discharges remain below the DRLs. Releases of radioactive effluents, both gaseous emissions to the atmosphere and liquid discharges to the sea, remained well below the DRLs during the

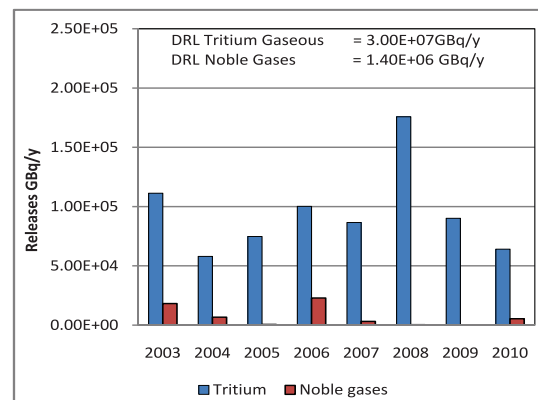


Figure 20: Gaseous Effluents from K-1

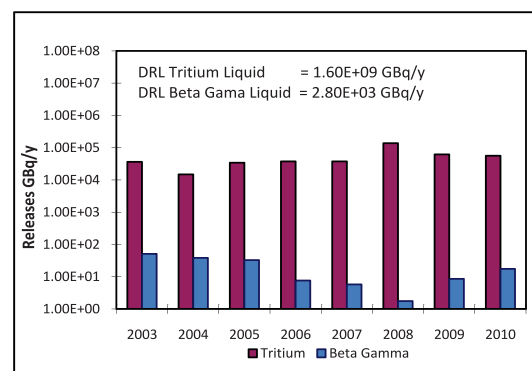


Figure 21: Liquid Effluents from K-1

year 2010 (Figures 20 and 21). The established Derived Release Limits (DRLs) are based on 30% of public dose limit (1 mSv) as required under regulations. DRLs for liquid effluent are 1.60×10^9 GBq/year of tritium and 2.80×10^3 GBq/year of beta gamma and for gaseous releases are 3.0×10^7

GBq/year of tritium; 1.40×10^6 GBq/year of noble gases; 4.10×10^2 GBq/year of iodine & 2.30×10^2 GBq/year of particulates.

Solid radioactive waste is currently stored at K-1 in compacted drums. The number of drums containing waste generated added every year at K-1 is shown in Figure 22. The waste generated during 2010 is not yet compacted. However, from the waste generated, it is expected that waste will be compacted into about 48 drums. As a further step to enhance its safety and security, PNRA advised K-1 to compile an inventory of all solid radioactive waste it has generated since it commenced commercial operation. So far, K-1 has provided the

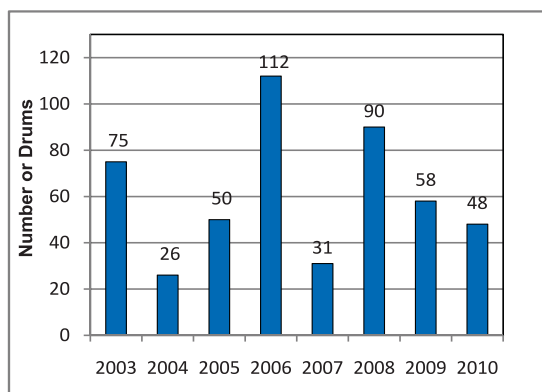


Figure 22: Compacted Solid Waste Generated at K-1

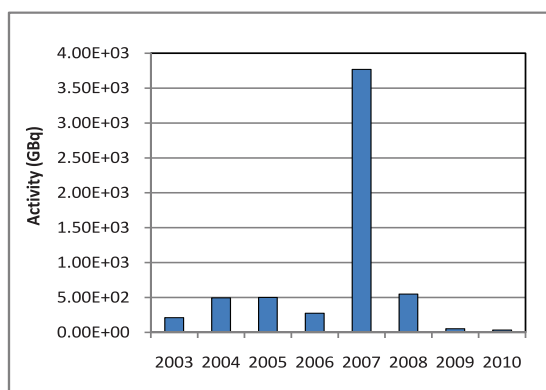


Figure 23: Activity of Solid Radioactive Waste Generated at K-1

inventory of the last 28 years. The plant was requested during the reported period to expedite compilation of the remaining inventory. On the advice of PNRA, K-1 has started work on the establishment of a separate radioactive waste

storage facility in the vicinity of the plant. The total activity of solid radioactive waste generated at K-1 is shown in Figure 23.

Chashma Nuclear Power Plant Unit 1 (C-1)

PNRA keeps a constant eye on the discharges of C-1 and analyses them to ensure that they remain below the technical specification limits. No abnormal discharges were reported during 2010.

Treatment of gaseous waste from C-1 includes pressurized storage of radioactive hydrogenated effluents in six hold-up tanks for 60 days until the waste decays to a value allowable for discharge to the environment. Discharge of gaseous waste is allowed to continue as long as the radioactivity level is less than 1×10^{10} Bq/m³ (10 GBq/m³) and terminated if radioactivity level exceeds this value. Figure 24 provides the total activity released in gaseous effluents from C-1 since the start of its operation in 2000. The discharges remained less than 2 percent of the technical specification limit.

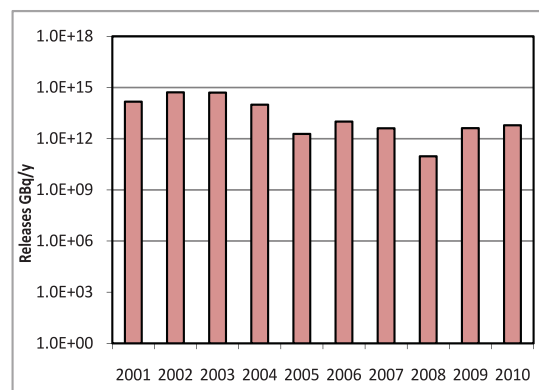


Figure 24: Activity Released in Gaseous Effluents from C-1

The plant's liquid waste is discharged directly to the environment if its radioactivity level is less than 3.7×10^5 Bq/m³ (370 KBq/m³). If radioactivity exceeds this limit, the wastes are collected in three different, independent collecting tanks depending upon their radioactivity level and the nature of their source. Figure 25 provides the total activity released in liquid effluents by C-1 since the start of its operation in 2000. The discharges remained less than 1 percent of the technical specification limit.

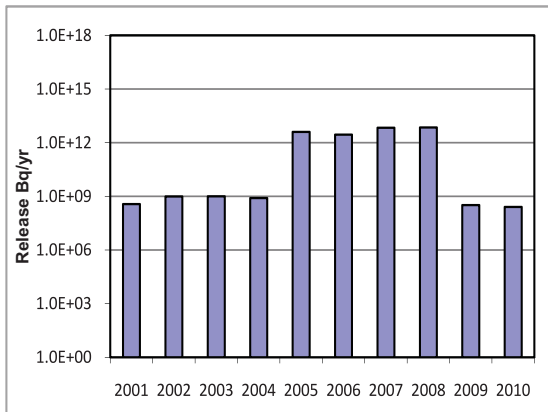


Figure 25: Activity Released in Liquid Effluents from C-1

Solid wastes generated at C-1 are compacted and stored in drums in a storage building at the plant. The design capacity of this building is for 10 years, corresponding to 1,700 drums. At the end of 2010, the available capacity had been reduced to 448 drums. The accumulated number of waste storage drums against the available capacity at C-1 is shown in Figure 26. Availability of storage space for waste is constantly being monitored by PNRA and the licensee has been advised to increase the storage capacity for future operation of the plant. C-1 has started the establishment of an additional waste storage building to cater to its own future needs, as well as the needs of other NPPs to be constructed at the Chashma site.

PINSTECH

The Pakistan Institute of Science and Technology (PINSTECH) is a multidisciplinary research facility of PAEC which houses two research reactors, PARR-I and PARR-II. Radioactive waste is generated from research and development (R&D) activities carried out at PINSTECH.



RCC Barrels/Drums of Waste at PINSTECH

In addition, the Institute is one of the designated sites for storage of waste generated from other radiation facilities in Pakistan. Radioactive waste is stored at the Institute in Reinforced Cement Concrete (RCC) barrels. The volume of low level waste collected has varied from year to year. Figure 27 shows the number of cementized and

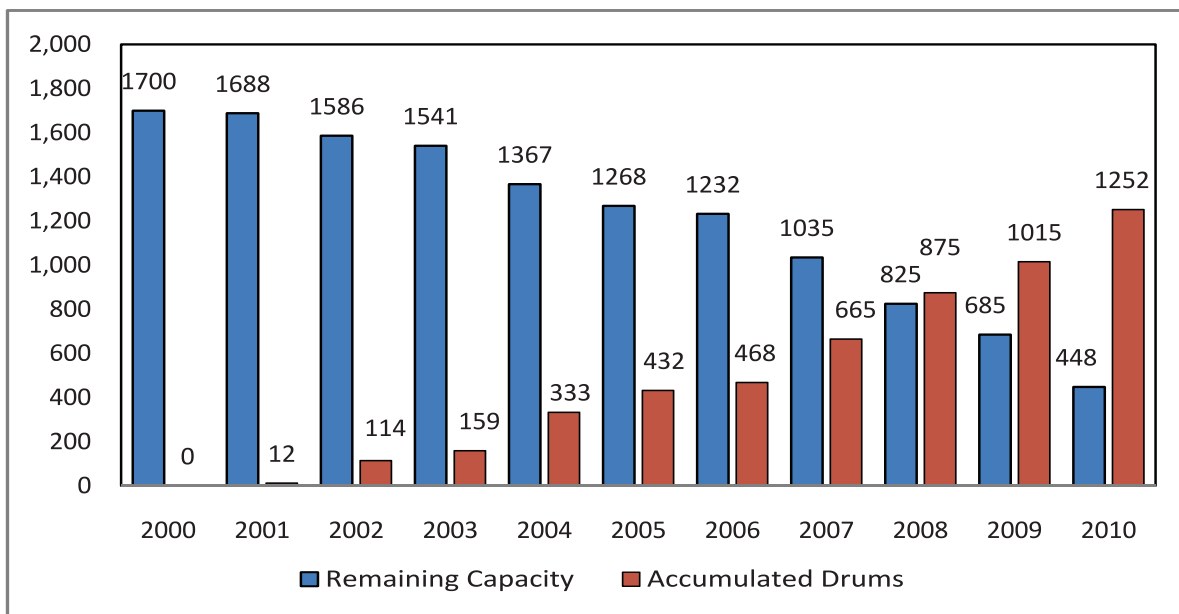


Figure 26: Compacted Waste Drums Accumulation Vs. Capacity at C-1

compacted containers of waste produced at PINSTECH during the last eight years.

PNRA ensures that national requirements regarding waste minimization are also met at PINSTECH. Waste management activities at the Institute are regularly monitored. No deviation from the requirements of national regulations and international standards was observed during the reporting year.

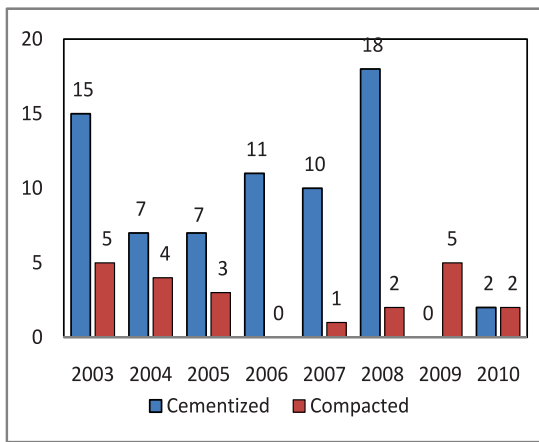


Figure 27: Cementized and Compacted Containers at PINSTECH

Management of Disused Sealed Radioactive Sources

The national regulations on radioactive waste management require that sealed radioactive sources containing long-lived radionuclides (having

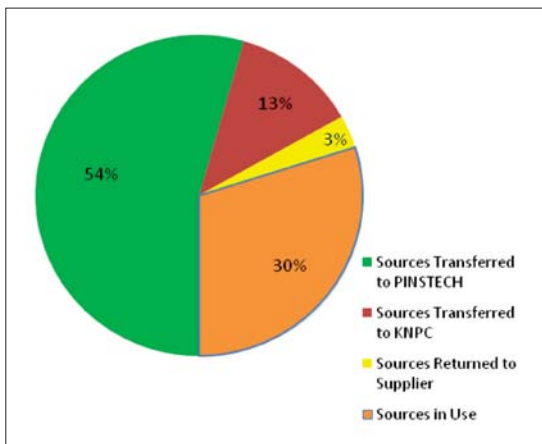


Figure 28: Status of Imported SRS

a half life of more than one year and with initial activity of 100 GBq or more) not be purchased without an undertaking from the manufacturer/supplier to accept the return of the sources when they are no longer useful.

The disused radioactive sources in possession of the licensees prior to the promulgation of PNRA regulations and those not covered above need to be disposed off in a safe manner. PNRA has designated two sites, one in Islamabad (PINSTECH) and the other in Karachi (K-1), for receiving Disused Sealed Radioactive Sources (DSRS) for safe storage.

Figure 28 gives a status of imported SRS in the country. Out of the total SRS imported into Pakistan, 54% have been transferred to PINSTECH after completion of their useful life, 13% are stored at K-1, and 3% have been returned to the concerned supplier. The remaining 30% are in use by the licensees. The DSRS stored at PINSTECH and K-1 contains Cobolt-60, Cesium-137, Irradium-192, Radium-226, etc. The respective percentages of these DSRS stored at PINSTECH and K-1 are given in Figure 29.

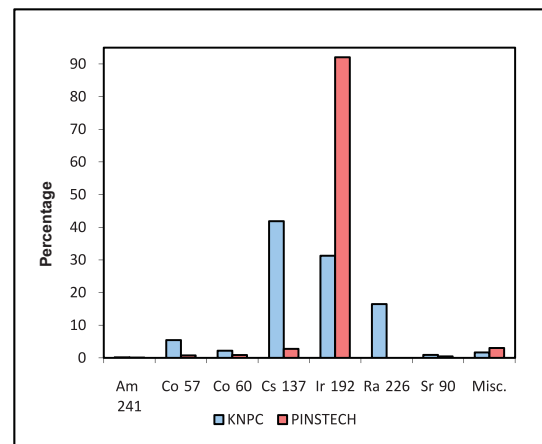


Figure 29: Disused Sources in the Country

Inspections in the Area of Waste Management

PNRA conducts inspections of the nuclear and radiation facilities to verify compliance with the radioactive waste management program established by the operator. These inspections

mainly focus on storage facilities and radioactive waste management programs to assess the safety of waste collection and classification, treatment, conditioning and storage at these facilities. During the reported period, three such inspections were conducted and ensured that the radioactive waste management practices are being conducted in safe manner and are in compliance with the national regulations. Recommendations were issued to the operators for further improvement in the implementation of their radioactive waste management program.

Decommissioning of Nuclear Facilities

K-1 is an old NPP, and its eventual decommissioning is an important concern for PNRA, especially because, as with the decommissioning of all NPPs, it will entail significant monetary resources. K-1 has established a financial mechanism to cope with activities related to decommissioning. During the reporting period, K-1 submitted its preliminary decommissioning plan, which was reviewed at PNRA against international standards and guides. K-1 has since revised its decommissioning plan to meet requirements identified by PNRA.

PNRA is also in contact with C-1 and C-2 to consider for preparing its initial decommissioning plan to cope with the challenge of decommissioning, even if it is premature for any reason.

Safe Transport of Radioactive Material

Besides controlling radioactive waste in the country, PNRA also regulates transportation of radioactive material to protect the public and the environment from the associated hazards. Our national regulations on transport of radioactive material are in line with the international requirements.

Based on national requirements, technical guidance is provided to various establishments dealing with transportation of radioactive material or radioactive sources, specifically regarding

matters such as the transport index, United Nations (UN) number, categorization of packages, content limiting of packages, etc. During 2010, PNRA conducted safety reviews and safety assessments of type A transport packages, which can be used to transport radiopharmaceuticals by road and rail. PNRA witnessed tests on type A package conducted by PINSTECH and also provided guidance to PINSTECH regarding certification and quality assurance for the transportation of type B (U) packages.

PNRA ensures that consignors and carriers fulfil their obligations and comply with the national requirements for safe transportation of radioactive sources within the country. The Authority's regional directorates conduct routine and periodic inspections, some of which are unannounced, to verify that users' activities comply with regulatory requirements.

All radioactive consignments imported into the country and exported under contract are duly authorized by PNRA. The shipping documents of such consignments are evaluated and permissions granted after confirming that the shipments meet national and international requirements for transportation.



Training of PNRA Personnel on Safe Transport of Radioactive Material

6 EMERGENCY PREPAREDNESS

Nuclear installations and radiation facilities are designed and operated to a very high level of safety with advanced engineered safety features to prevent accident. Strict regulatory control is exercised throughout the life of installations and facilities. A possibility of accidents nevertheless remains, even though it is quite low compared to other conventional industries. Therefore, there is always a need for preparedness to respond to and mitigate the consequences of incidents that might occur at a nuclear installation or radiation facility affecting workers, the public and the environment. PNRA is obliged under the Ordinance to ensure preparation and implementation of emergency plans for actions to be taken by the relevant onsite and offsite authorities following a radiological emergency.

Regulations issued by PNRA on the management of a nuclear accident or radiological emergency (PAK/914) require licensees to have in place emergency plans, the necessary workforce, equipment and mechanism for responding to any such eventuality. The licensees are also required to maintain capacity for coordination with offsite response organizations involved in mitigating the consequences of radiation emergency.

Nuclear installations and radiation facilities have been categorized according to hazard associated with them and requirements for emergency preparedness are commensurate with their hazard categorization.



PNRA Finalizing Strategy for Demonstration of K-1 Offsite Drills and KOFREP

Emergency Plans and Drills

PNRA reviews and approves emergency plans of the facilities under its purview to ensure that the plans are commensurate with regulatory requirements, incorporate all possible control and mitigation steps and are executable. PNRA also requires licensees to conduct exercises and drills on a regular basis to ensure that their emergency plans are effective and workable. The frequency of exercises and drills is agreed in the approved emergency plans and they are witnessed by PNRA to assess the licensees' preparedness for executing them as and when required. PNRA also invites representatives from relevant governmental departments and ministries to witness drills at nuclear power plants.

In 2010, six emergency exercises and drills were conducted. During the reporting period, PNRA reviewed and approved the revised K-1 Offsite Radiological Emergency Plan (KOFREP). As per plan, Provincial Disaster Management Authority (PDMA), Sindh has been assigned the responsibility of taking all measures including sheltering and evacuation outside the plant boundary, if required.

PNRA evaluated offsite emergency drills to verify that the revised KOFREP and actions to be performed by different response organization during an emergency at K-1 are executable. PNRA evaluated K-1's offsite and onsite radiological emergency exercises in June and December 2010 respectively. Sheltering, distribution of Potassium



Dr. Ashfaq Ahmed, Advisor to Prime Minister During a Visit to NRECC at PNRA

Iodide tablets and access control to potentially affected areas were demonstrated in these drills.

C-1 and C-2 are both located at Chashma site. C-1 is operational for the last ten years while C-2 is under construction and is expected to start operation in 2011. The onsite emergency plan of C-1 is already approved by PNRA based on which C-1 conducted its sixth integrated exercise. The exercise was considered satisfactory by PNRA.

Onsite emergency plan and implementing procedures for C-2 were reviewed during the reported year. The plan was modified in the light of PNRA's recommendations. C-2 carried out its first fuel load emergency exercises, which were witnessed during November 2010.

After construction of C-2, the offsite plan of C-1 also needed modifications. The licensee was asked to submit a site-based offsite emergency plan applicable to both C-1 and C-2. The offsite plan and relevant Standing Order Procedures (SOPs) were approved by the District Coordination Officer (DCO), Mianwali. These plans were submitted by the licensee and reviewed by PNRA. Based on these plans, a comprehensive offsite drill, involving district officers, was conducted by the licensee and observed by PNRA.

PNRA has also reviewed emergency plans of radiation facilities, including radiotherapy and nuclear medicine centres, industries and research institutes and communicated recommendations for improvements. Emergency drills of certain industries using radioactive sources were also conducted during the reported year.

National Radiation Emergency Coordination Centre (NRECC)

The National Radiation Emergency Coordination Centre (NRECC), based at PNRA Headquarters, is responsible for coordinating the response to nuclear accidents or radiological emergencies and functions round-the-clock. NRECC is Pakistan's designated National Warning Point (NWP) under



PNRA and PAEC Meeting on Improvements in Emergency Preparedness

the Conventions on "Early Notification of a Nuclear Accident" and "Assistance in the Case of a Nuclear Accident or Radiological Emergency". It is responsible for notifying the competent authorities (both domestic and abroad) and IAEA about any nuclear accident or radiological emergency in the country.

NRECC is equipped with the necessary communication facilities, Mobile Radiological Monitoring Laboratories (MRMLs) and various types of radiation detection and personal protective equipment. The Centre conducts different types of emergency exercises, including the Communication Test Exercise (COMTEX), in which the availability of communication channels with licensees and regional directorates of PNRA is verified; the MRML exercise, which tests the capability to respond to an event involving radiation monitoring; and field



Briefing of PNRA to Authority Members and NDMA Representatives

EMERGENCY PREPAREDNESS

exercises. During the reported period, NRECC conducted three COMTEX exercises and two MRML exercises.

NRECC also participates in exercises and drills conducted by licensees, as well as Conventional Exercises (ConvEx) conducted by IAEA under international conventions. The ConvEx focus on verification of international communication channels and the capability of Member States to evaluate and respond to different radiological accidents. NRECC participated in three ConvEx exercises in 2010.

PNRA has registered for participation in an International Nuclear Emergency Exercise (INEX) being conducted with the support of the Nuclear Energy Agency, Organization for Economic Cooperation and Development (OECD), France. The objective of the exercise is to test arrangements for and issues in, consequence management and transition to recovery in response to a malicious act in an urban area. The exercise will be conducted during February 2011.

Training of Trainers for First Responders to a Radiological Emergency

Training of those responding within the first few hours of a radiological emergency is very important to avoid the spread of contamination and



Participants of a PNRA Arranged Train the Trainer Course for First Responders at Vienna

overexposure to radiations. PNRA provided training to more than 180 first responders of Rescue 1122 and front line personnel at border entry and exit points during the reported period.

During the reported period, PNRA planned to conduct a national training course for first responders with the assistance of international experts but was unable to do so due to the prevailing conditions. On PNRA's request, IAEA agreed to host it as a train-the-trainer course at IAEA Headquarters in Vienna. The course was arranged in October 2010 and was attended by master trainers from Rescue 1122, the fire brigade, law enforcement agencies, the National Disaster Management Authority (NDMA), the Provincial Disaster Management Authority (PDMA), Sindh and PNRA. The training course included lectures and tabletop exercises. In addition to international experts, PNRA personnel also delivered lectures during the workshop.



NRECC Response Team During an Emergency Exercise

Training of Medical Professionals in Handling of Radiation Injuries

The potential of radiological accidents cannot be ruled out and a medical practitioner may be the first person to diagnose a radiation induced injury caused by handling a radioactive source. Yet, the medical community is seldom aware of the precautions necessary for the safe management of

exposed or contaminated persons. With a view to addressing this issue, PNRA formulated a committee consisting of representatives from PNRA, PAEC and other related organizations in 2005 to develop national capabilities for the handling and management of exposed and contaminated individuals. The committee focuses special attention on arranging training courses and seminars for medical doctors.

These efforts continued during the reported period. The committee decided that PNRA would arrange short seminars on the techniques and precautions for handling of contaminated or overexposed individuals at hospitals, and methods to identify whether an injury is due to radiation exposure at all the major hospitals in the country. In the first phase, ten seminars were conducted at different hospitals at Islamabad and Rawalpindi. These hospitals included District Headquarters Hospital, Holy Family

Hospital, Fauji Foundation Hospital and Cantonment General Hospital in Rawalpindi and at Nuclear Oncology and Radiotherapy Institute (NORI), PAEC General Hospital, Federal Government Polyclinic Hospital, CDA/Capital Hospital and Shifa International Hospital in Islamabad.

In the second phase, similar seminars were held at eight major hospitals at Lahore. The selected hospitals included Jinnah Hospital, Ittefaq Hospital, Gulab Devi Chest Hospital, Lahore General Hospital, Sheikh Zayed Post Graduate Medical Institute, Sir Ganga Ram Hospital, K.E. Medical University/Mayo Hospital and SIMS/Services Hospital, Lahore. More than 700 medical professionals were briefed during these seminars on techniques and precautions for handling of contaminated / overexposed individuals.

In the third phase, similar trainings will be imparted at selected hospitals in other major cities.



Authority Members Being Briefed at NRECC During an Emergency Exercise

7 PUBLIC SECTOR DEVELOPMENT PROJECTS

The Government of Pakistan has approved six Public Sector Development Programme funded projects for the capacity building and strengthening of PNRA. A summary of these projects is presented below:

S. No.	Name of Project/Approval Status	Total Cost (PKR million)	Duration
1	Institutional Strengthening and Capacity Building of PNRA Regarding Regulatory Activities Related to Licensing of NPPs	480.00	2005–2011
2	Capacity Building of PNRA to Implement National Nuclear Security Action Plan	497.00	2006–2011
3	PNRA's School for Nuclear and Radiation Safety	413.00	2006–2012
4	Establishment of National Dosimetry and Protection Level Calibration Laboratory	292.00	2007–2013
5	National Programme on Environmental Radioactivity Surveillance: Islamabad, Kundian, Karachi	263.0.0	2007–2013
6	Safety Analysis Centre (SAC) to Provide Regulatory Support and for Indigenisation of NPP in Pakistan	463.00	2010–2015

These projects are briefly discussed in the following sections:

Institutional Strengthening and Capacity Building of PNRA Regarding Regulatory Activities Related to Licensing of NPPs

This project commenced in June 2005. Under this project, PNRA has established a technical support organization called the "Centre for Nuclear Safety" (CNS) to provide technical support for review and assessment work pertaining to C-2 and future plants. The project was planned to be completed by

mid-2010; however, due to paucity of funds, the government was unable to release allocations on schedule and some essential training items-which also involve foreign training-are yet to be completed. Therefore, the project has been extended for a further period of one year, i.e. up to 2011.

Although the project is still in the execution phase, CNS is already providing technical support to PNRA's technical directorates in the review, assessment and inspection of licensees. The Centre also has the capability to undertake research and development activities in specialized areas, such as deterministic and probabilistic safety analysis, stress analysis, NPP site evaluation, radiological hazard



PNRA Officials with International Experts at IAEA, Vienna for Training on Safety Analysis

analysis in case of anticipated accidents at NPPs, etc., which form the basis of regulatory decisions. CNS is thus an important element of PNRA's indigenous capability for effective and efficient regulation of the country's nuclear industry. Centre's growing role signifies decreasing reliance on regulators of foreign countries in the assessment of plant safety.

The performance of CNS is continuously monitored by the Planning and Development Division, Government of Pakistan. The Planning Division has expressed appreciation of the initiatives and achievements of CNS against various milestones and termed the Centre a "model project".

Thus far, the project has recruited and trained 55 professionals, who are now responsible for the review of safety analysis reports of future plants periodic safety review reports, design modifications of existing and future plants, and safety research and development.

CNS performed the review and assessment of C-2's Final Safety Analysis Report during 2010 indiginously for the first time. Previously, this kind of review was carried out with the help of foreign consultants. This activity has resulted in building confidence of PNRA staff to conduct such tasks independently and saving of a significant amount of foreign exchange. In addition to this review activity, CNS proactively contributed to PNRA in the following activities:

- Preparation of National Report on Convention of Nuclear Safety;
- Review of nuclear design, core loading patterns and Safety Evaluation Report of C-1 during its sixth refuelling;
- Review of Periodic Safety Review reports of C-1 for 10-year licence renewal;
- Participation in safety inspections of C-1 during refuelling;
- Review of probabilistic safety analysis of C-2;
- Review of quality assurance program of C-2 for operation;
- Participation in inspections during commissioning tests of C-2;
- Confirmatory analysis of design basis and beyond design basis scenarios; and
- Audit calculations of structural analysis and equipment design.

In addition, following papers were published in international journals and presented at various international seminars:

- Faisal Asfand, "CFD Simulation of Thermal Stratification in Pressurizer Surge Line", Published in ASME Journal.
- Faisal Asfand, "Energy Crisis and the Need to Enhance Nuclear Energy in Pakistan", Presented at ICESE-2010.
- Mehboob Alam, Faisal Asfand, "Environmental Impact of Nuclear Power



Signing of Agreement between PNRA and Xian Jiaotong University , China



Signing of Agreement Between CNS-PNRA and NSC-NNSA, China

PUBLIC SECTOR DEVELOPMENT PROJECTS

Plant and its Comparison with Other Technologies”, Presented at PGSRET-2010.

- M. Sadiq, Kamran Mansoor, Waqas Sherani, “National and Worldwide Nuclear Plant Safety Regulations and Standards”, Presented at PGSRET-2010.
- Aijaz Mangi, Zahid Khan, Inam Shah, “Net Metering: Zero Electricity Bill”, Presented at PGSRET-2010.
- Naseer Ahmad, “A Statistical Approach to Determine the Earthquake Probability, Calculation of Peak Ground Acceleration for Karachi”, Presented at Baragali Summer Campus, University of Peshawar.
- Dr. Shahid A. Mallick, Uzman Habib, Ammar Mehdi, “Challenges in Developing TSO to Provide Technical Support in Nuclear Safety and Security in PNRA”, International Conference on Challenges Faced by TSO at Tokyo Japan.

Capacity Building of PNRA to Implement National Nuclear Security Action Plan

This project was initiated in 2006 with the vision to develop a sustainable system of prevention, detection and response for incidents related to nuclear security. The project has completed most of its major activities and will be completed by mid

2011. The main focus areas of the National Security Action Plan (NSAP) include the following:



Field Exercise on Response to Radiological Dispersal Device

- **Management of radioactive sources of categories 1, 2 and 3:** The assessment of the vulnerabilities of radiation facilities in the country has been completed and security upgrades of 12 facilities using high-activity radioactive sources have been made. An inspectorate was established in 2010 in Bahawalpur for inspections of the facilities using radioactive sources of categories 1, 2, and 3.
- **Nuclear Security Training Centre:** The Nuclear Security Training Centre (NSTC), currently housed at PNRA Headquarters, is continuously conducting training. About 341 Front Line Officers (FLOs) were trained

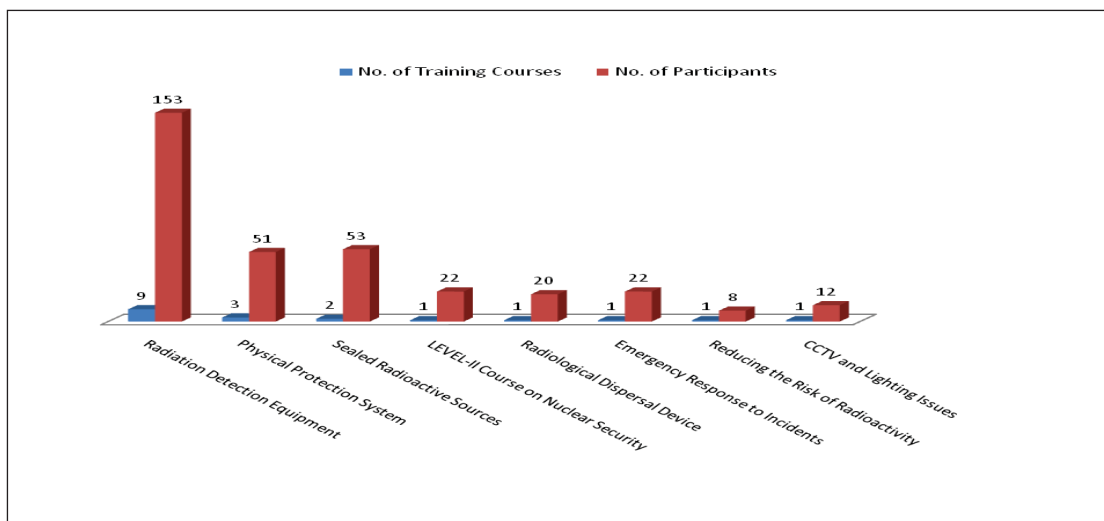


Figure 30: Trainings conducted by NSTC

through 19 training courses in 2010 (Figure 30). Construction of the NSTC building is in progress and is expected to be completed by 2011.

- **Nuclear Security Emergency Coordination Centre (NuSECC):**The Nuclear Security Emergency Coordination Centre (NuSECC), which was established under the project to facilitate coordination



Lecture in Fire and Security Pakistan Conference at Karachi

among government agencies and respond to different incidents and emergencies pertaining to nuclear security. NuSECC also provides training to front line officers, first responders and law enforcement agencies to enhance their ability and build their confidence to take appropriate measures to protect themselves and the public while managing an emergency that involves radioactive materials or radiation.



Visit of IAEA Expert to PNRA for Training on Nuclear Security



Exercise to Search Nuclear Material or Source in Scrap

NuSECC was equipped with incident and emergency mobile laboratories during 2010. Three Incident Response Mobile Laboratories are stationed at the Regional Nuclear Security Inspectorates (RNSIs) established in Peshawar, Quetta and Bahawalpur, while three Emergency Mobile Laboratories have been placed at Regional Nuclear Safety Directorates (RNSDs) in Islamabad, Kundian and Karachi. These mobile laboratories, fitted with state-of-the-art equipment, are ready to assess and respond to any incident pertaining to nuclear security in the major cities of the country.

During the reporting period, PNRA's Field Response Team responded to four incidents related to naturally occurring radioactive material (NORM) in the vicinity of Islamabad. One field exercise was also conducted to prepare for an effective



Participants of the 1st Professional Training Course on Nuclear Security



Participants of PNRA Train the Trainer Program

response against malicious acts involving radioactive material.

NuSECC also participated in the “Fire and Security Pakistan Conference” in Karachi. In this conference, PNRA's representative presented a paper titled “Preparedness and Response to a Radiological Incident and Emergency.”

- **Locating and securing orphan sources:** One of the objectives of the project is to provide clean environment to the public. This objective could be achieved through a public awareness campaign and conducting countrywide physical and non-physical (documentation) searches for orphan sources. The search for orphan sources is a continuous process; during the reporting period, 42 physical searches were conducted.
- **Provision of detection equipment at borders:** Under this project, radiation detection equipment has been purchased and distributed in phases to eight strategic entry–exit points on the country's border, according to a memorandum of understanding with the Federal Board of Revenue (FBR). Training is being provided to FBR personnel in the operation and maintenance of the equipment.

Key activities conducted under NSAP in 2010 are summarized in Figure 31.

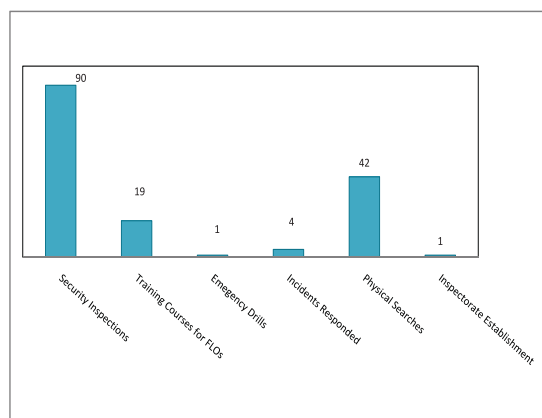


Figure 31: NSAP Activities in 2010

In addition, expert from PNRA was invited to the International Conference on Challenges faced by TSO at Tokyo, Japan. A paper on “Possible Modes of Establishing Nuclear Security Technical and Scientific Support in Member States intending to Launch or Expand Nuclear Power Programs” was presented by PNRA.

PNRA's School for Nuclear and Radiation Safety

The licensing and supervision of nuclear power plants, research reactors and radiation facilities is a critical and challenging task for the regulatory body in any country. Among the key issues is maintaining a sufficient number of highly skilled professionals, with appropriate academic qualifications and adequate experience for regulatory supervision. Under this project, aimed at developing the indigenous work force required for nuclear regulation, PNRA has established the School for Nuclear and Radiation Safety (SNRS). The school imparts knowledge and skills to newly recruited officers as well as conducts refresher courses for existing staff. SNRS has also initiated training for stakeholders who have a role in maintaining radiation safety in the country and whose professional training is therefore important.

The construction of civil structures of the SNRS building is almost complete and its finishing will be completed by the end of 2011, well before the completion of the project. For the present time,



Radiographers Course for Stakeholders in Progress



Chairman PNRA with Ex-PAEC Officials During their Visit to PNRA

PUBLIC SECTOR DEVELOPMENT PROJECTS

SNRS has been established in the PNRA headquarters building. All modern gadgets are available in the classrooms. Laboratories are equipped with the necessary relevant tools, a soft-panel training simulator, physical models of nuclear plant equipment and various computer software to assess the safety of nuclear installations. A Non-Destructive Testing (NDT) laboratory has been established where PNRA inspectors can learn about welding and NDT activities at NPPs and manufacturing facilities.

SNRS has arranged a number of courses between 2006 and 2010. Figures 32 and 33 provide information about the number of training courses conducted and the number of participants of the courses. These figures show an increasing trend in the trainings being conducted at SNRS. During 2010, SNRS conducted 25 training courses and 28 one day seminars in specialized areas. A total of 1,077 officers from PNRA, PAEC and other stakeholder organizations participated in these events.

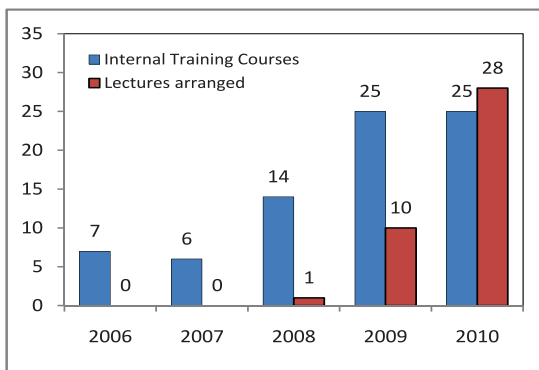


Figure 32: Inhouse Professional, Short Training Courses & Lectures (SNRS)

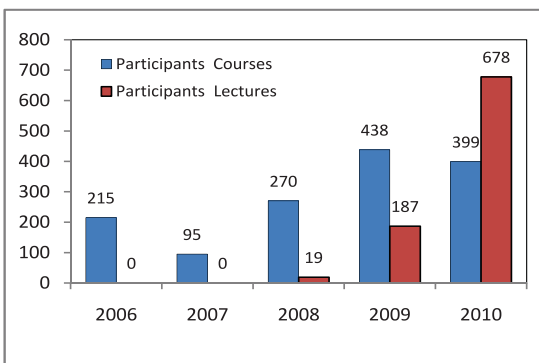


Figure 33: Personnel Trained/Participants

Based on R & D work on human resource development, SNRS presented the following papers at various international seminars:



Dr. Inam ur Rahman, Scientist Emeritus is Giving a Talk on Human Behavior at Work Place

- Moazzam Shahzad, Bilal Tahir, Iftikhar Ahmed, Ammar Mehdi, "Development and Application of Soft Panel Simulator in a Regulatory Body", ISNE-10 at Amman, Jordan;
- Dr. M. Sadiq, Dr. Shahid A. Mallick, Ammar Mehdi, "Methodology of Human Resource Development in PNRA", IC on HRD for Nuclear Programme at UAE;
- Ammar Mehdi, Dr. Shahid A. Mallick, Dr. M. Sadiq, "Training Need Assessment Practices at PNRA", IC on HRD for Nuclear Programme at UAE; and
- Ammar Mehdi, Dr. Shahid A. Mallick, M. Ayub, "Human Resource Guidelines for Countries Embarking on NPP, with a Special Focus on Best Practices Adopted by PNRA", - IC on HRD for Nuclear Programme at UAE.



Dr. Shoaib Ahmed, Member Physical Sciences PAEC Distributing Certificates on Successful Completion of a Training Course at PNRA

National Dosimetry and Protection Level Calibration Laboratory

The project for establishment of National Dosimetry and Protection Level Calibration Laboratory (NDCL) was initiated in 2007 to develop a national level laboratory to provide internal and external radiation exposure assessment (Dosimetry service) to radiation workers which is a mandatory national requirement. Currently, nuclear power plants provide radiation dosimetry services to their own workers while PINSTECH and Karachi Institute of Radiotherapy and Nuclear-medicine (KIRN) provide this service not only to their own workers but also to other radiation workers in private sector on commercial basis. However, as number of radiation workers in the country is increasing with increased use of radiation sources and equipment, current services are insufficient to cater to the increasing demands. This PSDP project will provide external and internal dosimetry as well as protection level calibration services to the radiation facilities and radiation workers in the country. Laboratories are being established in Karachi, Islamabad and Kundian for this purpose.

During the reported year, project achieved important physical targets. Construction work of laboratories in Karachi is in final stages while land has been acquired for laboratories in Islamabad. Equipment for Karachi and Kundian laboratories have been procured. Their testing and installation will be done early next year. All possible efforts are being made to complete project activities in time and within available resources.

National Environmental Radioactivity Surveillance Programme

PNRA has the responsibility to ensure that the public is protected from any buildup of environmental radioactivity. The PSDP-funded "Establishment of National Environmental Radioactivity Surveillance Programme (NERSP)" is aimed at enhancing PNRA's capabilities for monitoring environmental radioactivity, evaluating

any buildups of radiation and assessing the doses being received by the public. The programme is being implemented by PNRA and entails systematic measurement of radioactivity in soil, air, water, flora and fauna throughout the country.

Under the aegis of NERSP, the establishment of well-equipped laboratories at PNRA is in progress. In this regard, during 2010, procurement of equipment through IAEA and training of personnel for operation of gamma-ray spectrometry equipment remained in progress.

PNRA will be in a position to conduct effective and comprehensive environmental surveillance in the country once the laboratories are fully established. The laboratories will be useful in measuring discharges for the assessment of radiation doses to the public; monitoring radiation during a radiological emergency or a nuclear accident; verifying the environmental data provided by NPPs to PNRA; conducting assessments of food and other items to be exported for issuance of "Radiation Free Certificates"; and preparation and certification of standard reference materials.

While the laboratories are being established, the work of sampling and analysis under NERSP has already been started. In 2009 and 2010, soil samples were collected from 32 districts of Pakistan.

Safety Analysis Centre

The project for the development of a Safety Analysis Centre (SAC) in Karachi was approved in September 2009 to provide regulatory support in safety analyses for indigenisation of NPPs in Pakistan. The main objective of this project is to develop a centre of excellence in the southern region of Pakistan to provide support to both regulators as well as the operators, while ensuring that regulatory independence is not compromised. However, due to paucity of funds, no releases have been made so far for this project. Keeping in view the importance of the project, the Advisory Committee on Improving Utility-Regulatory Interface (ACIURI) of

PUBLIC SECTOR DEVELOPMENT PROJECTS

the PNRA decided to finance this project from its own funds till releases from PSDP are received.

SAC has developed significant capability in performing Design Basis Accidents (DBA) and Beyond Design Basis Accidents (BDBA) analyses. The significant activities performed in this regard are as follows:

- i. Development of Design Database & Engineering Hand Books for computer codes RELAP5 and MELCOR for C-1 & C-2;
- ii. Accident analyses for the transients presented in the Safety Analysis Report;
- iii. Confirmatory/Audit analysis of the transients with RELAP5;
- iv. Fine nodalization of the model previously developed for RELAP5;
- v. Development of CANDU model in RELAP environment (for K-1 SEOPs and SAMGs analysis);

SAC has developed indigenous capability to use the analytical tools in the area of safety assessment of NPPs. Currently, SAC is involved in the development of analytical capabilities for Symptom Based Emergency Operating Procedures (SEOPs) for C-2. It

may be mentioned that formally such development work for C-1 was accomplished by contract with a foreign organization which involved heavy foreign exchange. Similarly, K-1 has also requested SAC for performing background analysis for development and validation of SAMGs for KANUPP in compliance to the regulatory requirements.

SAC has also enhanced simulation and modeling capabilities with the understanding of PCTTRAN source code files and additional simulation platforms such as MATLAB, MODELICA and SCILAB. Development of Management Information System (MIS) was completed and implemented in PNRA. 2D/3D drawings related to NPP systems and equipments were prepared in CADWorx.

SAC personnel had contributed in joint activities with CNS such as safety review and assessment of SAR of C-2. SAC also participated in the meetings, training courses and workshops to enhance the analytical capability of its technical staff in the area of DBA & BDBA, PSA, CFD & Structural Analysis.

In 2010, generally the funds released in all 6 PSDP projects were below the allocated amount.



Ground Breaking Ceremony for Establishment of NDCL and NERSP Laboratories at Karachi

8 NATIONAL AND INTERNATIONAL COOPERATION

PNRA recognizes the importance of cooperating with national and international stakeholders in the performance of its regulatory functions and in the capacity development of all stakeholders to ensure safe operation of nuclear and radiation facilities.

At the national level, PNRA interacts closely with the Pakistan Atomic Energy Commission (PAEC) and with other national regulators, including the Oil and Gas Regulatory Authority (OGRA), Public Procurement Regulatory Authority (PPRA), the National Electric Power Regulatory Authority (NEPRA) etc. in safety and regulatory activities in the country. PNRA also enjoys technical support from leaders in academia, such as Ghulam Ishaq Khan Institute of Engineering and Technology (GIKI), University of Engineering and Technology (UET), Peshawar; UET, Taxila; and the Quaid-i-Azam University, among others.

At the international level, PNRA works with various institutions under bilateral and multilateral cooperation programmes. PNRA assists the Government of Pakistan in fulfilling all of its obligations under the four international conventions pertaining to nuclear and radiation safety to which Pakistan is a signatory. These conventions include Convention on Nuclear Safety; Convention on Early Notification of a Nuclear Accident; Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency; and Convention on Physical Protection of Nuclear Materials. In addition, the Authority continues to avail technical capacity building opportunities with IAEA, actively extends cooperation for international peer reviews and provides experts for international regulatory missions when requested by IAEA.

National Linkages

Relations with Licensees

PNRA maintains a relationship of mutual respect and trust with all its stakeholders, including its licensees. In 2010, apart from routine regulatory activities, PNRA remained involved in many public awareness and education and training activities for

licensees. One hundred and twelve PAEC officers and a number of officials from other stakeholders participated in training courses conducted by PNRA's School for Nuclear and Radiation Safety. PNRA had established an Advisory Committee on Improving Utility-Regulatory Interface (ACIURI) to resolve issues arising due to any reason. This committee held two meetings during 2010, in which areas of mutual cooperation to enhance safety were discussed and agreed to finance the newly established Safety Analysis Centre till funds from GoP are released.

Collaboration with National Academic Institutions

PNRA strives for continuous improvement of its regulatory performance and, in this regard, has initiated a number of collaborative programs with prestigious national academic institutions.

In 2010, three officers of PNRA completed a two-months training course on full scope simulator at the Chashma Centre for Nuclear Training (CHASCENT). These officers are involved in commissioning of the first soft-panel NPP simulator in Pakistan, which has been developed by PAEC and PNRA as a part of joint research activities.

A project on Soil Structure Interaction Analysis has been initiated in collaboration with UET, Peshawar. In this regard, details have been worked out to hold a two-weeks workshop to give PNRA and PAEC officials hands-on experience with the computer



Briefing to Additional Secretary During his Visit to PNRA

NATIONAL AND INTERNATIONAL COOPERATION

code Structural Analysis Program (SAP) 2000.

Fourteen (14) officers were awarded fellowships for MS degrees in nuclear engineering at the Pakistan Institute of Engineering and Applied Sciences (PIEAS) and KANUPP Institute of Nuclear Power Engineering (KINPOE) this year.

In addition, 135 officials of PNRA participated in 43 courses at different national institutes. A year-wise comparison of training courses arranged in different national institutes is given in the Figure 34.

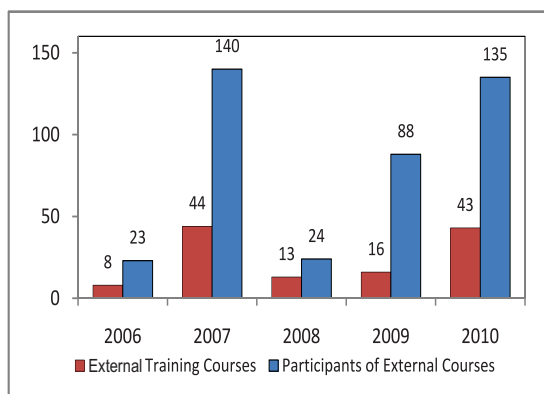


Figure 34: Training Courses & Participants in Various National Institutions

Relations with the Public

As a general practice, PNRA keeps the public informed about its activities. Its website, www.pnra.org, serves as a continuous source of updated and detailed information for the public.

In addition, PNRA ensures that the facts of any significant event at nuclear installations and radiation facilities are communicated to the public through timely press releases. Various means are used to educate the public regarding the most relevant aspects of nuclear and radiation safety.

For the awareness and instruction of first responders to a radiological emergency, as well as the guidance of the general public, PNRA has prepared information materials, including brochures and booklets, regarding rescue activities, control of contamination spread and protection during response to a radiological emergency. These materials are provided to participants of PNRA's

trainings of responders and may also be distributed during an emergency.

Various lectures on use of radiation for diagnostic and treatment purpose, preventive measures and its consequences are delivered at institutes and hospitals for awareness of general public and workers.

International Cooperation

Fulfilment of Obligations

PNRA continues to ensure that Pakistan fulfils its international obligations under the Convention on Nuclear Safety. Under this convention, all Member States are required to submit a national report on nuclear safety after every four years. During the reporting period, Pakistan's Fifth National Report was prepared by PNRA, finalized in a meeting of representatives of all the relevant organizations and submitted to IAEA. The report will be discussed in the upcoming meeting of the Convention on Nuclear Safety in Vienna in April 2011.

Bilateral and Multilateral Cooperation

It is widely recognized that bilateral cooperation and networking among national nuclear regulators and other concerned organizations is essential for regulatory effectiveness. PNRA has signed Memoranda of Understanding (MoUs) and bilateral cooperation agreements with international nuclear regulators, technical support organizations and universities.

Cooperation with China

Fifth Steering Committee meeting was held at Haikou, China, between NNSA and PNRA. Chinese delegation was headed by the Vice-Minister, Mr. Li Ganjie while delegation from Pakistan was lead by Chairman, PNRA, Mr. Mohammad Anwar Habib. Discussions were held on areas of mutual cooperation, including exchange of personnel, operating experience feedback and joint inspections etc. Agreement on cooperation



Fifth Steering Committee Meeting of PNRA and NNSA at Haikou, China

between the Technical Support Organizations of PNRA and NNSA was finalized.



PNRA Delegation and Chinese Counterparts After 5th Steering Committee Meeting at Haikou, China

A delegation of PNRA visited China Nuclear Power Operation Technology Corporation (CNPO) headquarters in Wuhan, China to discuss areas of



Vice Minister-Ministry of Environmental Protection (MEP), China and Chairman-PNRA

mutual cooperation and the agreement on training of personnel and joint research was renewed. The delegation also visited Xian Jiaotong University, China and an agreement with the Department of Nuclear Science and Technology was finalized for provision of education and training, research and development and information exchange in areas of nuclear safety.

Cooperation with other Countries

PNRA is also interacting with the United States Nuclear Regulatory Commission (USNRC), the regulatory body of USA. USNRC has agreed to host two PNRA officials at its headquarters on attachment on yearly basis. In 2010, one officer from PNRA proceeded to USNRC Headquarters in Washington DC to work in areas of reactor safety and probabilistic safety assessment. PNRA also has agreement with VUJE, which is an engineering, design and research organization of Slovak Republic, specializing in nuclear power technology. One officer from PNRA departed to VUJE on IAEA fellowship to work in area of Pressurized Thermal Shock analysis in nuclear power plants.

PNRA is also a member of Network of Regulators of Countries with Small Nuclear Programmes (NERS) and maintains its web site (www.ners.info). The annual meeting of NERS scheduled in September 2010 in South Africa was postponed and is now expected to be held in February 2011.

On the invitation of Jordanian Nuclear Regulatory



PNRA Expert with Participants of a Training Course at University Sains, Malaysia



PNRA Expert in University Sains, Malaysia

Commission (JNRC), Chairman PNRA, Mr. Mohammad Anwar Habib, participated in the Third International Symposium on Nuclear Energy ISNE-10 held in Amman, Jordan and delivered a keynote address. Assistance to JNRC in developing regulatory framework was the focus area of the symposium.

Chairman, PNRA also visited South Korea and delivered a keynote address at the International Forum on Nuclear Safety Challenges in the Flat, Mixed and Open World in Seoul, Korea. Discussion on signing an agreement of cooperation between Korean Institute of Nuclear Safety (KINS) and PNRA was also held with the President of KINS. PNRA also sends its officers for higher studies at International Nuclear Safety School at KINS for Masters in the fields related to nuclear safety.



Chairman PNRA During a Visit to JNRC

Technical Cooperation with IAEA

Technical Cooperation Projects

PNRA works closely with the International Atomic Energy Agency for the capacity building of its young scientists and engineers in nuclear safety and security and to provide technical support to other Member States in these areas. PNRA is participating in some of IAEA Technical Cooperation Projects and Regional Asia Projects that are aimed at strengthening the regulatory framework of Member States.

Presently, two Technical Cooperation Projects, "Further Strengthening of Regulatory Performance for the Pakistan Nuclear Regulatory Authority (PAK/9/028)" and "Strengthening Infrastructure for Radiation, Transport and Waste Safety (PAK/9/034)", are in progress. Various activities, such as workshops, training courses, fellowships, scientific visits and procurement of equipment have been carried out under these projects.

During the reported year, IAEA arranged five specialized training courses on PNRA's request in which about 50 officials from various organizations, such as PNRA, PAEC, the Capital Development Authority, Pakistan Institute of Medical Sciences and the National Disaster Management Authority, among others, participated. These training courses were:

- Workshop on safety analysis using advance safety assessment tools, Vienna, Austria
- Workshop on licensing/certification of nuclear-grade equipment manufacturer, Beijing, China
- "Train the Trainers" course for first responders to a radiological emergency, Vienna, Austria
- Training course on "Safety, Compliance, Assurance for the Safe Transport of Radioactive Material", Vienna, Austria
- Training course on "Review and Assessment of Waste Minimization at Design and Operation Stages of NPPs", Vienna, Austria

Equipment procured under the Technical Cooperation Projects included physical models of the Reactor Pressure Vessel (RPV) and other major components of NPP, Whole Body Counter, Radiation Dosimetry System, Personnel Radiation Detectors and Gamma Spectrometry System etc.

PNRA is participating in nine Regional Asia projects, under the auspices of IAEA. These projects are mainly concerned with strengthening the national regulatory infrastructure for control of radiation sources and protection of the public and the environment from harmful effects of radiation in the Asia and Pacific Region. The projects help in supporting education and training activities and developing human resources in the region. PNRA officials participated in various training courses and were also awarded fellowships and scientific visits under these projects.

As a member of various IAEA committees, such as Nuclear Safety Standards Committee (NUSSC), Transport Safety Standards Committee (TRANSSC), Waste Safety Standards Committee (WASSC), Radiation Safety Standards Committee (RASSC) and Committee on Safety Standards (CSS), PNRA made

fruitful contributions towards the development of international safety standards. In addition, PNRA also participated in the activities of the International Nuclear Event Scale (INES) and Incident Reporting System (IRS) forums of IAEA.

In 2010, a number of PNRA officials participated in international events, such as workshops, training courses, meetings and seminars organized by IAEA. Details of these activities are shown in Figure 35. In addition, PNRA participated in the 54th Session of General Conference at IAEA, Vienna, in September 2010.

PNRA also participated, as an observer, in the 57th United Nations Scientific Committee on the Effects of Atomic Radiations (UNSCEAR) meeting, which was held in Vienna on 16–20 August 2010. Efforts are being made by the Government of Pakistan to become a regular member of UNSCEAR. In this regard, a meeting of the 4th Committee of the United Nations on the Special Political and Decolonization on “Effects of Atomic Radiation” was held in New York in October 2010. PNRA was represented in the formal and informal discussions of this committee. Pakistan has been invited to

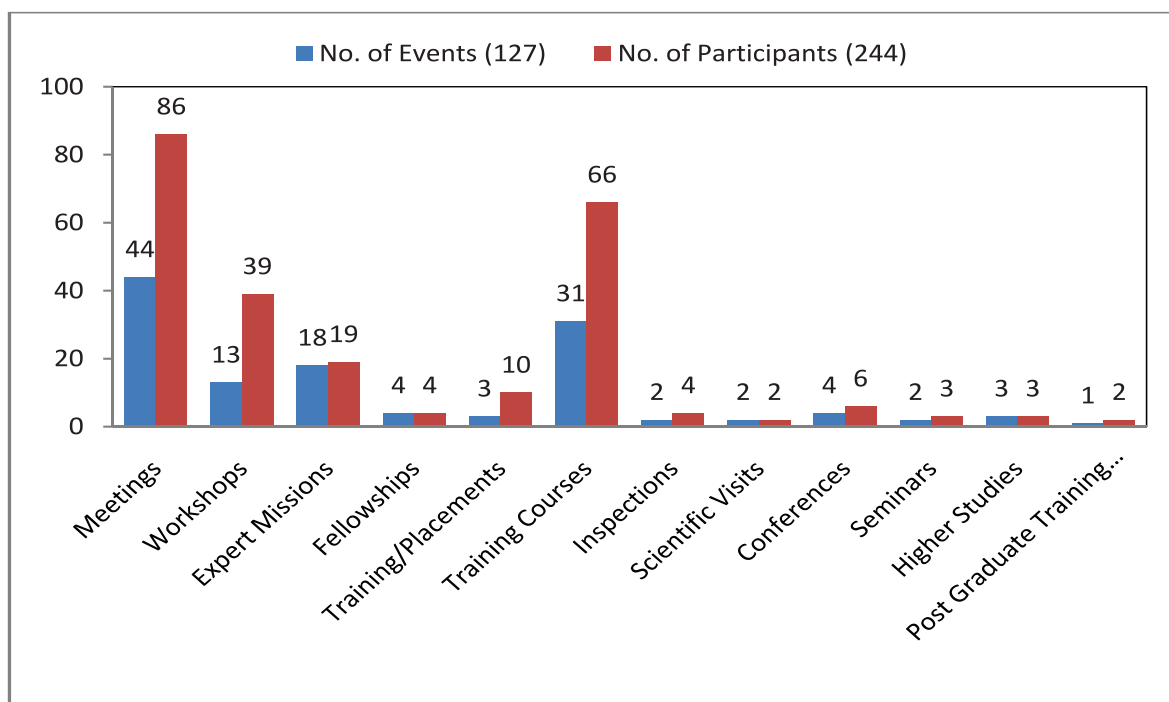


Figure 35: International Trainings/Activities During 2010

NATIONAL AND INTERNATIONAL COOPERATION

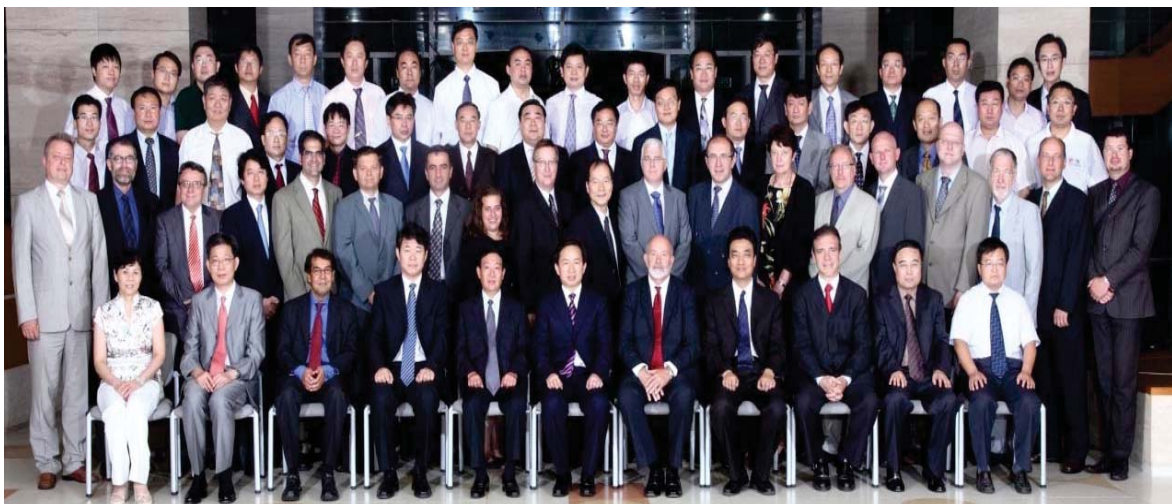
attend the 58th meeting of UNSCEAR in 2011 and the Secretary General of United Nations has been requested to finalize the criteria for UNSCEAR membership.

This year PNRA has been involved in the IAEA initiated Regulatory Cooperation Forum (RCF) as a provider state, which includes China, Finland, France, Japan, Republic of Korea, Russian Federation, United Kingdom and the USA. The objective of the forum is to help develop regulatory infrastructure in new countries embarking on nuclear power programme by sharing nuclear knowledge and training of personnel in core functions of regulatory body. The recipient states of RCF include Chile, Egypt, Jordan, Poland, South Africa, Vietnam and United Arab Emirates.

Expert Missions

PNRA contributed its expertise in various training courses, consultancies and expert missions conducted by IAEA in different Member States. In 2010, two officers from PNRA participated in Integrated Regulatory Review Services (IRRS) mission to China and Ukraine. Representative from PNRA was the deputy team leader for IRRS mission in China. Besides the IRRS mission, a number of PNRA officials, on the request of IAEA, conducted the following expert missions and training courses:

- National regulatory infrastructure for the control of radiation sources, Vientiane, Lao People's Democratic Republic;
- Systematic analysis of regulatory competence, Beijing, China;
- Utilization of IAEA Centre for Advanced Safety Analysis Tools (CASAT), Vienna, Austria;
- Review of current physical protection upgrade projects, Vienna, Austria;
- Preparation of the safety report on a competence management system and systematic assessment of competence, needs planning and training, Vienna, Austria;
- Workshop on governmental and regulatory framework for nuclear safety for Gulf Cooperation Council (GCC) member states, Vienna, Austria;
- National training course on physical protection of nuclear materials and facilities, Beijing, China;
- Regional meeting on systematic training needs assessment for regulatory bodies, Amman, Jordan;
- Training Needs Assessment (TNA) based on IAEA-TECDOC-1254, "Training the staff of the regulatory body for nuclear facilities" for the Romanian regulatory body, CNCAN, Bucharest, Romania;



Participation of Expert from PNRA as part of IAEA Integrated Regulatory Review Services (IRRS) Mission to NNSA, China

NATIONAL AND INTERNATIONAL COOPERATION

- Training course on regulatory skills to implement regulatory function and process at Dacca, Bangladesh;
- Establishment and implementation of management system, Beijing, China;
- Workshop on capacity building and knowledge management for CNCAN in Bucharest, Romania;
- IAEA post-graduate educational course in radiation protection and safety of Radioactive sources in Malaysia;
- National training course on authorization/licensing process for NPPs and safety-related modification, Abuja, Nigeria;
- National training course on review and assessment activities and requirements by the regulatory body Abuja, Nigeria;
- Regional meeting on self assessment against IAEA safety guide DS416 in Damascus, Syrian Arab Republic;
- Draft guidelines and question-sets for advisory missions on national regulatory

infrastructure for the control of radiation sources in Vienna, Austria; and

- International train the trainers course on physical protection in Ljubljana, Slovenia.

Research and Analysis in International Affairs

PNRA has initiated an International Relations Analysis (IRA) Programme to focus on regulatory work having an international dimension. Activities being carried out under this programme include research on the international strategic issues that influence regulatory activities. It includes review and analysis of conventions, treaties and protocols related to nuclear safety, security and physical protection. In this context, PNRA closely interacts with South Asian Strategic Stability Institute (SASSI), a think-tank involved in national nuclear policy discourse.



Chairman PNRA Addressing the Chinese Delegation

9 PERFORMANCE REVIEW

PNRA has been monitoring, evaluating and continuously striving to improve its performance since its inception in 2001.

Soon after it was created, the Authority took the initiative of systematically evaluating its performance and reporting transparently on both its activities and its self assessment to the Government of Pakistan. This practice, among others, reflected PNRA's drive for continuous improvement of its regulatory efficiency and effectiveness. An annual report is submitted regularly to the government at the end of each calendar year and also made available for the public on the Authority's website to enable all stakeholders to keep abreast with developments in the regulation of nuclear and radiation facilities in the country.

As a key element of its efforts to improve its performance, PNRA has developed a Management System to control, monitor and determine the effectiveness of the manner in which it discharges its responsibilities. A comparison of its overall performance since its inception is provided in Figure 36.

Qualitative Assessment of Performance

PNRA evaluates its regulatory performance qualitatively against pre-defined targets and goals. Non-conformances and weak areas are identified and preventive and corrective actions taken for improvement. PNRA has set 12 strategic performance indicators covering all areas of its jurisdiction to monitor its performance. A rating scale of five levels – Not Acceptable, Unsatisfactory, Needs Improvement, Minimally Acceptable and Satisfactory – is used to assess performance against each indicator. Monitoring and Evaluation (M&E) remained an ongoing activity during the reporting period. The result of the assessment for January–December 2010 is summarized in Figure 37 and discussed below.

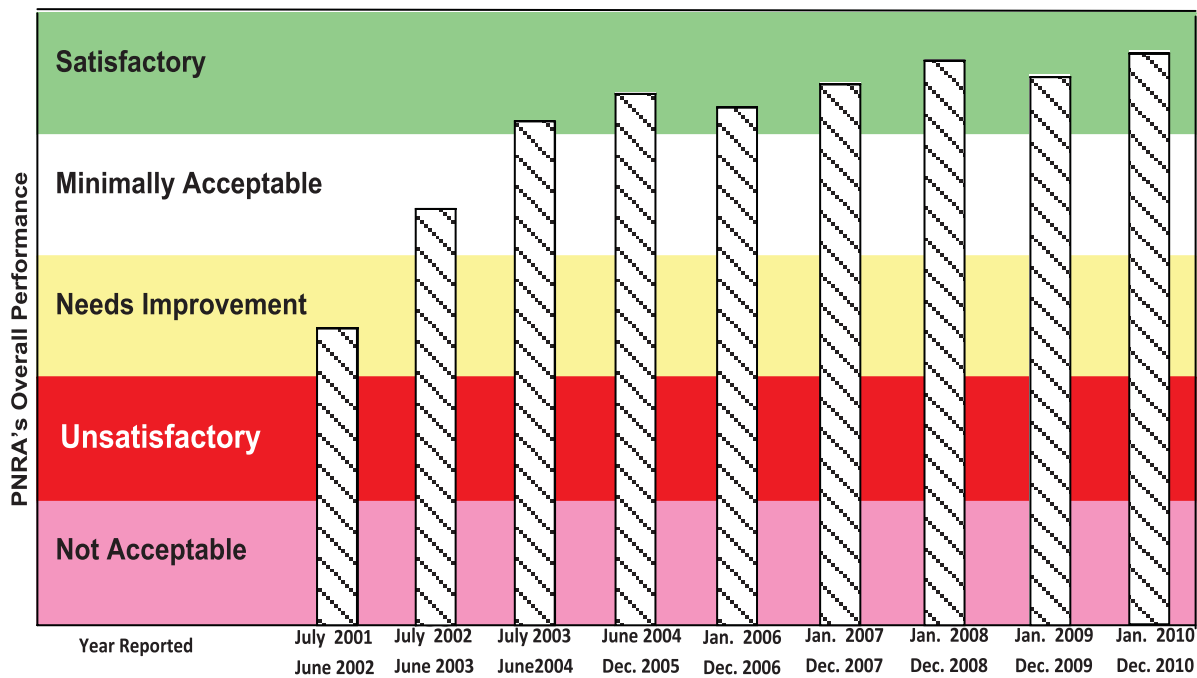


Figure 36: Assessment of Overall Performance of PNRA since 2001

In addition, PNRA has recently initiated an integrated regulatory review of its performance using the IAEA Self Assessment Tool (SAT). Response and analysis teams have been formed to carry out this activity and results will be included in PNRA's next report.

Needs Improvement, Minimally Acceptable and Satisfactory – is used to assess performance against each indicator. Monitoring and Evaluation (M&E) remained an ongoing activity during the reporting period. The result of the assessment for January–December 2010 is summarized in Figure 37 and discussed below.

Figure-37: Assessment of PNRA's Performance in 2010

<p align="center">(Indicator 1)</p> <p align="center">Ensures that acceptable level of safety is being maintained by licensees</p>	<p align="center">(Indicator 2)</p> <p align="center">Ensures that regulations and procedures are in position and understood by licensees</p>	<p align="center">(Indicator 3)</p> <p align="center">Strives for continuous improvement of its performance</p>
<p align="center">(Indicator 4)</p> <p align="center">Takes appropriate actions to prevent degradation of safety and to promote safety improvements</p>	<p align="center">(Indicator 5)</p> <p align="center">Takes appropriate steps for human resource development and has competent and certified regulatory staff</p>	<p align="center">(Indicator 6)</p> <p align="center">Ensures that adequate legal provisions exist for enforcement, e.g., dealing with non-compliance or licence violations</p>
<p align="center">(Indicator 7)</p> <p align="center">Performs its functions in a timely and cost-effective manner</p>	<p align="center">(Indicator 8)</p> <p align="center">Ensures that a well established quality management system exists</p>	<p align="center">(Indicator 9)</p> <p align="center">Ensures that adequate resources are available for performing its functions and Technical Support Centre is available for specialist assistance when required</p>
<p align="center">(Indicator 10)</p> <p align="center">Performs its functions in a manner that ensures confidence of the operating organizations</p>	<p align="center">(Indicator 11)</p> <p align="center">Performs its functions in a manner that ensures confidence of the general public</p>	<p align="center">(Indicator 12)</p> <p align="center">Performs its functions in a manner that ensures confidence of the Government</p>

Rating Scale

Green	Satisfactory
White	Minimally acceptable
Yellow	Needs improvement
Red	Unsatisfactory
Pink	Not acceptable

PERFORMANCE REVIEW

On **Indicator 1** (*Ensures that acceptable level of safety is being maintained by licensees*), PNRA rates its performance as "Needs Improvement" because, although an acceptable level of safety is maintained by licensees at all nuclear installations, many radiation facilities, especially X-rays facilities, remain outside PNRA's licensing net and their safety levels cannot be said to be satisfactory.

Throughout the reporting period, the nuclear power plants and reactors remained under PNRA's regulatory supervision; their releases to the environment and radiation doses to the workers remained well within regulatory limits.

K-1 was granted Licence to operate beyond its design life along with certain licensing conditions till December 2009. In October 2009, K-1 applied to PNRA to extend the Operating Licence for the next 10 years, i.e., up to 2019. Based on review and assessment made by PNRA, the Operating Licence was extended till 31 December 2010 and any further extension in the licence required completion of assessments of main equipment (such as steam generators and fuel channels) to determine their remaining useful life. K-1 is now undergoing a long outage to conduct necessary evaluations, maintenance, surveillance and modifications so that an assessment for further operation of the plant can be made. The activities will be under PNRA regulatory oversight of review & assessment and inspection to facilitate its regulatory decision making process to allow any further operation. Accordingly, PNRA has amended the operating licence of K-1, requiring K-1 to start operation only after completing the necessary actions and approval from PNRA.

C-1 was granted an Operating Licence for ten years ending on 31 December 2010. As per national regulations, revalidation of the operating licence requires submission of latest Periodic Safety Review (PSR) reports to PNRA. C-1 submitted the reports with the application to extend its Operating Licence for another 10 years. Based on the review of PSR reports, the operating licence of C-1 was revalidated up to 2020.

On November 26, 2009, PAEC submitted Final Safety Analysis Report (FSAR) of C-2, along with an application for Fuel Load Permit (FLP). After completion of review and assessment of the documents required under the national regulations, successful completion of commissioning tests, demonstration of implementation of emergency preparedness plan and completion of physical protection measures, fuel load permit was issued to C-2 on 21 December, 2010 and first fuel assembly was loaded on 22 December, 2010.

The Operating Licence of PARR-I was valid until 31 December 2010. PARR-I submitted Periodic Safety Review reports along with an application for renewal of its Operating Licence for the next ten years, as per licensing requirements. The PSR reports are currently under review at PNRA, along with the other safety related documents.

A radiation exposure record of occupational workers at nuclear installations and radiation facilities is maintained at PNRA to evaluate the safety of workers and the effectiveness of licensees' radiation protection programs. Currently, the record available with PNRA includes about 6,000 occupational workers. This year, there was no case of overexposure of any occupational worker where PNRA intervention was required.

The total number of licensed X-ray facilities increased by about 4 percent since December 2009. However, more than 500 of radiation facilities defaulted till 2010. This is why PNRA's performance rating on this indicator remained "Needs improvement" this year as well.

On **Indicator 2** (*Ensures that regulations and procedures are in position and understood by licensees*), PNRA's performance rating remained "Satisfactory" during the reporting year. During 2010, the following regulations were approved and Gazette-notified:

- Pakistan Nuclear Regulatory Authority Enforcement Regulations (PAK/950); and

- Amendment in Regulations on Radioactive Waste Management (PAK/915).

Work remained in progress on revision of the following notified regulations as a result of periodic review:

- Regulations for Licensing of Nuclear Installation(s) in Pakistan (PAK/909); and
- Regulations on the Safety of Nuclear Power Plant Design (PAK/911).

In addition, development of the following new regulations remained in progress during 2010:

- Regulations on Transaction of Business of the Authority (PAK/901);
- Regulations on Safety of Nuclear Research Reactor(s) Operation (PAK/923);
- Regulations on Physical Protection of Nuclear Material and Facilities (PAK/925); and
- Regulations on Decommissioning of Facilities using Radioactive Material (PAK/930).

During 2010, the following regulatory guides were issued:

- Quality Assurance in Nuclear Medicine;
- Probabilistic Safety Assessment (Level-1) for Nuclear Power Plants; and
- Dosage and Distribution of Potassium Iodide Tablets in Radiation Emergencies.

Work remained in progress on the development of the five new regulatory guides.

PNRA conducted several courses for licensed radiation facilities in Lahore, Peshawar, Karachi and Islamabad to develop licensees' understanding regarding implementation of regulatory requirements.

PNRA maintained a "Satisfactory" rating on its performance under **Indicator 3** (*Strives for*

continuous improvement of its performance). PNRA is committed to enhancing its regulatory effectiveness and efficiency, in pursuit of its vision of becoming a world class nuclear regulatory body.

During the reporting period, PNRA initiated self assessment using the IAEA Self Assessment Tool (SAT). For this purpose, a team has been constituted to work on the tool. The SAT team provided training in SAT software to other PNRA officials before initiating the full-scope self assessment. PNRA will assess its performance in the following eight core areas:

1. Legislative and governmental responsibilities;
2. Responsibilities and function of Regulatory Body (RB);
3. Organization of RB;
4. Activities of RB – Authorization process;
5. Activities of RB – Review and assessment;
6. Activities of RB – Inspection and enforcement;
7. Activities of RB – Development and implementation of regulations and guides; and
8. Management system of RB.

PNRA has also conducted an internal technical audit of all PNRA directorates located at its headquarters in Islamabad, which are taking corrective actions recommended by the audit teams. A comprehensive audit report will be issued after similar audits of the regional directorates in Chashma and Karachi are completed.

The effort and commitment demonstrated by PNRA in initiating a self assessment process aimed at continuous improvement of regulatory performance have been appreciated.

Against **Indicator 4** (*Takes appropriate actions to prevent degradation of safety and to promote safety improvements*), PNRA's rating has been upgraded by one level from "Needs improvement" to "Minimally Acceptable." The Authority reviewed various safety related modifications in plant systems; technical specification and operating

PERFORMANCE REVIEW

policies & procedures; routine and non-routine reports; technical and safety analysis reports; and other related documents of NPPs i.e. K-1, C-1 and C-2. Various upgrades in safety at C-1 and C-2 have been implemented while for K-1, the plant has been shut down to implement safety related upgradation. This reflects the significant improvements that PNRA facilitated at nuclear power plants during 2010.

PNRA conducted more than five hundred inspections of nuclear power plants and issued reports requiring various actions from the licensee and its contractor and sub-contractors. PNRA issued 07 directives to K-1, 21 to C-1 and 14 to C-2, requiring various actions to be taken to improve safety at the plants. Such activities were also carried out at the research reactors.

In addition, PNRA conducted about 1,785 inspections of radiation facilities throughout the country. Quite a large number of X-ray facilities are reluctant to register itself with PNRA. As a first step, PNRA hired individuals for three months from all 27 divisions of the four provinces of Pakistan to identify X-ray facilities in their localities. Further, PNRA has gazette notified the PNRA Enforcement Regulations (PAK/950), which will enable PNRA to prosecute the offenders and defaulters.

PNRA's performance against **Indicator 5** (*Takes appropriate steps for human resource development and has competent and certified regulatory staff*), remained "Satisfactory" this year as well. PNRA intends to double its technical officers' strength by 2015. Ten (10) fellows joined PNRA during 2010 after completion of their MS studies at Pakistan Institute of Engineering and Applied Sciences (PIEAS) and KANUPP Institute of Nuclear Power Engineering (KINPOE). Three officers were sent abroad for MS and Ph. D studies in 2010. Fourteen (14) officers were awarded new fellowships for MS degrees in nuclear engineering at the PIEAS and KINPOE.

SNRS conducted 25 professional and short training

courses, in which 399 officers from PNRA and PAEC participated. In addition, 135 PNRA officials attended 43 courses at external organizations to receive training in various disciplines.

On **Indicator 6** (*Ensures that adequate legal provisions exist for enforcement, i.e., dealing with non-compliance or licence violations*), PNRA judges its performance to have improved from "Unsatisfactory" to "Needs improvement" this year because the Pakistan Nuclear Regulatory Authority Enforcement Regulations (PAK/950) have been Gazette-notified. With the issuance of these regulations, it is considered that legal provisions for taking enforcement actions against offenders or defaulters are now available to PNRA.

PNRA maintained its "Satisfactory" rating on **Indicator 7** (*Performs its functions in a timely and cost-effective manner*), achieving all of its regulatory activities and targets set for the year 2010 within the allocated budgets and schedules. PNRA has carried out the review of PSR reports of C-1, FSAR of C-2 and SER of C-3 indigenously according to the agreed schedule meeting all the deadlines.

On **Indicator 8** (*Ensures that a well established quality management system exists*), PNRA's rating has improved by one level from "Needs improvement" in 2009 to "Minimally Acceptable" with finalization of the Management System Manual (MSM). The MSM has been prepared in accordance with international practices and applicable IAEA safety standards. It was extensively reviewed internally as well as by IAEA experts. The plan for its full implementation is being prepared. It is envisaged that implementation will commence in 2011.

Indicator 9 (*Ensures that adequate resources are available for performing its functions and technical support centre is available for specialist assistance when required*). The main purpose of PNRA's technical support organization, the Centre for Nuclear Safety, is to strengthen and enhance PNRA's

existing regulatory capabilities for the licensing of Chashma Nuclear Power Plant, Unit 2 and future NPPs in the country. CNS remained available for specialist assistance to PNRA's technical directorates regarding safety aspects of C-2 in spite of the limited budget releases. For the first time in Pakistan, the review of the Final Safety Analysis Report of C-2 and relevant audit calculations were undertaken solely by technical experts at CNS, without any assistance from foreign consultants as had been the previous practice. PNRA had established another technical support organization in the name of SAC for the southern region of the country in 2009, which will be performing safety related analysis both for regulatory body as well as for the operating organization. In 2010, the centre continued to develop expertise in deterministic and probabilistic safety analyses.

Although both the technical support organizations have started contributing in the safety review and assessment, however funds for SAC have not been released and there has been a significant cut on the releases for CNS. Therefore, the pace of development of the original plan has been affected. Consequently this indicator has been lowered by one level and is rated as "Needs Improvement".

PNRA's performance rating remained "Satisfactory" during this year on **Indicator 10** (*Performs its functions in a manner that ensures confidence of the operating organization*). The Advisory Committee for Improving Utility-Regulatory Interface (ACIURI) continued to ensure that operating organizations remain satisfied. ACIURI met twice in 2010 and ensured that an atmosphere of understanding, harmonization and consensus is maintained between the regulatory body and its licensees.

In 2010, PNRA held a special meeting with C-1 management to assess their views on PNRA performance. All the management of C-1 including operators participated and showed confidence on the competency of PNRA's inspectors and their

work. Similar meetings are planned to be held with C-2 and K-1 in 2011.


Prior to finalization of the national regulations, PNRA routinely shares their drafts with the licensees concerned for their feedback. Such drafts are also placed on the PNRA website for the information of and feedback from the general public.

Performance against **Indicator 11** (*Performs its functions in a manner that ensures confidence of the general public*), has remained "Minimally Acceptable" this year. PNRA keeps the general public informed about its activities through its annual report. Special activities and any significant event at radiation facilities are also reported through timely press releases. Information materials are prepared and published for the general public.

During 2010, a brochure about PNRA's activities for the general public has been prepared and is expected to be published in January 2011.

Against **Indicator 12** (*Performs its functions in a manner that ensures confidence of the Government*), PNRA judges its performance as "Satisfactory" for the reported period. PNRA continued to fulfil Pakistan's international obligations under the four conventions related to nuclear and radiation safety. PNRA, in collaboration with other relevant organizations prepared Pakistan's Fifth National Report under the Convention on Nuclear Safety and submitted it to the IAEA in September 2010. In addition, PNRA participated in the 54th Session of General Conference at IAEA, Vienna, in September 2010.

PNRA continued to maintain linkages with the Planning Commission, Ministry of Foreign Affairs, Strategic Plans Division and other government authorities in 2010.



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