

**R E P O R T
2 0 1 2**



PAKISTAN NUCLEAR REGULATORY AUTHORITY

MEMBERS OF PNRA

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MESSAGE FROM THE CHAIRMAN



With the blessings of Almighty Allah, I feel privileged to present this annual report at this important juncture when PNRA is in the thirteenth year of its inception as an independent regulatory body. Although this period is considered as a short time from the perspective of development of an organization, however, PNRA has made a history in development of its human capital, regulatory infrastructure and fulfilling national and international obligations. It is time to take a pause and look back over the past years to see what we have achieved with reference to our vision and mission. Despite the challenges of resources and infrastructure, PNRA has remained successful in pursuit of mission to protect the personnel and environment from the harmful effects of radiation and now we are considered among credible regulators of the world. In spite of financial constraints, we continued to meet the targets of enhancing the organizational strength, regulatory framework and regulatory oversight. While assuring regulatory oversight, an extensive plan of inspections of all radiation facilities, nuclear power plants, research reactors and nuclear grade equipment manufacturers was implemented. Efforts for expansion of PNRA licensing net as well as safety improvements in the radiation facilities progressed well during the recent years. The regulated net now includes eight nuclear installations (NPPs, Research Reactors, and Nuclear Grade Equipment Manufacturing unit) and more than 2500 radiation facilities. The implementation of Enforcement Regulations has been the major impetus in increasing the regulatory net.

Capacity building was an essential element in the expansion of PNRA expertise development, which was done through Public Sector Development Programmes (PSDP). The PSDP projects, Centre for Nuclear Safety (CNS) and School for Nuclear and Radiation Safety (SNRS), were completed in the years 2011 and 2012 respectively. Both the project are important corporate support for PNRA as the CNS is providing technical support in the areas of review and assessments and SNRS is nurturing the indigenous work force required for regulatory activities by maintaining a sufficient number of highly skilled professionals, with appropriate academic qualifications and adequate skills. In addition, four on-going projects are also realizing the targets with one of these progressing for completion in 2013. PNRA is also planning to have few more PSDP projects and for this purpose preparation of two more new PC-1s are under way for submission to the Government.

Fukushima Accident, caused by the great earthquake & tsunami in Japan in 2011 posed new challenges which are well taken by PNRA, and Fukushima Response Action Plans (FRAPs) prepared by PAEC are being implemented under the regulatory oversight of PNRA. Participation in two IAEA Ministerial Conferences on Nuclear Safety viz; Fukushima, in June 2011 in Austria and in December 2012 in Japan provided a greater insight and the international approach for safety after this accident. Pakistan also provided recommendations in these conferences in consultation with other related organizations, for the formulation of IAEA Action Plan.

At the international front, we believe on sharing of knowledge and expertise to enhance safety. In this regard, PNRA not only benefitted from the international community through participation of regulatory staff in international events such as workshops, seminars, technical meetings, etc. but also contributed in imparting knowledge through such activities as experts.

Short term strategic plan developed for two year is on track and PNRA intended to develop long term strategic plan for five year. All the achievements are attributed to the culture of team work in PNRA which is strengthening with the passage of time. This has created dedication and motivation among the regulatory staff. I am encouraged to have such a dedicated team having commitment and motivation to meet future challenges. While moving forward in accomplishment of PNRA's mission through prudent planning, zeal and efficient working, we would soon be ranked amongst the best organizations nationally and internationally having credible, caring and compassionate attitude towards ensuring safety of public, workers and environment from the harmful effects of radiation.

A handwritten signature in black ink, appearing to read 'Mohammad Anwar Habib', written over a light blue horizontal line.

Mohammad Anwar Habib

ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
Bq/m ³	Becquerel /cubic meter
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
CDA	Capital Development Authority
CHASCENT	CHASNUPP Centre for Nuclear Training
CNS	Centre for Nuclear Safety
DRLs	Derived Release Limits
DSRS	Disused Sealed Radioactive Sources
FSAR	Final Safety Analysis Report
GBq	Giga Becquerel (10 ⁹ Becquerel)
IAEA	International Atomic Energy Agency
K-1	Karachi Nuclear Power Plant Unit 1
KINPOE	KANUPP Institute of Nuclear Power Engineering
KWt	Kilowatt Thermal
MRML	Mobile Radiological Monitoring Laboratory
mSv	mili Sievert (unit of dose)
MWe	Megawatt Electrical
MWt	Megawatt Thermal
NDCL	National Dosimetry and Protection Level Calibration Laboratory
NERSP	National Environmental Radioactivity Surveillance Program
NPP	Nuclear Power Plant
NRECC	National Radiation Emergency Coordination Centre
NSAP	National Nuclear Security Action Plan
NSTC	Nuclear Security Training Centre
NUML	National University of Modern Languages
NuSECC	Nuclear Security Emergency Coordination Centre
PAEC	Pakistan Atomic Energy Commission
PARR-I	Pakistan Research Reactor-I
PARR-II	Pakistan Research Reactor-II
PIEAS	Pakistan Institute of Engineering and Applied Sciences
PINSTECH	Pakistan Institute of Nuclear Science and Technology
PNRA	Pakistan Nuclear Regulatory Authority
PSAR	Preliminary Safety Analysis Report
PSDP	Public Sector Development Program
RDE	Radiation Detection Equipment
R&M	Repair & Maintenance
SAC	Safety Analysis Centre
SAR	Safety Analysis Report
SARIS	Self Assessment of Regulatory Infrastructure for Safety
SAT	Self Assessment Tool
SNRS	School for Nuclear and Radiation Safety
SPD	Strategic Plans Division

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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 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

Since its inception in 2001, Pakistan Nuclear Regulatory Authority (PNRA) has been striving to fulfill its obligation for ensuring safe use of nuclear energy and radiation facilities within the country. Within the decade of its evolution, PNRA has made appreciable progress in the development of infrastructure necessary for a nuclear regulatory body. For this purpose, PNRA adopted multipronged strategy for the development of essential elements of a regulatory body. The first is the availability of legal basis for the decision making, followed by development of competencies and necessary infrastructure for discharging the responsibilities. Although, PNRA ordinance empowers PNRA to devise adopt and make regulations to protect workers, public and the environment from harmful effects of ionizing radiations, however, availability of effective regulations for the whole domain of its responsibility i.e. siting, design, construction, commissioning, operation and decommissioning of nuclear and radiation facilities was a challenge. Up till now, sixteen regulations related to different areas of nuclear safety and radiation protection have been developed and promulgated. Development and promulgation of regulations was kept vibrant by seeking comments from the stakeholders and many regulations were revised on the basis of implementing experience feedback and considering technological advancement worldwide. Availability of legal basis for regulating nuclear and radiation facilities from cradle to grave has contributed to effectiveness in discharging PNRA's responsibilities and implementing effective regulatory oversight process through competent staff. Now PNRA has legal basis for nuclear safety, radiation protection, emergency planning and preparedness, radioactive waste management, physical protection and enforcement. Availability of competent staff is ensured through qualification, training and retraining. Necessary infrastructure for carrying out regulatory functions is also available.

As part of its obligations, PNRA remained at the forefront for ensuring safety at our nuclear

installations in the aftermath of Fukushima accident and apprising international community at the forum of Nuclear Safety Convention. PNRA prepared national report in consultation with other national stakeholders and presented this report in the IAEA Extra-Ordinary Meeting and ministerial conferences. PNRA also implemented necessary regulatory vigilance program focusing safety related areas which were identified and being confronted by the PAEC.

The organization of PNRA comprises of a Chairman, two full-time Members and seven part-time Members, including eminent professionals from the science, engineering and medical sectors; and representatives of the Ministry of Health, Pakistan Environmental Protection Agency, Pakistan Atomic Energy Commission, Strategic Plans Division of the Joint Staff Headquarters. The organizational structure is presented in Figure 1.

Major Activities in 2012

Major activities of PNRA during 2012 are summarized as follows:

1. Monitoring of activities at three operational nuclear power plants (Karachi Nuclear Power Plant Unit-1, Chashma Nuclear Power Plants Units-1&2) and two under construction nuclear power plants (Chashma Nuclear Power Plant Units 3 & 4) continued. Releases to the environment from operating NPPs and radiation doses to workers remained well below the regulatory limits;
2. Monitoring of the eighth refueling outage of Chashma Nuclear Power Plant Unit-1 (C-1) being continued;
3. Issued Operating Licence to Chashma Nuclear Power Plant Unit-2 (C-2) till 2021 after review and acceptance of revised Final Safety Analysis Report (FSAR);
4. Extended Operating Licence of Karachi Nuclear Power Plant Unit-1 (K-1) up to 2016 based on acceptance of Periodic Safety Review (PSR) and implementation of design

INTRODUCTION AND BACKGROUND

- modifications;
5. Issued Licence to HMC-3 to manufacture nuclear safety class 1 equipment for five years based on review of regulatory submissions and regulatory inspections;
 6. Issued Operating Licence to PARR-I till December 2013 based on review of revised FSAR and other regulatory documents;
 7. Granted permission to C-1 to start construction of Surveillance Capsule Assembly Testing Facility (SCATF) and extended storage facility for low level radioactive waste;
 8. Issued "Regulations on Transaction of Business of Pakistan Nuclear Regulatory Authority" - (PAK/901);
 9. Issued Revision 1 of "Regulations on Licensing of Nuclear Installations in Pakistan" - (PAK/909);
 10. Issued "Regulations on the Safety of Nuclear Research Reactor(s) Operation" – (PAK/923);
 11. Enhanced the licensing net for diagnostic radiation facilities by more than 30 percent;
 12. Developed PNRA Short Term Strategic Plan 2012-2013;
 13. Closed PSDP Project "Centre for Nuclear Safety" after formal approval of the government. As a result, seventy-five personnel of the project were included as part of permanent employees of PNRA.
 14. Prepared Pakistan's National Report for the Extra-Ordinary Meeting of the Contracting Parties to the Convention on Nuclear Safety in response to accident at Fukushima Nuclear Power Plants in Japan;
 15. Established interior physical protection laboratories at PNRA which include an Interior intrusion detection system lab, access control system lab and CCTV display centre;
 16. Established External Dosimetry TLD Laboratory at Islamabad;
 17. Installed Whole Body Counter (WBC) for quick assessment of internal contamination at NDCL Laboratories at Karachi and Chashma;
 18. Conducted twenty five (25) professional training courses in the areas of nuclear safety and radiation protection. About five hundred and sixty two (562) officials from PNRA, PAEC and other stakeholder organizations were trained;
 19. Conducted twenty (20) training courses in the areas of nuclear security for the capacity building of first responders, emergency response personnel, front line officers, etc. About three hundred & ninety five (395) personnel from PNRA, PAEC, law enforcement agencies and other related organizations participated;
 20. Two hundred & thirty four (234) PNRA officials participated in one hundred & sixty one (161) international events such as workshops, training courses, meetings and seminars organized by IAEA under the Agencies' technical assistance program; and
 21. PNRA officials assisted IAEA in thirty (30) expert missions to other countries.

Targets for 2013

The targets set for 2013 are summed up as follows:

1. Continuous monitoring of licensees' activities to avoid major incidents, overexposure to workers, and releases to the environment;
2. Enhancing the licensing net for diagnostic radiation facilities by another 15 percent;
3. Issuance of "Regulations on Decommissioning of Facilities using Radioactive Material" (PAK/930) and revision of "Regulations for Licensing of Nuclear Safety Class Equipment and Component Manufacturers" (PAK/907);
4. Issuance of the following regulatory guides:
 - a. Protection of Patients in Diagnostic Radiology (RG-904.01);
 - b. Issued Regulatory guide on "Guidance for use of I-131" (RG 904.02);



Members of PNRA in Authority Meeting

- c. Radiation Safety in Industrial Radiography (RG 904.03); and
- d. Format and Contents of Application for Design Modification/Change Approvals for Nuclear Power Plants (RG-913.02).
5. Conducting Self assessment of regulatory activities using IAEA SARIS – Self-Assessment of Regulatory Infrastructure for Safety;
6. Preparation of IAEA Integrated Regulatory Review mission (IRRS) to Pakistan;
7. Conducting about 40 training courses on nuclear safety, security and radiation protection; providing training to about 700 officials from PNRA and other stakeholders;
8. Establishing environmental monitoring laboratory at Kundian;
9. Setting-up of Whole Body Counting (WBC) Laboratory at Islamabad;
10. Formal Closure of PSDP project “School for Nuclear and Radiation Safety (SNRS)”;
11. Formal Closure of PSDP project “Nuclear Security Action Plan (NSAP)”;
12. Revision of the scope of exiting PSDP projects NDCL and NERSP;
13. Preparation of Sixth National Report (6thNR) on Convention on Nuclear Safety; and
14. Completion of PSA Level-1 Regulatory Model Development Project for Chashma Nuclear Power Plant Unit-1(C-1).
15. Preparing and submitting new PSDP Projects for approval by GoP.



Chairman Addressing to PNRA Staff on Annual Day

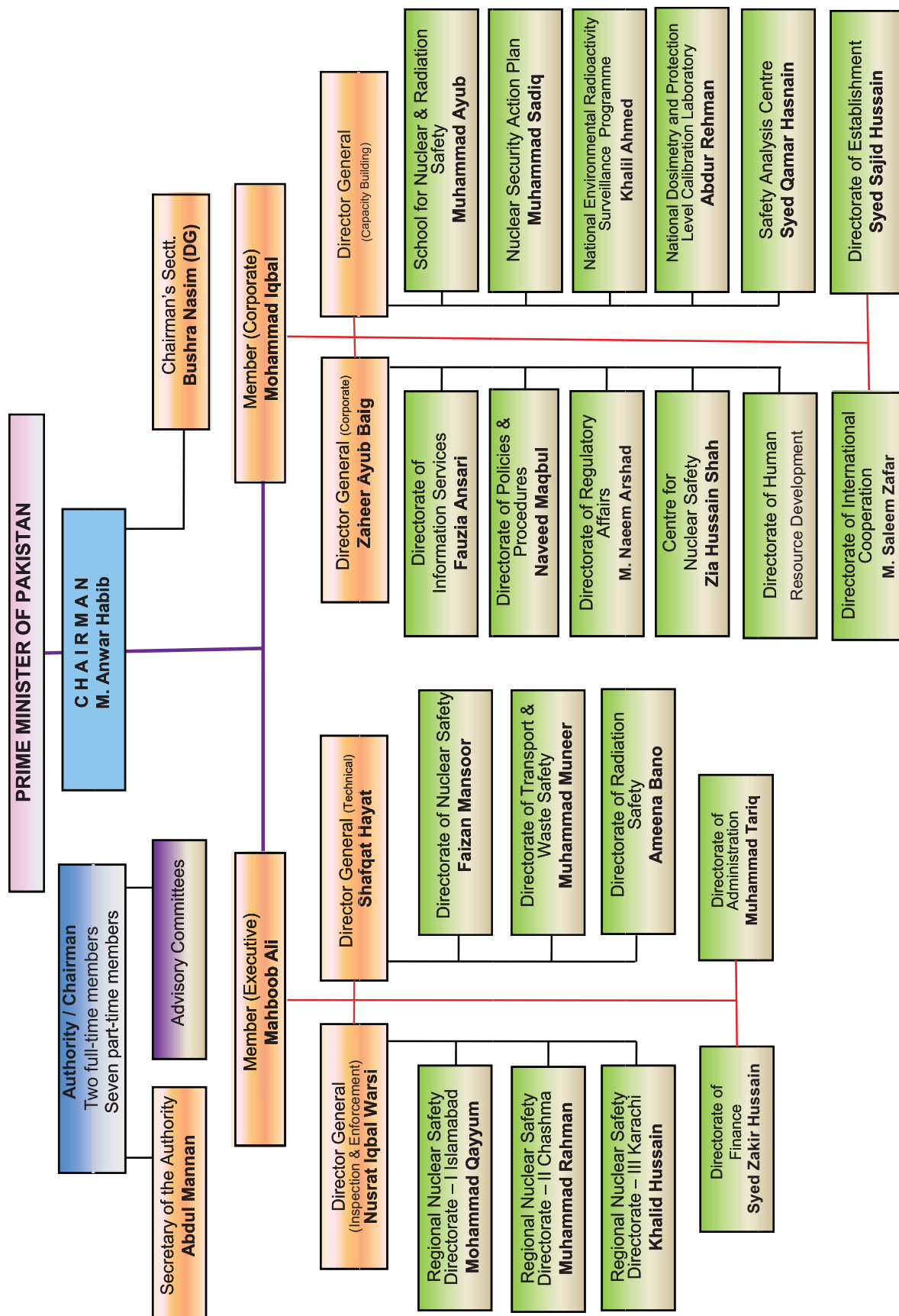


Figure 1: Organizational Structure of PNRA

2 REGULATORY FRAMEWORK

The regulatory framework of PNRA comprises of three tiers as shown in the Figure 2. The first tier is the PNRA Ordinance, followed by PNRA regulations and regulatory guides in the subsequent tiers. The highest level document i.e. PNRA Ordinance, describes the mandate, powers and functions and responsibilities of PNRA. Under the Ordinance, PNRA is empowered to issue regulations in order to regulate various areas of nuclear safety and radiation protection. These regulations form the second tier of the regulatory pyramid. Compliance with the PNRA regulations is mandatory for the licensees and is verified through conducting regulatory inspections and performing review and assessment of the licensee's documents required by the regulations. Non-compliance with the regulatory requirements is controlled through an enforcement process which is based on PNRA regulations PAK/950. However, prosecution is used as a last resort when all the other mechanisms such as persuasion and serving of notices do not result in a positive outcome.

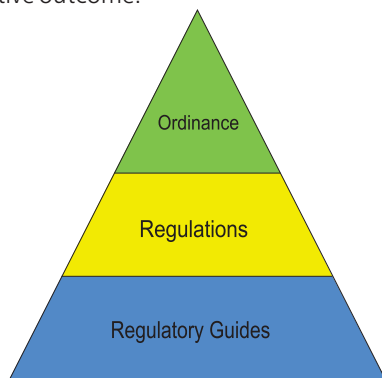


Figure 2: Regulatory Framework

The third level of the regulatory framework consists of regulatory guides which describe acceptable methods for implementing the requirements of PNRA regulations. These guides are non mandatory in nature and the licensee may choose other methods to meet the regulatory requirements. In such a case, the applicant/licensee is required to demonstrate that the proposed methods provide at least the same level of safety as would have been achieved if the methods describe in the guides have been applied.

Regulations

The regulations provide the bases to PNRA for realization of its mission of protecting the people and the environment from harmful effects of radiation. PNRA follows a very comprehensive process for the development of its regulations including rigorous internal reviews at different levels within PNRA which is followed by inviting comments from all the stakeholders such as the licensees, the government, and the general public. The entire process of developing a new set of regulations or revising existing regulations takes approximately three years. Figure 3 shows different stages of the regulations development process.

The procedure for preparation, revision and adoption of regulations requires review of regulations after every five years taking into account obligations of international conventions, feedback from licensing experience, feedback from stakeholders, and current international practices.

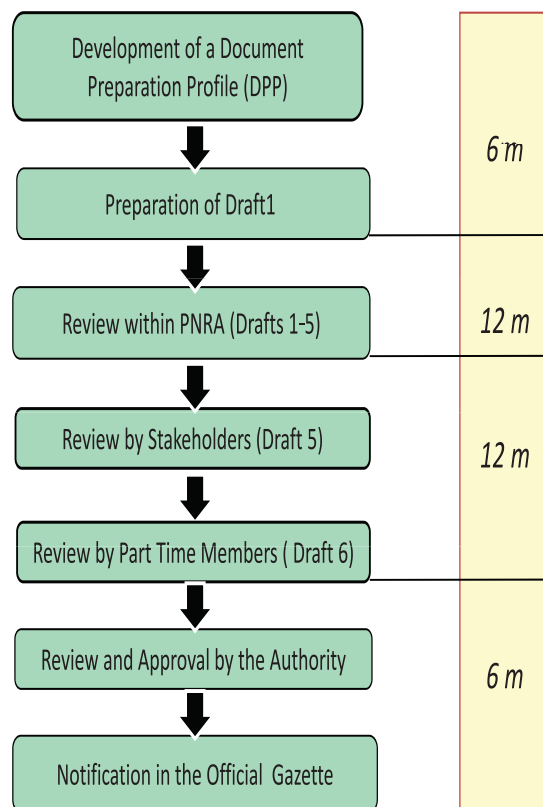


Figure 3: Regulations Development Process

REGULATORY FRAMEWORK

The regulations that have so far been published by PNRA are available at PNRA website (www.pnra.org).

During 2012, following regulations were approved for notification in official gazette of Pakistan:

1. Regulations on Transaction of Business of Pakistan Nuclear Regulatory Authority (PAK/901);
2. Amendment in Regulations on Radiation Protection (PAK/904) to include RPO Qualification criteria;
3. Regulations for Licensing of Nuclear Installations in Pakistan (PAK/909, Rev.1); and
4. Regulations on the Safety of Nuclear Research Reactor Operation (PAK/923);.

Development of new and revision of the following existing regulations remained in progress during the year as a result of their periodic review:

1. Revision of Regulations for Licensing of Nuclear Safety Class Equipment and Component Manufacturers (PAK/907);
2. Revision of Regulations for the Licensing of Radiation Facilities other than Nuclear Installations (PAK/908);
3. Revision of Regulations on Radioactive Waste Management (PAK/915);
4. Regulations on Physical Protection of Nuclear Installations and Nuclear Material (PAK/925); and
5. Regulations on Decommissioning of Facilities using Radioactive Material (PAK/930).

Regulatory Guides

Regulatory guides are non mandatory documents developed under the PNRA regulations to facilitate the licensees in the implementation of the requirements of national regulations.

In the areas where PNRA regulations and regulatory guides are not available, the licensees may choose to follow the latest revisions of the applicable IAEA Safety and Security Standards or the USNRC

regulations and regulatory guides.

During 2012, development of the following regulatory guides remained in progress:

1. Protection of patient in diagnostic radiology (RG 904.01);
2. Guidance for the Users of I- 131 in Nuclear Medicine Centres (RG 904.02);
3. Radiation Safety in Industrial Radiography (RG 904.03);
4. Format and Contents of Application for Design Modification/Change Approvals for Nuclear Power Plants (RG-913.02); and
5. Format and Contents of Emergency Plans of Radiation Facilities and Activities (RG 914.02).

Draft Preparation Profiles for the development of the following regulatory guides were approved:

1. Format & Contents of Radiation Protection Programme of Radiation Facilities;
2. Guidance for Preparation of License Applications of Radiation Facilities; and
3. Guidelines for Medical Professionals on Transport, Diagnosis & Management of Overexposed & Contaminated Individuals in Radiological Emergency.

Central Registry

PNRA maintains a central registry of all regulatory documents, including regulations, regulatory guides, policies and procedures. Figure 4 provides detail of regulations, policies, guides, and working procedures registered so far.

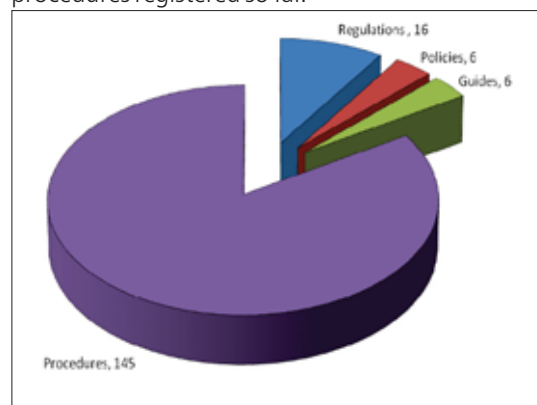


Figure 4: Status of PNRA Central Registry

3 NUCLEAR SAFETY

PNRA regulates all civilian nuclear facilities in the country. At present, there are five operational nuclear facilities in the country, which include three nuclear power plants and two research reactors. In addition, construction of two nuclear power plants have been progressing after obtaining construction licences from PNRA. Details of nuclear facilities that are in operation and under construction in the country are provided in Table 1.

The authorization/licensing, review and assessment, inspection and enforcement processes of PNRA ensure that the nuclear facilities remain under strict regulatory control and in compliance with PNRA regulations and licence conditions throughout their lives, from siting to decommissioning until the site is removed from the regulatory control upon demonstration that no radiation hazard or potential for radiation hazards exists at the site. The authorization and licences issued during various stages of nuclear facilities are site registration, construction licence, permission for commissioning, permission to load nuclear material, operating licence, decommissioning licence and authorization for removal of the site from regulatory control. All authorizations and licences are issued by PNRA upon completion of thorough review, assessment and verification of the

safety of the facility to ensure that relevant regulations and other regulatory requirements are fulfilled by the applicant/licensee. The licences and authorizations issued by PNRA are subject to fulfilment of certain generic and specific conditions that are attached with the issued authorizations and licences.

PNRA also issues licences to personnel responsible for operating nuclear power plants and research reactors; no nuclear facility in the country is permitted to operate unless it is staffed with adequate number of licensed operating personnel.

The review and assessment of licensees' submissions and regulatory inspections are carried out in accordance with national regulations and applicable codes and standards to ensure that the licensees maintain an acceptable level of safety at its nuclear facilities. In case of degradation of safety, PNRA is empowered to take enforcement measures, ranging from issuance of directives, curtailing activities to revocation of authorization or licence (in case of serious violations).

PNRA also monitors the safety performance of the plants and progress of necessary actions for safety improvements; identifies barriers, if any, in

Table 1: Nuclear Installations 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)	In Operation	Pressurized light water reactor	325MWe	2011
4.	Chashma Nuclear Power Plant Unit 3 (C-3)	Under Construction	Pressurized light water reactor	325 MWe	2016 (expected)
5.	Chashma Nuclear Power Plant Unit 4 (C-4)	Under Construction	Pressurized light water reactor	325 MWe	2016 (expected)
6.	Pakistan Research Reactor-I (PARR-I)	In Operation	Swimming Pool	10 MWt	1965
7.	Pakistan Research Reactor-II (PARR-II)	In Operation	Tank-in-Pool	30 KWt	1991

implementation of necessary actions for safety improvements; and decides on actions and the time frame for their completion.

Review and Assessment

PNRA performs review and assessment of the documents submitted by applicant/licensee to ensure that the facility or activity is functioning as per regulatory requirements and meets the ultimate goals and objectives of protection of the public, worker and environment from harmful effects of ionizing radiation. Review and assessment is a core function of PNRA. The documents/submissions are made in support of applications for licensing; modifications in the safety structures, systems and component of the facility; and other activities for which authorization is necessary under PNRA regulations. In addition, PNRA also reviews and assesses routine reports (annual, biannual and monthly) and non-routine reports (event reports) submitted by licensees as per regulatory requirements.

The objective of review and assessment is to verify compliance of licensees' activities with PNRA regulations, licence conditions, applicable codes and standards, and proven engineering practices. In case of non-compliance with regulatory requirements or a trend towards safety degradation, PNRA issues directives for taking necessary corrective actions within a defined time frame so that the health and safety of the workers, general public and environment remain uncompromised. PNRA also monitors safety performance of operating nuclear power plants and observe the trends. Any decline in the trend is taken up with the plants for necessary improvement. PNRA conducted trend analysis of K-1 and C-1 safety performances in 2012.

Operating Nuclear Power Plants

K-1 is a pressurized heavy water reactor (CANDU type) with natural Uranium fuel and uses heavy water as reactor coolant and moderator. The design

life of K-1 expired in 2002 and is operating beyond its design life. The operating licence of K-1 has been extended for a period up to December 31, 2016 upon completion of a thorough assessment of life and integrity of the most life limiting components (steam generators and fuel channels).

In addition, PNRA reviewed ten design modifications, one modification in the operating policies and principles and one event report of K-1.

C-1 is a pressurized light water reactor with enriched Uranium fuel. It started commercial operation in 2000 and a licence was granted for a period of ten years, which expired in 2010. C-1 submitted the Periodic Safety Review (PSR) to PNRA. The operating licence of C-1 was revalidated in December 2010 for a further period of ten years based on the outcome of the PSR.

During 2012, C-1 submitted two design modifications regarding change of studs with tensioning studs on fuel supply line of diesel generator and steam generator lower manhole. Furthermore, routine submissions made by C-1, as per requirement of PNRA regulations and approved technical specifications, were reviewed and assessed to ensure compliance with regulatory requirements. PNRA extended time specific condition regarding storage of radioactive waste up to 2014 on request to C-1 after thorough review and assessment and reactive inspections to ensure that adequate storage capacity exist to handle radioactive waste that will be generated till 2014. During the reported period, directives were issued to C-1 which are being followed-up by PNRA.

During the year, C-1 has set a new record in the country of continuous safe power operation of 239.15 days.

C-2 is an improved version of C-1 with certain safety enhancements. The plant was awarded operating licence on February 25, 2012 in a ceremony held at PNRA Headquarters, Islamabad. Routine submissions made by C-2, as per requirement of

PNRA regulations, were evaluated and PNRA position, where found necessary, was conveyed for alteration/justification. C-2 submitted its offsite emergency plan for approval which is under review at PNRA. During the reported period, several directives were also issued to C-2 which are being followed-up by PNRA. Similarly, design modifications and event reports submitted by C-2 were also evaluated.

Integrated Safety Assessment

PNRA has developed a process for integrated safety assessment (ISA) by combining its regulatory processes of review and assessment, inspections and safety performance trending. ISA is based on a systematic methodology and helps in identifying weak areas at macro level along with necessary actions for improvement. In 2012, ISA of K-1 and C-1 was conducted and reports shared with the licensees.

Post Fukushima Actions

The accident at nuclear power plants in Fukushima, Japan identified new avenues that needed immediate attention to enhance the safety levels at nuclear power plants. Based on feedback of Fukushima accident, PNRA required the nuclear

power plants in Pakistan to re-evaluate the hazards and safety, particularly plants' capability to withstand natural hazards more than the design basis, ensuring availability of power sources and cooling water, availability and validity of procedures to deal with accident situations, improvement in emergency preparedness and management systems and their demonstration. Accordingly, the nuclear power plants have identified certain areas for further enhancing and strengthening safety of the plants. These assessments, evaluations and action plans have been reviewed by PNRA and their implementation are followed-up. In addition, PNRA has also reviewed its regulations in the light of feedback of Fukushima accident and have identified certain areas for improvement in the regulations. The identified improvements are under review as per management system process for modification in the regulations.

Nuclear Power Plants Under Construction

The construction of C-3 and C-4 is in progress after getting construction licence from PNRA on May 28, 2011 and December 14, 2011 respectively.

Construction of civil structures and manufacturing of equipment for C-3 and C-4 are in progress under regulatory supervision of PNRA. Construction of



Chairman and Member PNRA in C-2 Operating Licensing Ceremony



PNRA Inspectors at Under Construction Plant

both the plants is proceeding satisfactory

During 2012, PNRA issued directives to C-3 and C-4. PNRA is actively pursuing C-3 and C-4 to implement the actions on these directives.

Figure 5 summarizes the review and assessment activities carried out by PNRA for the nuclear power plants during 2012.

Research Reactors

The Operation Licences (OL) of PARR-I was valid till December 2012 and extended for one more year till December 2013. PARR-I submitted PSR reports to PNRA for renewal of its operating license for ten years. These reports have been reviewed and the operating licence to PARR-I will be revalidated after satisfactorily completion of the proposed corrective actions. The operation Licences (OL) of PARR-II is renewed on yearly basis.

During 2012, PNRA conducted planned inspections of research reactors in the areas of radiation

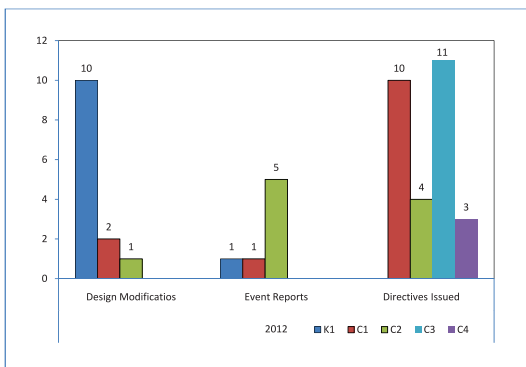


Figure 5: Review and Assessment of NPPs

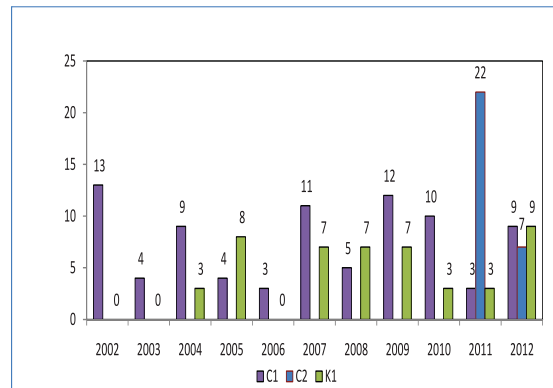


Figure 6: Issuance of New Operator's Licences for NPPs

protection, maintenance, operation, etc. and witnessed emergency exercise.

Licensing of Operating Personnel

PNRA ensures that appropriately qualified and trained operating personnel remain available throughout the operating lifespan of each nuclear installation. According to PNRA regulations (PAK/913), operating personnel working as shift supervisors, shift engineers and reactor operators require licence from PNRA. PNRA conducts licensing examinations for award of licences to these operating personnel. The licensees are required to get their operator's licences renewed annually.

During the reported period, nine personnel at K-1, nine at C-1 and seven at C-2 were granted operators' licences (Figure 6), whereas the licences of thirty operating personnel at K-1, thirty-three at C-1 and twenty-eight at C-2 were renewed (Figure 7).

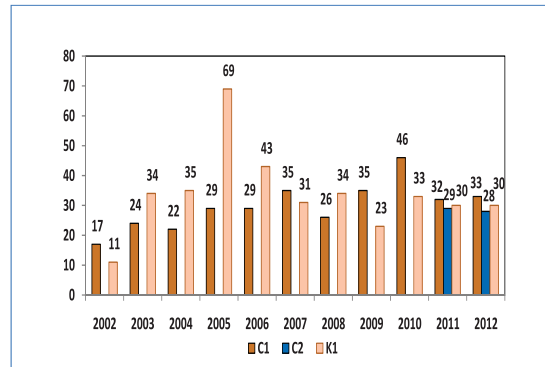


Figure 7: Renewal of Operator's Licences for NPPs



An Overview of C-3 NPP



Steam Generator and Reactor Coolant Pump foundations

At PARR-I and PARR-II, PNRA issued licences to one new operator and renewed eighteen licences of supervisors and operators (Figure 8).

Inspections of Nuclear Installations

PNRA conducts regulatory inspections during construction, commissioning and operation phases of nuclear installations. The main purpose of these inspections is to ensure that the licensees are conducting their operations in accordance with PNRA 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 necessary corrective action requirements, 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 where inspectors have been posted. The RNSDs conduct regulatory inspections of nuclear installations and radiation facilities in their respective regions. The directorates located at PNRA headquarters provide support during the inspections if needed by the regional directorates.

Various routine and planned inspections of nuclear installations are carried out in accordance with the PNRA inspection programme. Other inspections of nuclear installations, like unplanned and reactive inspection, are carried out when required. In addition, control point inspections (Hold, Witness

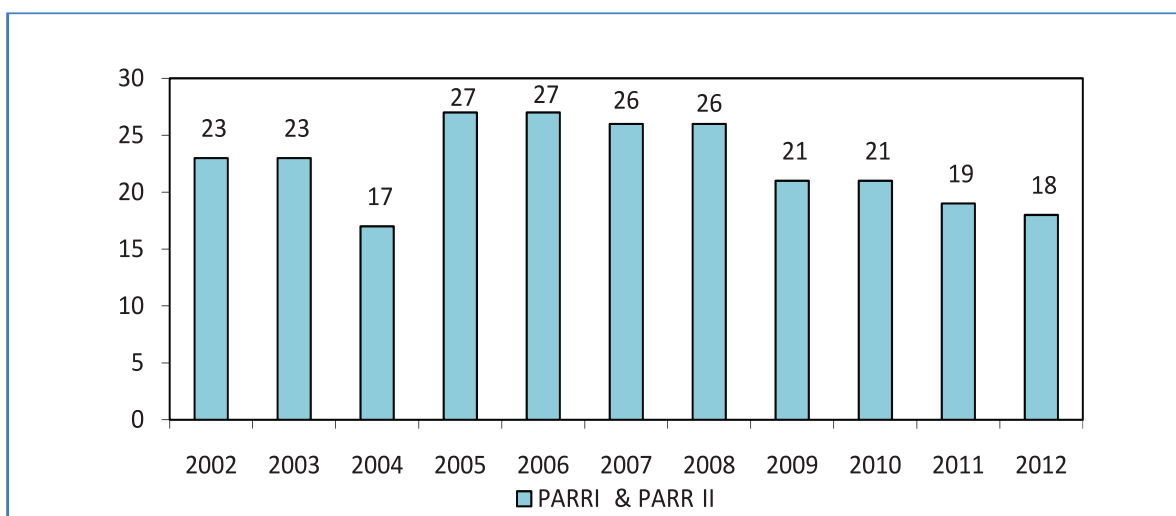


Figure 8: Renewal of Operator's Licences at PARR-I and PARR-II

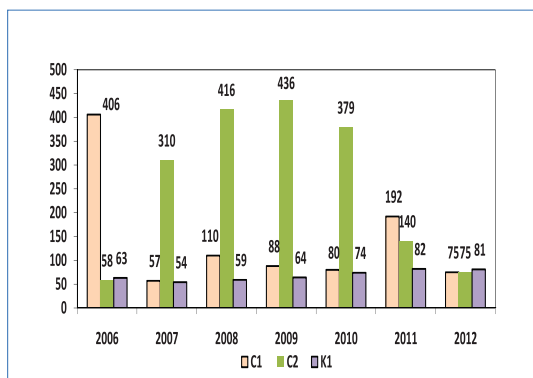


Figure 9: Regulatory Inspections of K-1, C-1 and C-2

and Record Points) are carried out during construction, commissioning and operation of NPPs. In hold point inspections, the licensee requires explicit permission of PNRA for proceeding beyond this point.

In 2012, PNRA conducted a total of eighty-one (81) inspections at K-1, seventy-five (75) at C-1, and seventy-five (75) at C-2 as per the annual inspection plans (Figure 09). In addition, one hundred and ninety (190) control point inspections and forty-eight (48) general surveillance were conducted at C-3 and C-4. These inspections were in addition to daily and routine inspections and surveillance of different plant areas.

PNRA also performs inspections during manufacturing of C-3/C-4. These inspections are managed by the Directorate of Nuclear Safety at PNRA Headquarters. In 2012, PNRA conducted eight inspections during equipment manufacturing.

Eight safety inspections were conducted at PARR-I and two at PARR-II to check compliance with regulations in the areas of operation, safety systems, radiation protection, radioactive waste, fire protection and environmental monitoring (Figure 10).

Equipment Manufacturer

Heavy Mechanical Complex-3 (HMC-3) was licensed to manufacture nuclear safety class 2 and 3

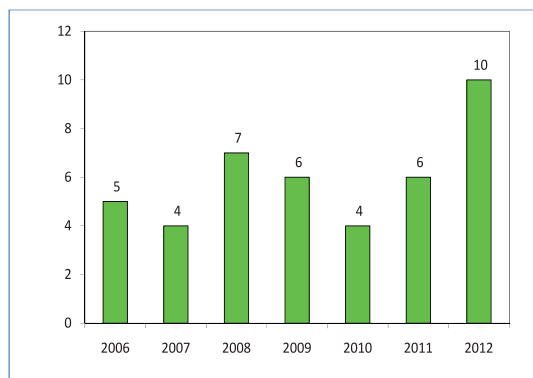


Figure 10: Regulatory Inspections of PARR-I and PARR-II

equipment in 2005. The Complex submitted a request to allow manufacturing of safety class-1 equipment in 2011. The submissions of HMC-3 were reviewed thoroughly during 2012. Upon completion of the due process, PNRA granted licence to HMC-3 on October 02, 2012 for five years to manufacture safety class-1 equipment. Ninety-nine (99) inspections were conducted during the reported period.

Scientific Engineering Services (SES) has also submitted its request along with the documents required under regulations PAK/907 for licensing of SES as nuclear safety class 1 equipment manufacturer. Review of the documents has completed whereas inspections to verify capabilities of SES has been planned in the activities of 2013. A licence will be issued to SES only after complete satisfaction of PNRA that the applicant has sufficient capabilities to manufacture safety class-1 equipment.



Chairman PNRA Awarding SC Equipment Manufacturing License to Chairman PAEC

4 RADIATION SAFETY

The application of radiation in everyday life for the benefit of society has been greatly increasing throughout the globe since last decades. Same is the case for Pakistan where, at present five nuclear installations and a large number of radiation facilities and practices are in operation. These include nuclear power plants, research reactors, diagnostic radiology practices (including X-rays), radiotherapy centers, nuclear medicine facilities, irradiators, practices involving use of radioactive sources in industry, research and industrial radiography etc. Since any radiation exposure from these nuclear installations or radiation facilities presumably involves some risk to workers, public and the environment, PNRA has to regulate radiation safety at these installations and facilities in order to protect worker, public and the environment from the harmful effects of radiation. PNRA utilizes regulatory tools like development and implementation of regulations and regulatory guides, review and assessment of licensee's submissions, licensing and inspection of installations and facilities, and where necessary enforcement actions to fulfill its regulatory obligations.

Review and Assessment

PNRA requires the holders of any ionizing radiation generating apparatus to submit various reports during the lifetime of such apparatus in order to ascertain that the facility is working safely under all conditions. Review and assessment of these submissions is a major regulatory activity to ensure compliance of regulatory requirements for radiation safety set forth in national regulations. During the reported period, revised radiation protection program of KANUPP was reviewed and approved. Similarly radiation protection programs of about 30 radiation facilities were reviewed, commented upon and several of them were approved during 2012. Dosimetry program and dose results of the workers of nuclear installations and radiation facilities were assessed. Evaluation and trending of ambient radiation levels around the nuclear power plants is continuously performed at

PNRA. An updated report of these levels is presented in every meeting of the Authority.

This year, PNRA conducted a special assessment of selected radiation facilities belonging to different activity types like radiology, nuclear medicine, radiotherapy, and industrial radiography from different cities of the country against the criteria set forth by the regulations. Radiation facilities were divided according to the type and each type of facility was assessed against various performance indicators like facility design, QA/QC, personal dosimetry, emergency preparedness etc. The assessment indicated that radiation safety status in many types of facilities like nuclear medicine, radiotherapy, irradiation, research, nuclear gauge and well logging facilities appeared to be satisfactory, whereas situation in radiology needed much improvement.

The review and assessment is a continuous process in which activities of different nature and volume are performed. A summary of activities related to radiation safety at nuclear installations and radiation facilities during the reported period is presented below.

Radiation Safety at Nuclear installations

Karachi Nuclear Power Plant Unit 1 (K-1)

Karachi Nuclear Power Plant submits its detailed annual safety report each year to PNRA. In 2012, K-1 submitted its Annual Safety Report for the year 2011, which was reviewed during the reported period. Revised radiation protection program of K-1 was also reviewed and approved during 2012. Assessment of radiation exposures to plant workers, provided in above mentioned annual safety report of 2011 submitted in 2012, was performed and these were found to be largely within the prescribed regulatory limit of 20 milli Sieverts (mSv) per year. Detailed dose records of any worker who approaches 20 mSv annual doses in any year are evaluated at PNRA to ensure the compliance of regulatory requirement. It was verified that few workers who received more than

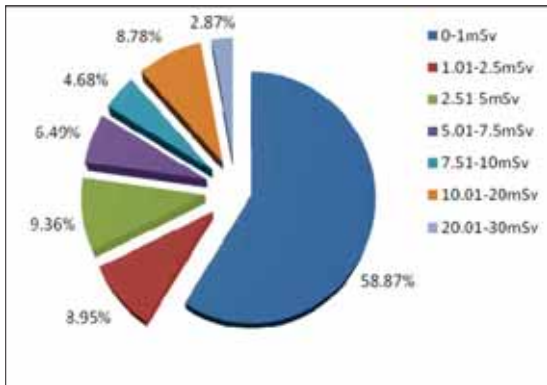


Figure 11: Annual Radiation Doses to K-1 Workers

20 mSv dose during 2012, had received a total dose of less than 100 mSv over the last five years. The dose distribution of workers at K-1 is detailed in Figure 11.

Monthly Technical Reports of K-1 for the year 2012 were evaluated during the reported period. It was observed that Annual Collective Dose i.e. the sum of individual radiation doses received by all workers during the whole year were well within the regulatory limits. Monthly distribution of collective dose is represented in Figure 12.

Ambient radiation levels at K-1 and in the nearby city of Karachi are continuously monitored and assessed. Over the last five 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).

Chashma Nuclear Power Plant Unit 1 (C-1)

In 2012, dose constraints for public exposure from the plants releases at the Chashma Nuclear Power

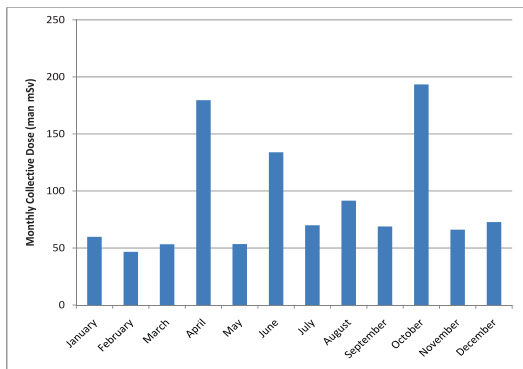


Figure 12 : Monthly Collective Doses at K-1 during 2012

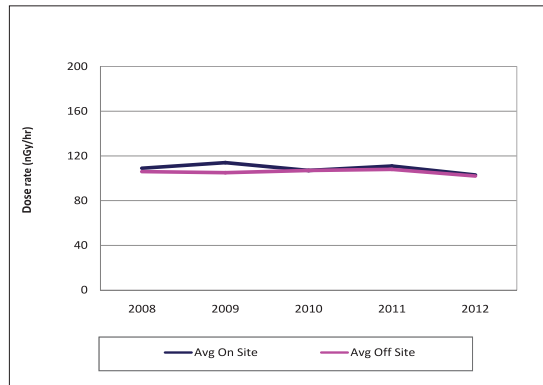


Figure 13: K-1 Onsite and Offsite Average Ambient Dose Level Trend

Generation Station (CNPGS) site were reviewed in detail and approved by PNRA. C-1 submitted its annual dose report for the year 2011 which was reviewed in detail during the reported period. Radiation exposures to plant workers provided in above mentioned annual report of 2011 submitted in 2012 were assessed and found to be well below the prescribed regulatory limits. Figure 14 provides detail of annual radiation doses to workers .

Monthly Technical Reports of C-1 for the year 2012 were evaluated during the reported period. It was observed that Annual Collective Dose i.e. the sum of individual radiation doses received by all workers during the whole year was 131 man-mSv. Monthly distribution of collective dose is represented in Figure 15. It may be noted that C-1 initiated its eighth Refueling Outage (RFO) of fifty days duration in December 2012. A sharp rise in monthly collective dose in December 2012 was seen owing to refueling outage activities. Dose estimates for all activities of the refueling outage were submitted to

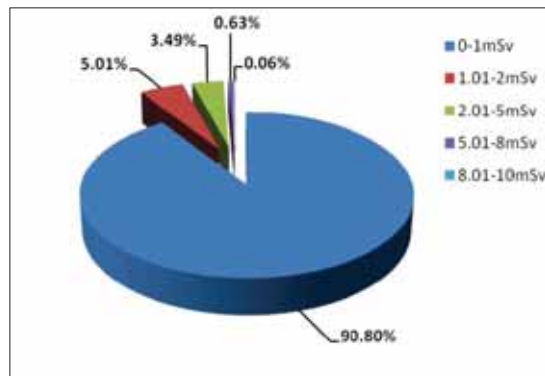


Figure 14: Annual Radiation Doses to C-1 Workers

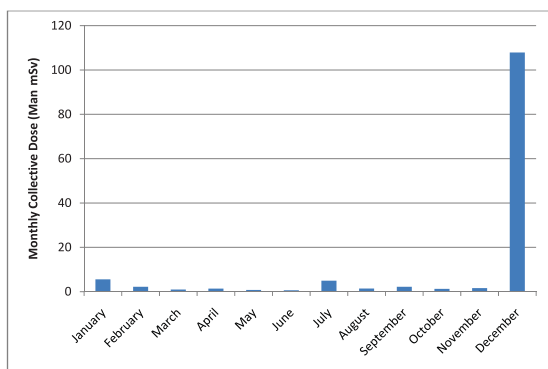


Figure 15: Monthly Collective Dose at C-1 During 2012

PNRA and evaluated against activities and previous experiences. By the end of reporting period, refueling outage activities were in progress. Comparison of the estimated and actual doses received by workers will be presented in the annual report of 2013.

Chashma Nuclear Power Plant Unit 2 (C-2)

The annual dose report of C-2 for 2011 was submitted and reviewed in detail during reported period and radiation exposures to plant workers were assessed. Radiation exposures of all plant workers were found well below the prescribed regulatory limits. Doses to all workers remained below 1 mSv while maximum dose received by a worker was 0.67 mSv.

Monthly Technical Reports of C-2 for the year 2012 were evaluated during the reported period. It was observed that Annual Collective Dose i.e. the sum of individual radiation doses received by all workers during the whole year, was 5.45 man-mSv. Monthly

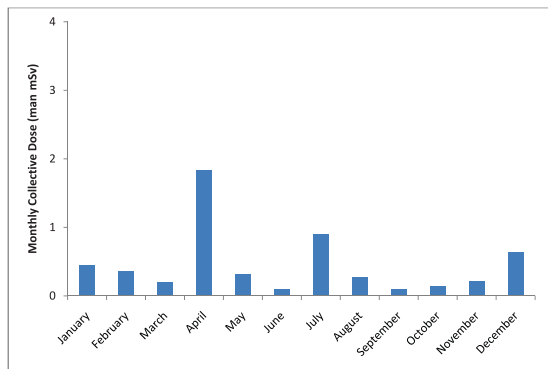


Figure 16 : Monthly Collective Doses at C-2 during 2012



Figure 17: CNPGS Onsite and Offsite Average Ambient Dose Levels Trend

distribution of collective dose is represented in Figure 16.

Ambient radiation levels at CNPGS site comprising of two operational units namely C-1 and C-2 are monitored continuously and compared with the natural background of surrounding cities. Assessment of records reveals that ambient dose levels at site are generally at the level of the natural background of surrounding cities (Figure 17).

Pakistan Research Reactors (PARR-1&2)

Radiation safety at research reactor PARR-1 is ensured through, inter alia, review and assessment of the licensee's submissions. The annual dose report of PARR-1 for 2011 was submitted & reviewed in detail during reported period and radiation exposures to radiation workers were assessed. Radiation exposure of all workers was found to be well below the prescribed regulatory limits. Figure 18 provides a view of the doses to workers.

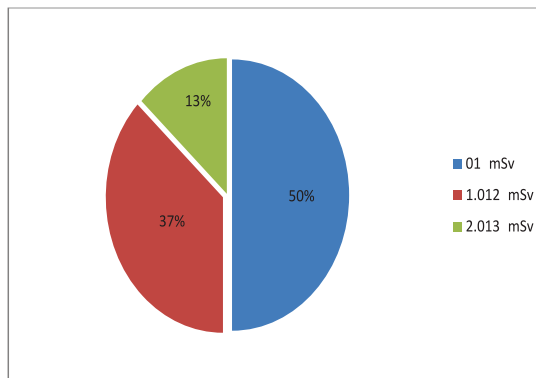


Figure 18: Annual Radiation Doses to Research Reactor Workers

Radiation Safety at Radiation Facilities

A large number of radiation facilities are operating in Pakistan. PNRA is obliged to ensure that appropriate regulatory framework is in place for the safe operation of these facilities. The radiation facilities being monitored by PNRA includes:

- Medical applications (radiology, radiotherapy and nuclear medicine);
- Industrial applications (industrial radiography, nuclear gauges, scanning, irradiation, etc.); and
- Research/Education

During the reported period, PNRA continued the program to arrange training courses for industrial radiographers. By the end of 2012, PNRA had conducted three courses in which around 71 radiographers participated out of which 44 have successfully completed the course. During this year, PNRA also initiated a certification course for radiation protection officers of radiation facilities. Course outline and training manual was prepared during the reporting period and first certification course was conducted during October 2012. 26 RPOs from different medical centers participated in this course out of which 24 successfully completed it. Conduct of such courses will continue in the coming years.

Licensing of Radiation Facilities

Under PNRA Ordinance, it is essential for radiation facilities in the country to operate only after getting a license from PNRA. The procedure of issuance of license requires the applicant to fulfill regulatory requirements prior to issuance of license. Licenses to radiation facilities are issued after detailed review and assessment of the applicants' submissions specified under the national regulations and inspection of the site and equipment. Periodic inspections of radiation facilities are performed to monitor continued compliance with safety provisions.

All the radiation facilities using radioactive material

in the country have been licensed by PNRA however a number of medical X-ray facilities are still outside the licensing net. During the reported period, strong persuasions have been made to get X-ray facilities in the licensing net which has resulted in an appreciable increase in licensed X-ray facilities this year.

Previously quite a number of facilities were not renewing their licences after its expiry. However the number of such defaulters decreased during 2012 as compared to previous year. To deal with these defaulters, enforcement regulations have been gazette-notified and enforcement procedure has been prepared. Beside strong persuasion, efforts are underway to start legal proceedings against defaulters.

During the reported period, 755 new facilities were licensed by the three regional directorates of PNRA.

Occupational Exposure at Radiation Facilities

Radiation facilities are required to submit radiation exposure data of workers involved in radiation work on annual basis. PNRA also obtains the occupational exposure records from service providers. These records are maintained in database of occupational exposures at PNRA. Currently, the database includes dose records of around 7800 radiation workers including around 1600 workers in the radiotherapy/nuclear medicine, 1500 workers in the industrial sector, 450 workers in research and education, 3500 in diagnostic radiology and 200 other workers. Distribution of radiation workers in various sectors is shown in Figure 19 and a representation of radiation workers in different dose ranges is given in Figure 20.

Radiological Protection of Patients

It is well understood that the largest component of radiation dose from manmade source received annually by humans, is from medical procedures. It is also recognized that the contribution of medical

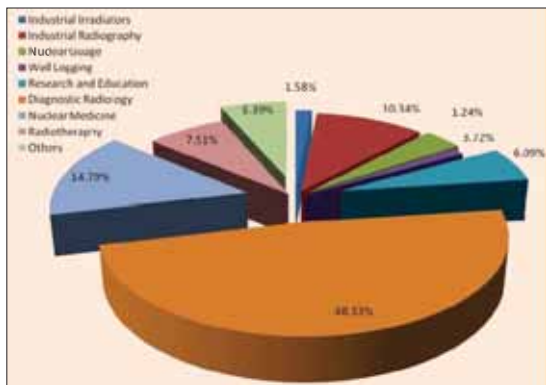


Figure 19: Radiation Workers in Different Activity Types

radiation dose to human can be reduced without compromising the quality of diagnosis or treatment. Activities of PNRA focused on radiological protection of patients involve development of regulatory guides (described in regulatory framework section), training of medical community in this aspect and a program to assess radiation doses received by patients in various radiological procedures. During the reported period PNRA conducted four workshops on quality assurance and protection of patients in imaging and radiotherapy. These workshops were conducted at medical centers in Islamabad and Karachi. The program to assess radiation doses of patients remained in progress during the reported year. The program comprises of several phases. The first phase involved the procurement of related equipment for experimental work which has been completed. The next phase is the collection of data from different medical facilities in major cities of Pakistan which has been initiated in the reporting year. During 2012 clinical attachments were conducted at hospitals in Islamabad e.g, NORI, Shifa International Hospital, KRL General Hospital and PIMS. Analysis of collected data for chest examinations reveals that in 90% of the procedures, patient doses are within guidance levels as prescribed by the regulations. Next phases of project will continue in coming year.

Inspections of Radiation Facilities

Regulatory inspections of radiation facilities are one

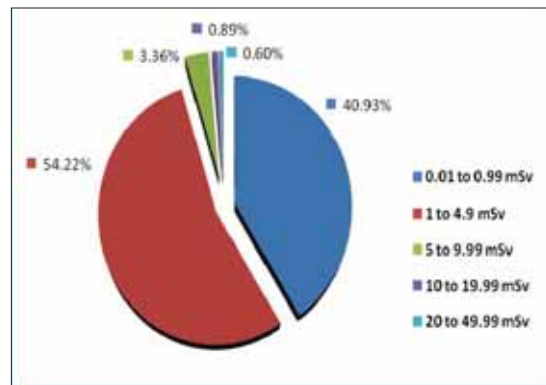


Figure 20: Radiation Workers in Different Dose Ranges

of the core activities of PNRA. These inspections are carried out to verify that provisions of the PNRA Ordinance, regulatory requirements, license conditions and other directives of PNRA are comply with, by the licensee. An annual inspection program to conduct periodic inspections of all radiation facilities is prepared each year with the provisions for special inspections where required. In accordance with the annual inspection plan for the reported period, 2318 inspections of different types of radiation facilities were performed. A comparison of the regulatory inspections performed during the reported year with the inspections performed during the previous years is shown in Figure 21. These inspections are focussed on verification of the facility design, functioning, work practices, ALARA implementation and adequacy of security measures being taken by licensees during use, transportation and storage of the sources. Directives and recommendations for improvement and compliance with regulations are communicated to the inspected facilities in inspection reports and these are appropriately followed up for compliance.

Authorization of Import and Export of Radiation Sources and Generators

PNRA is the competent authority in Pakistan which maintains cradle-to-grave track of all radiation sources / generators used in the country. According to this tracking mechanism any person or facility which intends to use radiation sources or

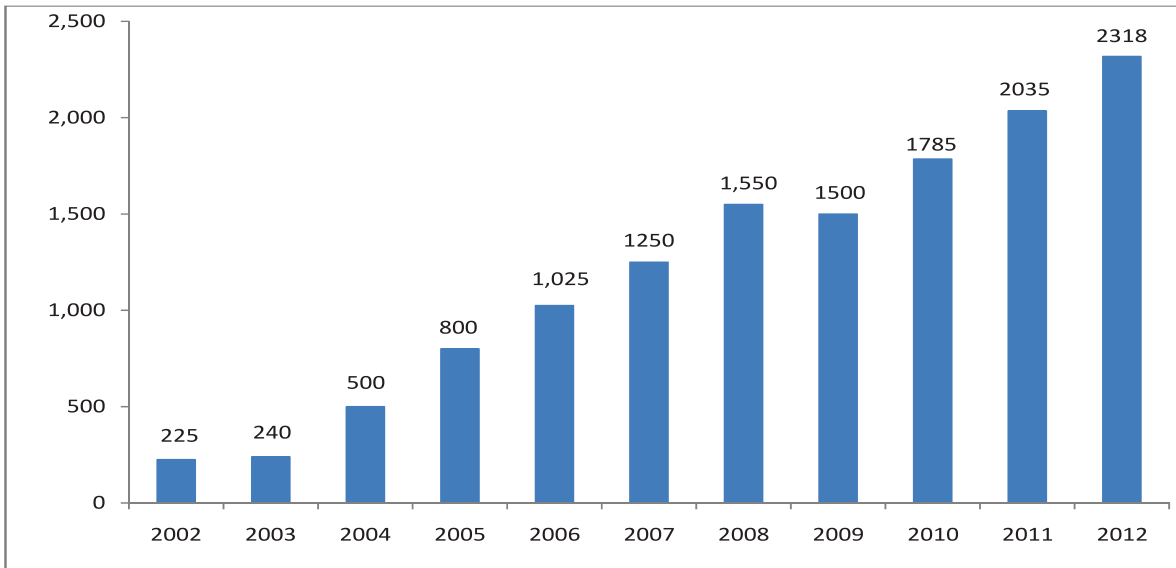


Figure 21: Regulatory Inspections of Radiation Facilities

generators is required to be licensed with PNRA. An import permit is issued to a person or facility when it intends to import radiation source and applies for this import permit for fulfilling suppliers' requirement. At the time when radiation source or generator arrives at a port in Pakistan, a "No Objection Certificate" (NOC) from PNRA is mandatory for its custom clearance. Facilities are required to make arrangement for returning the source to supplier after its useful life (i.e. when it is disused). An NOC for export is required to be

obtained from PNRA for returning the disused source back to supplier.

Issuance of Import Permit or NOC is based on regulatory verification of the intended end use and fulfillment of technical requirements according to specifications of the radiation source or generator to be imported or exported. A comparison of NOCs issued during 2012 with those issued during the previous years is given in Figure 22 whereas use of sources in different categories is shown in Figure 23.

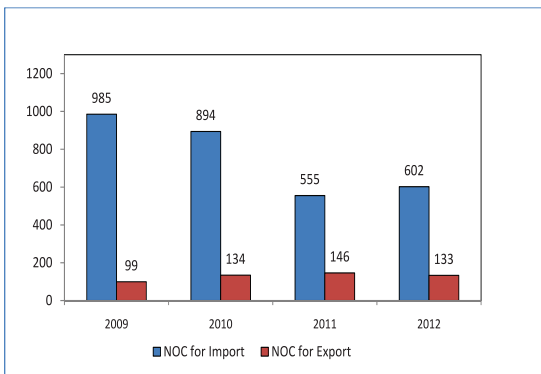


Figure 22: Issuance of Permits for Export-Import of Radiation Sources and Equipment

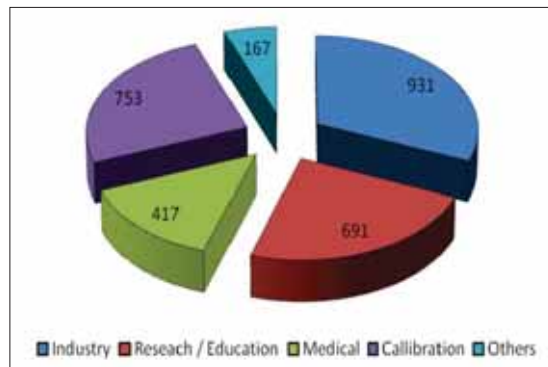


Figure 23: Distribution of Sealed Radiation Sources by Usage

5 WASTE AND TRANSPORT SAFETY

Radioactive waste is generated as a result of operation of nuclear installations and application of radio-nuclides in various industries, medical facilities, research activities, etc. Such waste contains materials that emit ionizing radiation and may pose hazard to human health and the environment if not handled properly. The safe management of radioactive waste is therefore essential to protect the public and the environment from its harmful effects. The long-term safety of radioactive waste cannot be ensured until it has been emplaced in a safe and secure disposal facility.

Regulating the safe management of radioactive waste and safe transportation of radioactive material is part of PNRA's mandate under the Pakistan Nuclear Regulatory Authority Ordinance, 2001. The Authority has issued national regulations on radioactive waste management (PAK/915) and safe transport of radioactive material (PAK/916) and their implementation is ensured through review and assessment, authorization and inspection processes.

Radioactive Waste Safety at Nuclear Installations

In Pakistan, the main generators of radioactive waste are the nuclear installations such as C-1, C-2, K-1 and PINSTECH. PNRA ensures that both the activity and the volume of radioactive waste generated at nuclear installations is minimized through suitable design, operation and other measures, and the discharges are kept minimum so

that doses to the public and the environment remain as low as reasonably achievable (ALARA). PNRA also ensures that the operator maintains round the-clock monitoring of gaseous and liquid effluent.

Karachi Nuclear Power Plant Unit 1

PNRA ensures that K-1 keeps its radioactive discharges to the environment within acceptable levels. For this purpose, Derived Release Limits (DRLs) for liquid and gaseous effluents have been established and approved for K-1. Moreover, PNRA ensures such compliance through record review and inspection process. Both the radioactive effluents i.e. gaseous and liquid effluents remained less than 1 percent of the DRLs during 2012 which are shown in the Figure 24 & 25 respectively.

Solid radioactive waste generated by K-1 during the reported year has been compacted and stored in MS drums at K-1. Figure 26 shows the graphical representation of the solid waste generation at K-1.

Radioactive Waste Storage Area at KANUPP

K-1 has established an additional Radioactive Waste Storage Facility (RAWSA) at its site to increase the available storage capacity. In this regard, KANUPP was required to submit Safety Analysis Report (SAR) to PNRA. In this regard a meeting was held in February 2012 between PNRA and KANUPP to discuss and finalize the applicable codes & standards and format & contents of SAR.

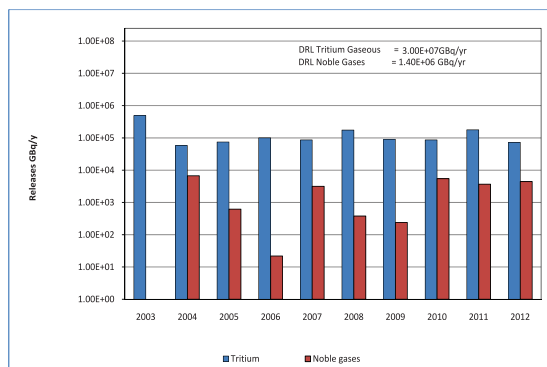


Figure 24: Gaseous Effluents from K-1

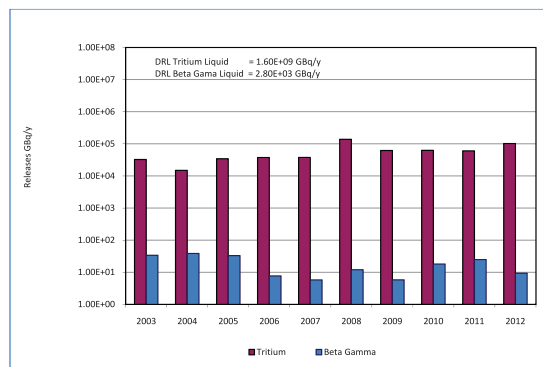


Figure 25: Liquid Effluents from K-1

WASTE AND TRANSPORT SAFETY

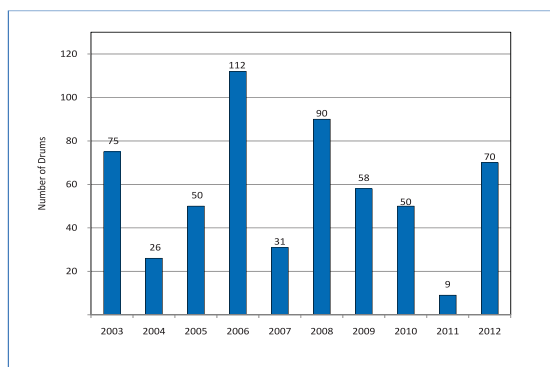


Figure 26 : Compacted Solid Waste Generated at K-1

During November 2012, KANUPP has submitted the safety analysis report for RAWSA which is under review at PNRA.

Chashma Nuclear Power Plant Unit 1 & Unit 2

PNRA emphasises that the releases of radioactive effluents from C-1 & C-2 to the environment are kept at minimum possible level and ensures that radioactive waste management at CHASNUPP is in accordance with the Radioactive Waste Management Programme (RWMP) established by CNPGS under national regulations.

PNRA keeps an eye on the discharges of C-1 & C-2 and analyzes them to ensure that they remain well below the technical specifications limits. The total activity released in gaseous and liquid effluents from C-1 during the reported year is shown in Figure 27 & 28 which indicates that the discharges remained less than 1 percent of the technical specification limits.

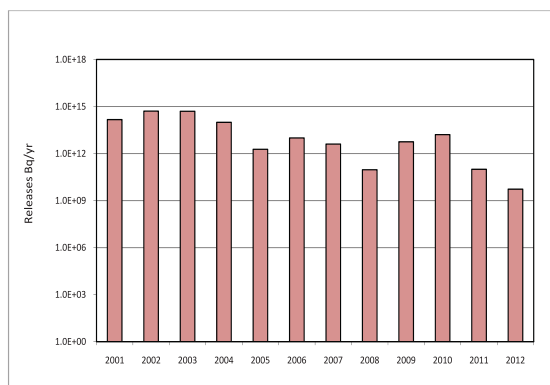


Figure 27 : Gaseous Effluents from C-1

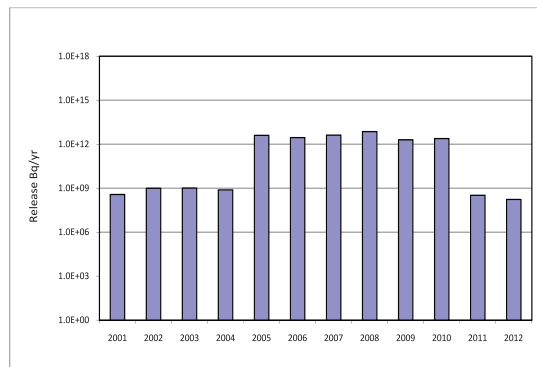


Figure 28 : Liquid Effluents from C-1

Two types of solid waste generated at C-1 i.e. solidified and compacted, are stored in drums in the radioactive waste storage building at the plant site. The accumulated number of solidified and compacted waste drums at C-1 is shown in Figure 29.

Extended Storage Facility

Under the Operation Licence Condition imposed by PNRA, C-1 plans to establish a Nuclear Power Waste Centre (NPWC) at Chashma site to provide additional capacity for the storage of radioactive waste to be generated from the operation of C-1, C-2 and future NPPs. PAEC submitted its case for FSAR modification in this regard. After getting permission from PNRA, the construction of extended storage facility has been started. In 2012, PNRA approved a modification of treatment of spent resin in radioactive waste management system.

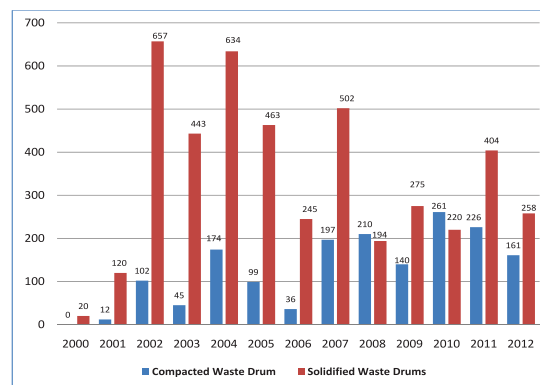


Figure 29 : Accumulated Compacted and Solidified Waste Drums at C-1

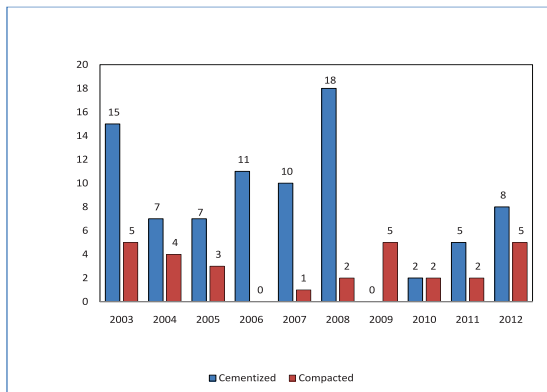


Figure 30: Cementized and Compacted Containers at PINSTECH

Pakistan Institute of Nuclear Science and Technology (PINSTECH)

The Pakistan Institute of Nuclear Science and Technology is a multidisciplinary research facility of PAEC which houses the country's two research reactors, PARR-I and PARR-II. The radioactive waste generated from research and development (R&D) activities at the Institute are stored in Reinforced Cement Concrete (RCC) barrels at PINSTECH. In addition, the Institute is one of the designated sites for storage of waste generated from other radiation facilities in Pakistan.

PNRA ensures that national requirements regarding waste minimization are met at PINSTECH. Waste management activities at the Institute are regularly monitored.

The number of cementized and compacted containers of radioactive waste produced at PINSTECH during 2012 is shown in figure 30.

National Waste Policy

Government of Pakistan approved a national policy on control and safe management of radioactive waste, wherein Pakistan Atomic Energy Commission (PAEC) has been assigned the responsibility for safe disposal of radioactive waste generated as a result of operation of radiation facilities in the country. PAEC has declared PINSTECH as one of the facilities for collection of waste from the northern part of the country and K-1 from the southern part. In this regard, PNRA

conducted meeting with DNS for the implementation of national policy. PNRA team pointed out that under the national policy, PAEC should develop a mechanism/plan for the management of ownerless/orphan waste and develop a mechanism for the charges required by PAEC from the waste generator in consultation with PNRA.

Licensing of PINSTECH Predisposal Radioactive Waste Management Facility

PINSTECH submitted its intention to obtain a separate licence for its existing facility for the pre-disposal management of radioactive waste. PNRA provided guidance on the codes and standards as well as contents and format to be followed in the preparation of the Safety Analysis Report. PINSTECH has prepared and submitted the safety analysis report for its Pre-disposal Radioactive Waste Management Facility to PNRA for review and assessment.

In this regard, a task force comprising of various technical officers of PNRA has been constituted to review the SAR.

Management of Disused Sealed Radioactive Sources (DSRS)

Under the national regulations on radioactive waste management, Sealed Radioactive Sources (SRS) containing long lived radio-nuclides (having half lives of more than one year with initial activity of 100 GBq or more) shall only be purchased with an undertaking from the manufacturers or suppliers to accept the return of the sources when they are no more useful.

The disused radioactive sources in possession of the licensees prior to the promulgation of the above mentioned regulations and those not covered in the national regulations need to be disposed off in a safe manner. As mentioned earlier, under the national policy on the control and safe management of radioactive waste, PINSTECH in Islamabad and K-1 in Karachi are responsible for

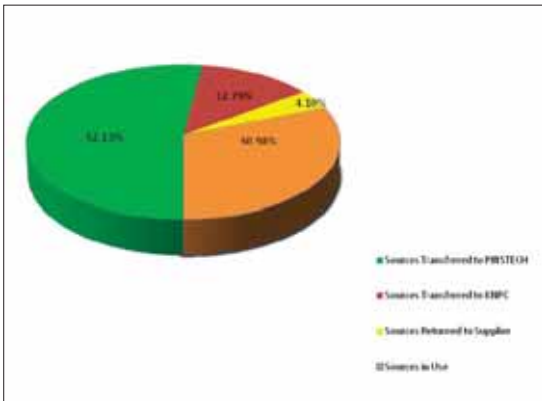


Figure 31 : Status of Imported SRS

receiving DSRS for safe storage.

Figure 31 presents the status of SRS in the country. Out of the total SRS imported into Pakistan, 52.13 percent have been transferred to PINSTECH after the completion of their useful life for storage, 12.79 percent to K-1, and 4.10 percent have been returned to the concerned supplier. The remaining 30.98 percent are in use by licensees.

The DSRS stored at PINSTECH and K-1 contains Cobolt-60, Cesium-137, Irradium-192, Radium-226, among other radio-nuclides is shown in Figure 32.

Inspections in the Area of Waste Management

PNRA conducts inspections of nuclear facilities to verify compliance with regulatory requirements concerning radioactive waste management and the implementation of radioactive waste management program & procedures. These inspections mainly focus on storage facilities to assess the safety of waste collection, classification, treatment, conditioning and storage.

During the reported period, three such inspections were conducted at C-2, K-1 and PINSTECH (Mo 99 production facility). Recommendations were made to the operators for further improvement in the implementation of their radioactive waste management programs.

Safe Transport of Radioactive Materials

PNRA ensures safe and secure transportation of radioactive material in the country. National regulations on transport of radioactive material are in line with the international requirements. PNRA provided technical guidance to the various establishments dealing with transportation of radioactive material or radioactive sources.

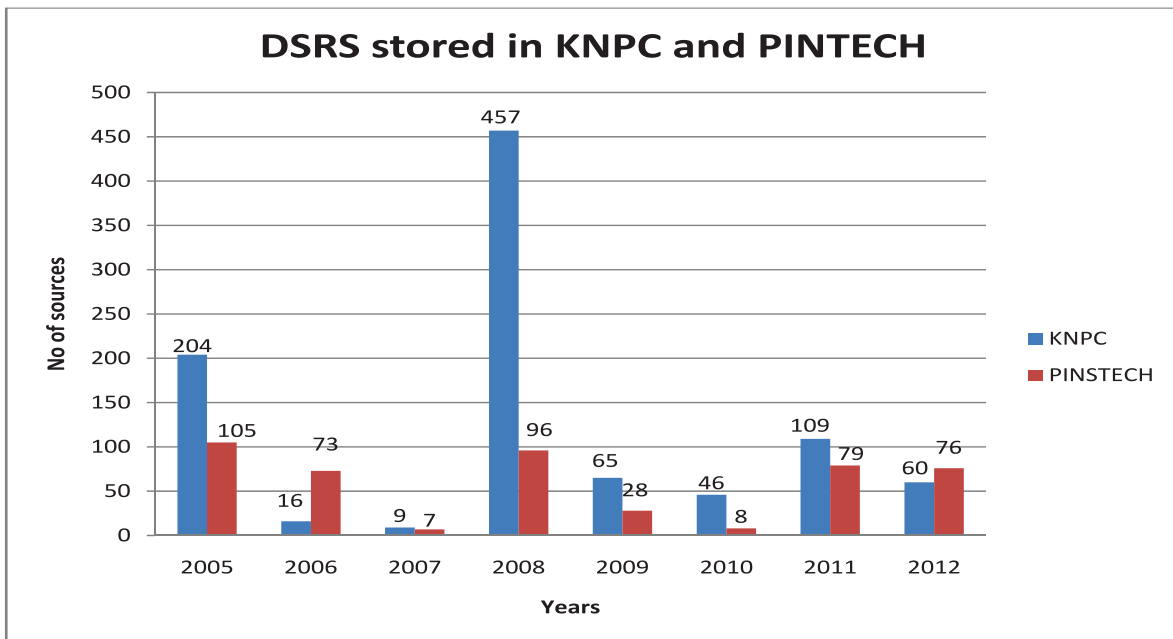


Figure 32: Disused Sources in the Country

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

Certification of Type B (U) Packaging

During 2011, PINSTECH formally communicated its intention to design and manufacture type B (U)

transport packaging for transportation of Mo-99. PNRA participated in several inspections of Type B (U) packaging to check the compliance of its regulatory requirements during the manufacturing.

In this regard, PNRA and PINSTECH finalized the codes and standards including format and contents to be followed in the preparation of SAR for the Type B (U) packaging. Subsequently, a Preliminary Safety Analysis Report (PSAR) of Type B (U) package was submitted to PNRA. PNRA constituted a taskforce comprising of various technical officers to review the PSAR.

The taskforce made queries on PSAR which were then discussed with senior management of PINSTECH for resolution to initiate the process of fabrication & licensing of Type B (U) package.



Participants of IAEA-PNRA Workshop on Safety Assessment of Dual Purpose Cask and Type B(U) Packaging

6 EMERGENCY PREPAREDNESS

Facilities and activities giving rise to radiation risk are usually designed and operated to a very high level of safety with inherent engineered safety features for prevention of accidents. Possibility of accidents in nuclear or radiation industry nevertheless remains, even though it is quite low compared to other conventional industries. There is always a need to ensure proportional preparedness to respond to and mitigate the consequences of incidents that might occur at facilities and activities giving rise to radiation risk; affecting workers, public and the environment. PNRA is given mandate to ensure, co-ordinate and enforce preparation and implementation of emergency plans for action to be taken by the relevant onsite and offsite authorities following foreseeable types of nuclear incidents. PNRA is responsible to ensure that the licensee has made arrangements for reporting and communication, co-ordination of action between various response organizations, training of personnel and provision of necessary facilities and instrumentation required for emergency response.

PNRA Regulations on management of a nuclear or radiological emergency (PAK/914) issued in this regard requires licensees to have in place emergency plans, the necessary workforce, equipment and mechanism for responding to such eventualities. Licensees are required to maintain capacity for coordination with offsite response organizations responsible to mitigate the consequences of a nuclear or radiological emergency. PNRA has categorized all such facilities and activities according to level of activity of radioactive material being used and hazard associated with them and requires that emergency preparedness arrangements should be commensurate with them.

Emergency Plans and Drills

PNRA reviews and approves emergency plans of facilities and activities under its purview to ensure that their plans correspond to applicable regulatory requirements, and are executable during the course

of an emergency. PNRA also requires licensees to conduct emergency drills and exercises at regular intervals to demonstrate that their emergency plans are effective and implementable. The frequency of such drills and exercises is agreed upon in their approved emergency plans and some of these are witnessed by PNRA for the assessment of licensees' emergency preparedness and response capabilities as and when required. PNRA also encourages the participation of relevant governmental ministries and departments to participate in the exercises conducted by nuclear power plants. During 2012, PNRA has required licensees to follow five years emergency exercise plan to ensure implementability of emergency preparedness and response arrangements irrespective of the times and weathers of the year.

PNRA has completed review of revised on-site emergency plans of C-1 and C-2 which describe actions to be taken by the licensee to mitigate consequences of a nuclear or radiological emergency on the site. On-site emergency plans of both the plants were approved after ensuring compliance of PNRA recommendations on previous drills/exercises. The off-site emergency plan of CNPGS, which describes actions to be taken by District Government - Mianwali for the implementation of protective measures in off-site area, has also been reviewed by PNRA during this year and review comments were communicated to CNPGS for incorporation in the revised plan.

A regulatory guide on "Format and Contents of Radiation Emergency Plan of Radiation Facilities and Activities" was also developed by PNRA which is in the process of approval. PNRA has reviewed radiation emergency plans of a number of facilities, including radiotherapy and nuclear medicine centers, industries and research institutes and recommendations were made for their improvement. Emergency drills of certain industries using radioactive sources were also witnessed during the reported year.

PNRA arranged a training course for operators of



NRECC Crew Coordinating with IEC-IAEA During Conduct of ConvEx-2b Exercise

nuclear installations for implementation of regulatory requirements related to emergency preparedness and response which proved to be very beneficial for the improvement of interaction among operators and the regulators. The course was attended by personnel dealing with matters related to nuclear or radiological emergencies at CNPGS (Unit-1, Unit-2, & Unit-3/4), KNPC, PINSTECH and DOS.

National Radiation Emergency Coordination Centre (NRECC)

National Radiation Emergency Coordination Centre (NRECC), based at PNRA Headquarters, is responsible for coordinating the response to nuclear accidents or radiological emergencies and operates round-the-clock. NRECC is Pakistan's designated National Warning Point (NWP) under the international 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 the IAEA about any nuclear accident or radiological emergency happening in the country.

NRECC is equipped with necessary communication facilities, Mobile Radiological Monitoring Laboratories (MRMLs) and various types of radiation detection and personal protective equipment. During reported year, capabilities of NRECC were enhanced by equipping it with advanced radiation monitoring equipment. The



NRECC Team Conducting an Emergency Exercise

equipment were procured with the assistance of IAEA. 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 of the Centre to respond to an event involving radiation monitoring; and the field exercises. During the reported period, NRECC conducted three COMTEX exercises and two MRML exercises.

NRECC also participates in drills and exercises conducted by the licensees, as well as in Conventional Exercises (ConvEx) conducted by IAEA under the obligations of international conventions. The ConvEx exercises 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 2012.

Nuclear Emergency Management System

An implementation plan for Nuclear Emergency Management System (NEMS) is being finalized in the country for centralized and coordinated response to nuclear or radiological emergencies. PNRA is contributing in development and improvement of the system by sharing its experience and providing technical inputs. As one of the stakeholders, PNRA has designated Radiological Assistance Group (RAG) teams at its headquarters and regional offices throughout the country. PNRA has also arranged training courses

EMERGENCY PREPAREDNESS

for RAG teams of PNRA and other stakeholder for use of radiation detection and personal protective equipment which have been issued to the teams.

Sharing of Information of Radiation Incidents and Emergencies

PNRA receives information of radiation incidents and emergencies occurring worldwide, through IAEA. These events are usually related to overexposure of workers/member of public, lost/stolen radiation sources, contamination/spill of radioactive material, malfunctioning of an equipment etc. PNRA analyzes the information received and implement lessons learned from this information for improvement of radiation safety and emergency response infrastructure. PNRA shares the information of radiation incidents occurring in medical application worldwide with certain medical facilities in Pakistan. PNRA is also planning to share the information with other facilities and activities in Pakistan. During this year, PNRA also shared lessons learnt from past emergency responses and exercises of Pakistan with international community through IAEA platform.

National Workshop on Response and Assistance Network (RANET)

Response and Assistance Network (RANET) is an integrated system of IAEA in which its Member States register and pool their capabilities to detect, measure, respond to or mitigate radiological emergencies and, when required, any Member State can request or offer assistance. Pakistan



RANET Workshop Participants

registered its National Assistance Capabilities (NACs) in areas of sources search and recovery, radiation monitoring, environmental monitoring and assessment & advice in year 2008. This system is designed to provide international assistance to Member States to minimize the radiological consequences of accidents.

During the reported year, PNRA arranged a national workshop on "Technical Arrangements for Activating/Deploying National Assistance Capabilities under RANET". The objective of the workshop was to familiarize RANET members with RANET activities, their role and responsibilities and to identify the need of documents for maintaining RANET preparedness in Pakistan. The workshop was attended by representatives from PAEC, KRL and PNRA. PNRA also participated in IAEA RANET related workshops/meetings to review the areas of RANET, preparation of RANET documentations and proposals for the inclusion of new areas of assistance in RANET pool after the Fukushima Accident.

Participation of Pakistan in an IAEA Emergency ConvEx Exercise

Pakistan participated in IAEA emergency exercise called ConvEx-2b which lasted from 30 July to 01 August, 2012 to test processes for requesting and/or providing assistance following a nuclear or radiological emergency under the Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency (Assistance Convention) through RANET forum. RANET setup in Pakistan



NRECC Display Poster and Equipment in an Internal Seminar

was activated during the exercise and simulated assistance was provided to the affected State by activating the related channels for deployment of resources (experts and equipments) to the affected requesting state. The exercise provided an opportunity to test arrangement for activating national assistance capabilities of Pakistan registered under RANET.

Participation in Disaster Management Exhibition 2012

PNRA participated in two days disaster management exhibition jointly organized by Center for Disaster Preparedness and Management, University of Peshawar and Pakistan Science Foundation during November 2012. The purpose of this exhibition was to demonstrate capabilities of different organizations involved in emergency planning & preparedness at national level, increase coordination among the organizations & disseminate related information to general public. PNRA presented radiation monitoring and personal protection equipment in the exhibitions which are used during response to a nuclear or a radiological emergency. PNRA officials briefed the visitors about radiation safety and role of PNRA in protection of workers, public and environment against harmful effects of ionizing radiations. PNRA distributed

number of brochures/pamphlets containing information about actions to be taken by first responders and general public in case of nuclear or radiological emergency, for the awareness of participants.

Training of 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 overexposure due to radiation. In 2012, PNRA arranged four (04) training courses for first responders including RESCUE-1122, SPD, ISI, CDA, KRL, Defense Training Center- Quetta and Casualty Center. A total of 65 personnel were trained on various topics which mainly include concepts about radiation, radiation protection, potential causes of radiological emergency, and radiological emergency preparedness and response.

Training of Medical Professionals in Handling Radiation Injuries

Medical professionals need to have appropriate knowledge regarding management of overexposed and contaminated individuals in case of a radiation accident. PNRA formulated a committee comprising of representatives from PAEC, PNRA,



Measurement of Dose Area Product and X-ray Beam Quality for Radiography Examinations at Radiography Machines

EMERGENCY PREPAREDNESS

PIMS & other relevant organizations in 2005 for the development of national capabilities for management of overexposed and contaminated individuals in case of radiation accidents. The committee focuses special attention on training of medical professionals and arranged several short seminars throughout the country. Ninth meeting of the committee was held in November 2012 and it was agreed that a train-the-trainer program will be launched during next year. Moreover, as

paramedical staff is an integral part of emergency response team, the committee also agreed to hold training courses for paramedics as well. The committee finalized the syllabi of both the courses. The committee also suggested that the forum of morning conferences in the medical centers/hospitals may also be utilized to enhance awareness among medical community. The members agreed to hold next meeting in 2013.



Briefing to DDG IAEA About NRECC

7 PUBLIC SECTOR DEVELOPMENT PROJECTS

PNRA has so far sought six PSDP-funded projects approved by the Government of Pakistan for the capacity building and institutional strengthening of PNRA. A summary of these projects is given 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 (Centre for Nuclear Safety)	480.00	2005–2011
2	Capacity Building of PNRA to Implement National Nuclear Security Action Plan (NSAP)	571.00	2006–2013
3	PNRA's School for Nuclear and Radiation Safety (SNRS)	435.00	2006–2012
4	Establishment of National Dosimetry and Protection Level Calibration Laboratory (NDCL)	292.00	2007–2013
5	National Programme on Environmental Radioactivity Surveillance: Islamabad, Kundian, Karachi (NERSP)	263.00	2007–2013
6	Safety Analysis Centre (SAC) to Provide Regulatory Support and for Indigenization of NPP in Pakistan	463.00	2010–2015

The activities under these projects are briefly discussed in the following sections:

Centre for Nuclear Safety (CNS)

The CNS project completed in 2011. The planning commission expressed the project as excellent in terms of achieving the goal and development of infrastructure within the allocated budget. All the manpower involved in the project was merged in PNRA as its regular workforce. Recurring cost of the project including establishment charges for officers and staff and operating cost of the project has been included as part of the regular budget of PNRA.

Review of SER for Future Plants

Site Evaluation Report (SER) for future plants was submitted by PAEC in December 2011. CNS accomplished review in four months. In addition to review of documents submitted by PAEC, review meetings were held with other departments such as National Institute of Oceanography (NIO); NED University (Civil Engineering Department); Pakistan Meteorological Department (PMD); Geological Survey of Pakistan (GSP); Pakistan Coast Guards (PCG). Additional information submitted by PAEC as per commitments during meetings is being

reviewed and responded accordingly.

Development of C-1 PSA Regulatory Model

CNS is undertaking a Project on PSA Regulatory Model under IAEA-TCP from 2011-2013. The activities under the project are progressing as per plan. Two Coordination & Review meetings were held among PNRA and IAEA experts during the year 2012. In addition, a specific training workshop was organized at PNRA HQ.

Research and Development Activities

CNS conducted analysis for pressurized thermal shock of SRC; Reliability of Class 1E Emergency Diesel Generators (EDG) of C-1; and Steady State behavior of fuel rod for different cases of power variation using FuelSim computer code. The other R&D activities include audit calculations of licensee's submissions for releases of radioactive materials in effluents; verification of atmospheric dispersion at NPP sites; and initiation of a project related to estimation of damage caused due to hypothetical accident in collaboration with PIEAS and NIAB.

PUBLIC SECTOR DEVELOPMENT PROJECTS

Other Major activities performed by CNS

- Review of documents for licensing of safety class equipment manufacturing.
- Provision of technical support in self assessment of PNRA as part of preparation for the forthcoming IRRS mission.
- Assistance in preparation of National Report for Extraordinary meeting on Convention on Nuclear Safety and review of National Reports of other countries as a part of preparation for the meeting.
- Being the National Coordinator for the IAEA International Reporting System on NPP Operating Experience, prepared Pakistan's contribution in consultation with the licensees, and provided access to licensee and PNRA personnel. Reviewed reports of the other countries as a part of lessons learned to be implemented at our NPPs and disseminated the information within PNRA and to the licensee's where applicable.
- Review of modifications such as change in technical specifications regarding reactor coolant pump seal injection flow at C-2 and reinforcement of block masonry wall, seismic support of local electrical control panel and cable trays of DE-DG- 1/2 at K-1.
- Review of manufacturers report on KANUPP steam generator tube assessment and steam generator life assessment.
- Review of design features of C-1 surveillance capsule assemblies test facilities.
- Radiological consequences analysis for PARR-I.
- Analysis of KANUPP containment strength assessment.
- Review of seismic potential and Tsunami Analysis report of Murray Ridge submitted by K-2.
- Review of safety analysis report of Type B(U) package transportation.
- Testing and commissioning of PNRA 325 MWe limited scope simulator.
- Review of K-1 radiation protection program and C-1 annual dose report for the year 2011.
- Development of data base of inspection reports of NPPs.
- Preparation of regulatory guide on format and contents of safety analysis report.
- Comparison of ASME and RCC-M Codes for future application in NPPs design review.

National Nuclear Security Action Plan (NSAP)

The project relates to implementation of National Nuclear Security Action Plan (NSAP) and it was initiated in 2006 for five years and then extended for two more years till June 2013.

Nuclear Security Emergency Coordination Centre (NuSECC)

Nuclear Security Emergency Coordination Centre (NuSECC) established at PNRA is working round the



Planning Commission Team Visited CNS to Assess its Completion Approval



Participants of PNRA-IAEA National Workshop on Nuclear Security Culture



Field Exercise/Drill

clock to assess, coordinate and respond to any incident with nuclear security implications. A number of drills/exercises were conducted at PNRA HQ, and regional offices to test the response procedures and enhance the efficiency of the responders. Assistance was provided to relevant national organizations for the development of National Emergency Response Plan.

Nuclear Security Training Centre (NSTC)

NSTC is functioning at PNRA with the aim “to develop competency through provision of trainings, table top exercises and awareness programs for relevant organizations in the fields of nuclear security”. NSTC, through its professionalism has won a global acclamation and it is termed as a model to emulate in international studies. According to international experts, NSTC can serve as a model centre for nuclear security education and training and provision of technical advice to state's authorities. During the reported period, NSTC has conducted twenty (20) training courses in which three hundred & ninety five (395) personnel from different organizations participated (Figure 33).

NSTC provides technical support to Pakistan Institute of Engineering and Applied Sciences (PIEAS) to implement MS Degree Programme in “Nuclear Engineering with Specialization in Nuclear Security”. PNRA donated equipment for radionuclide Identification to strengthen the capabilities of PIEAS for hands-on training and research in the areas of safety and security.



Ceremony for Donation of Radiation Detection Equipment to PIEAS

Other Major Activities Performed by NSAP

- Established interior physical protection laboratories (intrusion detection system, access control system, CCTV display centre) at Islamabad.
- Prepared inspection procedures, checklists for the guidance of the inspectors.
- Developed software tool “Nuclear Inspector's Tool for Security of SRS” .
- Reviewed physical security plans of the twenty radiation facilities.
- Provided support to regional directorates for inspection of radiation facilities to evaluate physical security systems and measures.
- Coordinated with IAEA for security up-gradation at 11 nuclear medical centers.
- Conducted a number of physical and non-physical searches and secured two orphan radioactive sources.
- Conducted five inspections of nuclear installations to verify the implementation of the physical protection plans.
- Repair & maintenance laboratory was made operational.

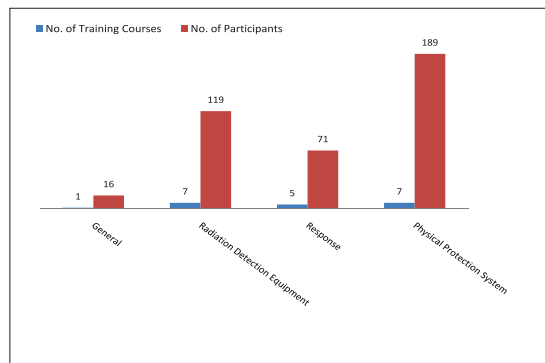


Figure 33: Training Courses Conducted by NSTC During 2012

PNRA School for Nuclear and Radiation Safety (SNRS)

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. Maintaining a sufficient number of highly skilled professionals, with appropriate academic qualifications and adequate experience, for regulatory supervision is one of the key future issue for PNRA. 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) which imparts knowledge and skills to newly recruited officers and conducts refresher courses for existing staff. This Project has been completed in June 2012 and PC-IV of the Project has been submitted to the Planning Commission for evaluation and approval.

SNRS is augmented with a number of laboratories which are equipped with the necessary tools, a soft-panel training simulator, physical models of nuclear power plant equipment, and various computer softwares 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 also initiated training for other stakeholders who have a role in maintaining radiation safety in the country and whose



Participants of the 3rd Basic Mangement Course Organized by SNRS

professional training is therefore important.

SNRS has arranged a number of courses from 2006 to 2012. During 2012, SNRS conducted 25 training courses and 9 special lectures. Around 1500 participants from PNRA, PAEC and other stakeholder organizations and students from different universities participated in these events (Figure 34 and Figure 35).

A soft panel training simulator has been designed and developed with the help of ICCC-PAEC which is primarily intended for training of technical officers involved in review & assessment, inspection and enforcement activities of NPPs as well as officers engaged in safety research and development activities related to deterministic and probabilistic safety analysis. The Simulator covers the plant operation from cold shutdown to full power and full power to cold shutdown during normal operation and it also covers the abnormal operating events and accident conditions.

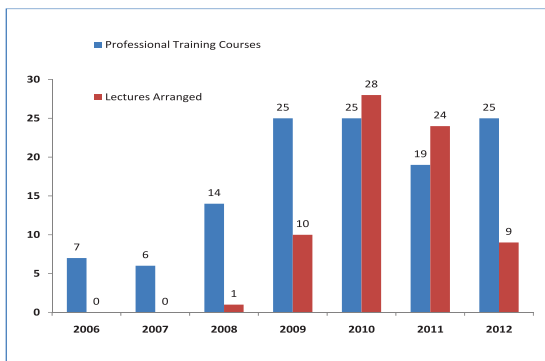


Figure 34: Training Courses and Lectures Conducted by SNRS

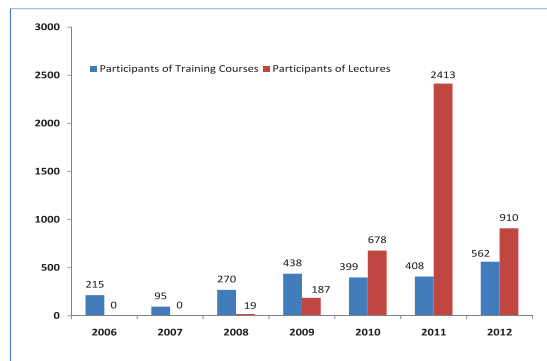


Figure 35: Summary of Participants in Training Courses & Lectures

Physical cut-away models of main equipments of PWR nuclear power plants have been designed and developed at reduced scale for understanding of internal structures and working principles of NPP equipments of Reactor Coolant System.

Virtual Modeling is a powerful support system for training and in-depth understanding of major equipment and systems of NPPs. Virtual Modeling can be used for the personnel training to have better and clear understanding of the parts, cross sections, cladding, assemblies and different 3D views and structure of NPP components.

National Dosimetry and Protection Level Calibration Laboratory (NDCL)

One of the main objectives of PNRA is to ensure the protection of radiation workers and general public from the harmful effects of ionizing radiations. PNRA has developed radiation protection regulations and annual radiation dose limits for occupational workers as well as for general public so that the risk of adverse radiation effects to the human body could be reduced. Assessment of radiation exposure is a fundamental mechanism to ensure the radiation safety of occupational

personnel working at the licensed facilities. In this regard, PNRA is implanting a project for establishment of National Dosimetry and Protection Level Calibration Laboratory (NDCL) with the objective to provide internal and external radiation dosimetry services to the licensed radiation facilities.

External Dosimetry Laboratory

In the reported period, External Dosimetry TLD Laboratory has been established at Islamabad. This lab is equipped with Automatic and Manual TLD Readers and other related accessories. The lab has started provision of external dosimetry services to the radiation workers. TLDs have also been issued to PNRA inspectors involved in the regulatory inspections of radiation facilities for assessment of their personal doses. Moreover, a policy has also been drafted for provision of dosimetry services to licensees which is under review and approval process. Furthermore, NDCL is coordinating with IAEA for the procurement of Automatic & Manual TLD Readers, film badge processing units and accessories for the establishment of second External Dosimetry Laboratory.



Participants of the Workshop on “Quality Assurance in Medical Imaging” at Shifa International Hospital



SNRS Officers Demonstrating Physical Models of NPPs Equipments to Officers of PAEC

Internal Dosimetry Laboratory

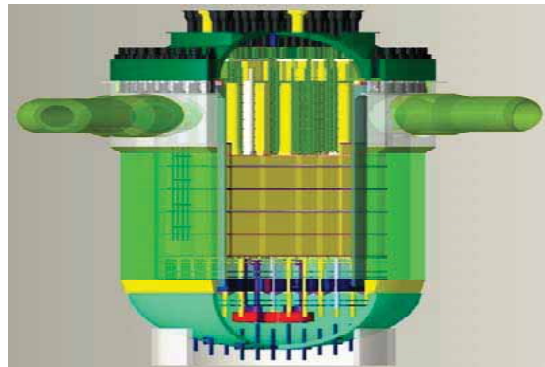
The process has been initiated for establishment of Internal Dosimetry Laboratory which includes a Whole Body Counter and related accessories. The equipment procured through IAEA has been received, and installed while coordination with the vendor experts is continued for installation and calibration of equipment. This is a sophisticated equipment for detailed assessment of internal contamination and performing internal dosimetry of radiation workers. Apart from that, two whole body counters have been procured for quick assessment of internal contamination which are installed at RNSD-II office Chashma and NDCL Lab Karachi.

National Environmental Radiological Surveillance Programme (NERSP)

PNRA has the responsibility to ensure that the public is protected from any buildup of



Preventive Maintenance of Manual TLD Reader 4500



Virtual Model of Reactor Pressure Vessel

environmental radioactivity in the country. The National Environmental Radioactivity Surveillance Programme (NERSP) is aimed at enhancing PNRA's capabilities for monitoring environmental radioactivity, evaluating any buildup of radiation, assessing the doses being received by the public, and verifying the environmental data provided by NPPs. The programme is being implemented by PNRA and entails systematic measurement of radioactivity in soil, air, water, flora and fauna throughout the country. The activities of this project for the reported period are described below:

Establishment of Environmental Monitoring (EM) Labs

Three Environmental Monitoring (EM) Laboratories are being established under this project which 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



Installation of TLD System by Supplier's Expert at NDCL Lab Islamabad



Inner View of WBC System Installed at NDCL Lab Islamabad

environmental data provided by NPPs to PNRA; conducting assessments of food and other items to be exported for issuance of "Radiation Free Certificates"; and preparing and certifying standard reference materials.

The laboratories at Karachi became operational for the analysis of environmental samples after equipping with Gamma Spectrometry System and Liquid Scintillation Analyzer. During the reported year, a large number of soil and air samples were collected from Baluchistan, Sindh and around KANUPP and analyzed at Karachi laboratories. In addition, food samples were also analyzed at Karachi Lab to issue radiation free certifications (NOCs).

The construction of laboratories at Kundian is expected to be completed next year and will be started at Islamabad next year. Meanwhile, the radiochemical processing labs equipped with Liquid Scintillation Analyzer (LSA) and Gamma



Gamma Spectrometry Lab (GSS lab), Karachi

Spectrometry System have temporarily been established at PNRA HQ. During the reported year, a large number of soil and water samples were collected and analyze at Islamabad Laboratories. In addition, different samples of food and other materials were also analyzed at Islamabad Lab to issue radiation free certifications (NOCs).

SAFETY ANALYSIS CENTRE (SAC)

Safety Analysis Centre is a Technical Support Organization (TSO) to provide technical support in safety analysis for NPPs to both regulators and operators without compromising regulatory independence. The project was approved in September 2009; however, actual work on the project was initiated in 2010. Major areas of work of SAC include deterministic and probabilistic safety analysis, structural and seismic analysis, etc. SAC has completed two out of six assigned work packages which are delivered to the users.



Chairman Visit to NDCL WBC Lab at Kundian



PNRA Authority Members Visit to NDCL Lab Karachi.

PUBLIC SECTOR DEVELOPMENT PROJECTS

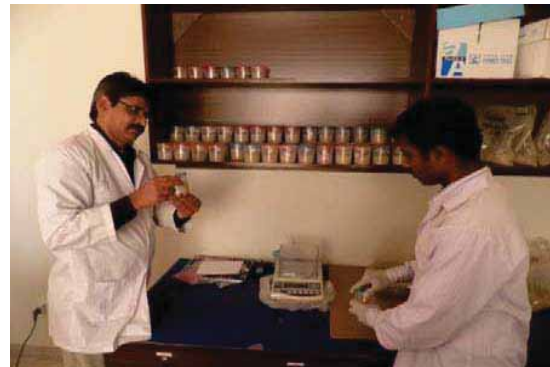


Radiochemical Lab (RC lab), Karachi

SAC performed analysis on a number of important issues including Coupled Field Analysis of Upper Closure Head of C-2 RPV under Operating Conditions, Radiological Consequence Analysis.

Significant activities performed at SAC during the reported period are as follows:

- Development of model and Analysis (by RELAP and MELCOR) required for preparation of K-1 Severe Accident Management Guidelines;
- Development of Regulatory Guide on Format & Contents of Safety Analysis Reports (SARs);
- Evaluation of Codes and Standards (ASME vs RCC-M) for K-2;



Sample Processing Lab, Karachi

- Preparation of basic models for 3 Loop PWR Design Basis Accidents (DBAs), and Beyond Design Basis Accidents (BDBAs) analysis
- Development of PNRA desktop simulator for 3 Loop PWR NPP
- Preparation of analysis reports required for Post Fukushima scenarios for KANUPP

PNRA is establishing a Nuclear Safety Centre (NSC) at KANUPP site, Karachi. The NERSP, NDCL, SAC and Nuclear Safety Inspectorate will be established in this Centre. The ground breaking ceremony of NSC was held on December 31, 2012 by DG (SPD).



Laying Foundation Stone of NERSP Lab at Chashma



Glimpses of Ground Breaking Ceremony of Nuclear Safety Centre



Ground Breaking Ceremony of PNRA Nuclear Safety Centre at Karachi

8 NATIONAL AND INTERNATIONAL COOPERATION

The national and international cooperation with stakeholders plays a vital role in the performance of PNRA regulatory functions to ensure safe operation of nuclear installations and radiation facilities.

At the national level, PNRA has suitable interaction with other national regulators such as, Oil and Gas Regulatory Authority (OGRA), the Pakistan Telecommunications Authority (PTA), Public Procurement Regulatory Authority (PPRA), Civil Aviation Authority (CAA), National Electric Power Regulatory Authority (NEPRA), Pakistan Environmental Protection Agency (PEPA), National Disaster Management Authority (NDMA), Planning Division, and other governmental organizations in safety and regulatory activities. PNRA links are maintained with national institutes and universities to keep abreast with latest national and international research & development and training activities.

At the international level, PNRA interacts with various institutions and organizations under bilateral and multilateral cooperation programmes to place its staff for higher studies and better technical competence to perform regulatory functions. PNRA provides assistance to the Government of Pakistan in execution of its obligations under the four international conventions to which Pakistan is a signatory. In addition, IAEA assists PNRA under various technical cooperation programs for capacity building and PNRA provides experts to IAEA for international regulatory missions, conduct training courses in

other countries and development of IAEA documents and training material. PNRA is also developing a centre of excellence for providing services and training on nuclear security at national and international level.

National Linkages

Relations with Licensees

PNRA maintains a relationship of mutual respect and trust with all its licensees. A dedicated Advisory Committee on Improving Utility-Regulatory Interface (ACIURI) exists to resolve issues which may arise between the licensee and PNRA.

This year PNRA communicated questionnaire to licensees, using radioactive sources of category I & II, to get feedback on regulatory action to assess its performance. In addition, regulatory coordination meetings with licensees are arranged to monitor the progress on safety activities, regulatory activities, etc.

In 2012, PNRA arranged around fifty training courses for licensees and other stakeholders in which more than one thousand personnel participated.

Collaboration with National Institutions

PNRA is collaborating with national institutes for improvement of its regulatory performance. For this purpose PNRA holds agreements with the Pakistan Institute of Engineering and Applied Sciences (PIEAS), KANUPP Institute of Nuclear Power Engineering (KINPOE) and Chashma Centre for Nuclear Training (CHASCENT) for training courses, MS programs and sharing of resources such as training facilities, expertise, training materials, research and development, etc. In addition, PNRA has also participated in short training courses at various national academic institutes.

In 2012, twelve (12) officers were awarded fellowships for MS degrees in nuclear engineering at PIEAS and KINPOE. In addition, 145 PNRA officials participated in 57 courses at different



Certificate Distribution Ceremony of Workshop on QA of Nuclear Imaging Techniques

national institutes. A year-wise comparison of training courses arranged in different national institutes is provided in Figure 36.

Relations with Public

The communication of information to the public through lectures, brochures, booklets and timely press releases regarding hazards from undue radiation exposure, protective measures in case of nuclear emergency and any significant event at nuclear installations and radiation facilities is ensured by PNRA. Updates to general public about its activities is also communicated through website www.pnra.org.

In order to create awareness among the general public and workers, various lectures are delivered at institutes and hospitals on the use of radiation for diagnostic and treatment purposes and associated hazards, protection from their harmful effects and nature of the postulated accidents and their radiological consequences. During 2012, PNRA arranged lectures at 10 institutes which were attended by a large number of participants. A summary of lectures delivered at various institutes and the number of participants in each lecture is elaborated in Figure 37.

International Cooperation

Fulfillment of Obligations

PNRA represents the country to fulfill its international obligations under four international conventions to which Pakistan is a signatory. These

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. Pakistan also follows the code of conduct on safety and security of radioactive sources.

During the reported period, PNRA prepared and submitted special national report for second extraordinary meeting of contracting parties of the Convention on Nuclear Safety for review by the member states. PNRA and PAEC also reviewed the reports received from various countries. PNRA led the Pakistan delegation in second extraordinary meeting of about 60 contracting parties to analyze the lessons learnt from the Fukushima accident. Furthermore, PNRA started to prepare Pakistan's sixth national report which is to be submitted to IAEA by August 2013 for the review of the contracting parties of the Convention on Nuclear Safety.

Bilateral and Multilateral Cooperation

PNRA is aware of the importance of bilateral and multilateral cooperation in enhancing regulatory effectiveness and human resource development in the field of nuclear safety and radiation protection. Presently, PNRA has protocol with National Nuclear safety Administration (NNSA) of China and bilateral agreement with Northern Regional Office (NRO) & Nuclear and Radiation Safety Centre (NRSC) of NNSA, China Nuclear Operation Technology Corporation (CNPO) and VUJE Inc. Slovakia, on

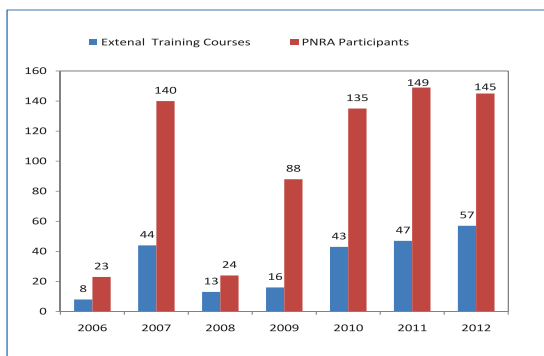


Figure 36: Training Courses and Participants in Various National Institutes

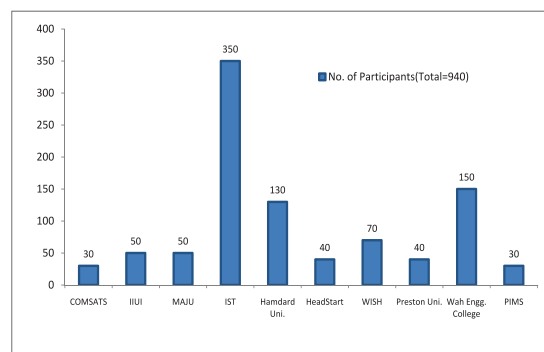


Figure 37: Summary of Lectures Delivered During the Year 2012

NATIONAL AND INTERNATIONAL COOPERATION



Chairman PNRA in Steering Committee Meeting at China

providing assistance in nuclear safety reviews and inspections of pressurized water reactors. However, efforts are underway to develop bilateral relations with the other national regulators.

PNRA is also interacting with United States Nuclear Regulatory Commission (USNRC) for the institutional strengthening and capacity building related to nuclear safety. Both organizations have an understanding to exchange information on issues such as development of severe accident management guidelines, licensing and inspection of fuel cycle facilities and accident analysis.

During the reported period, two PNRA officials returned after one and half year's attachment with USNRC, Washington. Under the protocol with National Nuclear Safety Administration (NNSA), China and agreements with North China Regional Office (NCRO) of NNSA, PNRA posted two officials at NRCO after completing Chinese language studies in Beijing.



6th Steering Committee Meeting on China and Pakistan Nuclear Safety Cooperation

Collaboration with IAEA

PNRA works closely with International Atomic Energy Agency (IAEA) for development and strengthening of regulatory infrastructure in Pakistan in the fields of nuclear and radiation safety and security. PNRA is participating in various IAEA activities such as Technical Cooperation Projects, and Regional Asia Projects. PNRA officials are members of many IAEA committees and they also participate in numerous other forums such as seminars, meetings, training courses, expert missions, etc.

a. IAEA Committees and other Forums

PNRA is an active Member of various IAEA committees, including the Nuclear Safety Standards Committee (NUSSC), Transport Safety Standards Committee (TRANSSC), Waste Safety Standards Committee (WASSC), Radiation Safety Standards Committee (RASSC), Nuclear Security Guidance Committee (NSGC), Advisory group on nuclear



Glimpses of Seminar on Safety Features of Advance PWR

Security (AdSec) and Committee on Safety Standards (CSS). In addition, PNRA participates as a national coordinator in the activities of International nuclear Event Scale (INES) and International Reporting System (IRS). Pakistan is also participating in the activities of Technical and Scientific Support Organization Forum (TSOF) as an observer.

Pakistan is participating in the activities of United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) since 2008 as an observer. However, this year United Nations General Assembly formally granted membership of UNSCEAR to Pakistan. Pakistan is fully devoted to contribute in the objective of this committee. During the reported period, Pakistan shared the environmental monitoring data collected immediately after Fukushima accident, with UNSCEAR to conduct its assessment on levels and effects of radiation exposure due to the nuclear accident in Japan.

Global Nuclear Safety & Security Network (GNSSN) is an important IAEA forum for sharing information on nuclear safety and security world wide. Pakistan is one of the active members of this forum among seventeen participating nations. Pakistan is also chairman of the steering committee of GNSSN.

b. IAEA Technical Cooperation Projects

PNRA is participating in two IAEA Technical Cooperation Projects, “Enhancing Nuclear Safety and Expansion/Strengthening of Regulatory Framework in Pakistan (PAK/9/035)” and “Strengthening Infrastructure for Radiation, Transport and Waste Safety (PAK/9/037)”.

Under project PAK/9/035, a number of activities such as meetings & training courses on development of PSA regulatory model & severe accident management guidelines, research reactors safety reviews, aging management, testing, maintenance and inspections events and procurement of equipment was completed as planned for year 2012. Under project PAK/9/037, IAEA carried out expert missions to PNRA to conduct workshops on licensing and safety assessment of dual purpose cask used for transportation and long term storage of spent nuclear fuel; safety assessment of Type B(U) packaging to be used for transport of high activity radioisotopes; low power and shutdown PSA model being developed for Chashma Nuclear Power Plant; and for installation of TLD Readers at PNRA Laboratories. Based on impressive implementation, IAEA has extended both these projects till year 2015.



Steering Committee of GNSSN Chaired by DG (C), PNRA

NATIONAL AND INTERNATIONAL COOPERATION



Inauguration of Training course on PSA Regulatory Model Development Activities

In addition to technical cooperation projects, IAEA is also providing funds to upgrade physical protection facilities at medical centers using category I & II radioactive sources and nuclear installations and to arrange training courses for PNRA and stakeholders. During the reported year, training courses on Security of Radioactive Sources; Nuclear Security Culture; Project Management; Physical Protection of Nuclear Material & Nuclear Facilities; and Development of Mobile Expert Support Team (MEST) capabilities in nuclear security application were arranged at PNRA.

c. IAEA Regional Asia Projects (RAS Projects)

PNRA is participating in nine IAEA Regional Asia (RAS) Projects which are related to strengthening national regulatory infrastructure for control of radiation sources; protection of public and the environment from radiation practices; strengthening nuclear regulatory authorities in the Asia and the Pacific region; supporting education and training in radiation protection; development of human resources in nuclear security; education and training in support of Radiation protection infrastructure; etc. Under these projects, officials from PNRA participated in various training courses organized by IAEA. IAEA also assisted PNRA in the procurement of equipment pertaining to radiation protection and environmental surveillance laboratories through extra-budgetary contribution.

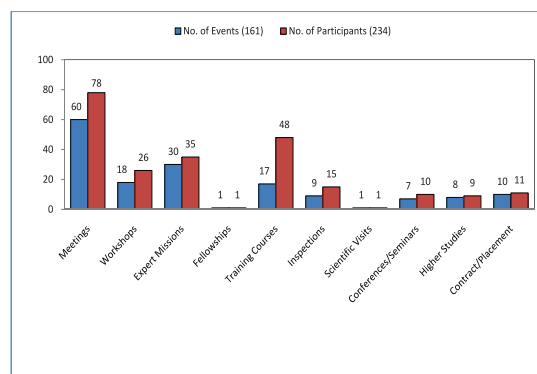


Figure 38: International Trainings/Activities During 2012

d. Expert Missions

PNRA is sharing knowledge and expertise with international community through participation in IAEA activities such as Integrated Regulatory Review Service (IRRS), Emergency Preparedness Review (EPREV), and Regulatory Authority Information System (RAIS). PNRA also provided experts for training courses held in Vienna and other countries such as Bangladesh, Indonesia, Vietnam, Jordan, Nigeria, Belarus venues in the areas of nuclear safety & security, development of regulatory framework, review and inspection, emergency preparedness and response and physical protection.

Participation of PNRA Officials in other International Events

In addition to the above activities, PNRA officials also participate in other international events. During 2012, altogether, around two hundred and fifty PNRA officials participated in more than one hundred and sixty international events. These events include meetings, workshops, training courses, and seminars. Details of these activities are shown in Figure 38.

Research and Analysis in International Affairs

PNRA has started an International Relations Analysts (IRAs) programme jointly with Federal Government and PAEC to cater to the special needs of regulatory work that has an international



PNRA Officials in IAEA Consultancy Meeting on NPP Review & Assessment

dimension. Activities being carried out under this programme include research on international strategic issues that influence regulatory activities. This entails review and analysis of conventions, treaties and protocols related to nuclear safety, security and physical protection, as well as research in the areas of regulatory and strategic importance.

As a part of a programme to expand the outreach of PNRA to national think-tanks, International Relations Analysts (IRAs) have maintained close

liaison with various other organizations such as South Asian Strategic Stability Institute (SASSI), Institute of Strategic Studies Islamabad (ISSI), Islamabad Policy Research Institute (IPRI) and other research institutions, and regularly participate in their seminars, conferences and lectures. This effort not only broadens the horizons of the PNRA mission but also facilitates a synergic approach in dealing with affairs of nuclear regulatory and strategic importance.



Regional Training Course on RAIS 3.2 held in Chile for South American Countries

9 PERFORMANCE REVIEW

Assessment of Performance

As part of its management system, PNRA monitors and evaluates its performance against twelve pre-defined strategic performance indicators to identify the weak areas and to enhance its regulatory effectiveness. These indicators cover all the areas related to responsibilities of PNRA and the establishment of regulatory framework. A rating scale of five levels – Not Acceptable (pink), Unsatisfactory (red), Needs Improvement (yellow), Minimally Acceptable (white), and Satisfactory (green) – is used to assess performance against each indicator. Performance is evaluated qualitatively against predefined targets and goals. The result of the assessment for the year 2012 is summarized in Figure 39 and discussed below.

Indicator 1 (*Ensures that acceptable level of safety is being maintained by licensees*): Regulatory inspections carried out by PNRA inspectors, show that the safety level at all the nuclear installations and most of the radiation facilities remained acceptable. The licensing net of radiation facilities especially X-ray facilities has increased by more than 30 percent during the year. In addition, PNRA arranged a number of training courses for the operators of the radiation facilities. Certification courses for radiation protection officers were also arranged by PNRA during the reported period. Keeping in view these facts, it is assessed that the performance of PNRA against this indicator has improved one step from “Needs Improvement” to “Minimally Acceptable”.

Indicator 2 (*Ensures that regulations and guides are in position and understood by licensees*): During 2012, two new regulations were approved and gazette notified, which include “Safety of Nuclear Research Reactor(s) Operation – PAK/923” and “Transaction of Business of PNRA – PAK/901”. In addition, “Regulations for Licensing of Nuclear Installations – PAK/909” were revised in the light of experience and international feedback. Amendment to include Radiation Protection Officer

(RPO) qualification criteria in “Regulations on Radiation Protection – PAK/904” was also issued. These regulations were forwarded to licensees for comments before approval. Revision of various regulations is under process. However, four regulatory guides that were planned to be issued, are still under preparation. Keeping in view these facts, it is assessed that PNRA's performance rating is lowered one step from “Satisfactory” to “Minimally Acceptable” during the reporting year.

Indicator 3 (*Strives for continuous improvement of its performance*): PNRA has been continuously working hard to improve its performance since its inception. Performance evaluation is carried out at three levels i.e. PNRA level, national level and international level. At PNRA level, Directorate of Regulatory Affairs conducts performance assessment of each Directorate and Project on quarterly basis. Performance evaluation reports of fourth quarter of 2011 and first three quarters of 2012 were issued during the reported period. These reports show that the performance of PNRA is improving continuously. To get a national feedback on its performance and suggestions for further improvement, PNRA prepared and forwarded a questionnaire to its licensees using Category I & II radioactive sources. Response to this questionnaire is quite encouraging. In order to open itself to international peer review, PNRA had requested IAEA for an Integrated Regulatory Review Services mission during the year 2012. The preparatory meeting for IRRS mission that was planned in October 2012 could not be held due to unavoidable situation. Now it would be conducted in March 2013. A pre-requisite of this mission is the self-assessment of the organization. PNRA has initiated self assessment using a newly issued IAEA self assessment tool called “SARIS” - Self-Assessment of Regulatory Infrastructure for Safety. PNRA participated in technical meeting on implementation of IAEA self-assessment methodology and tool. This task of self-assessment is expected to be completed in 2013, before the

Figure-:39 Assessment of PNRA's Performance in 2012

(Indicator 1) Ensures that acceptable level of safety is being maintained by licensees	(Indicator 2) Ensures that regulations and guides are in position and understood by licensees	(Indicator 3) Strives for continuous improvement of its performance
(Indicator 4) Takes appropriate actions to prevent degradation of safety and to promote safety improvements	(Indicator 5) Takes appropriate steps for human resource development and has competent and certified regulatory staff	(Indicator 6) Ensures that legal actions are taken in case of violations of regulatory requirements
(Indicator 7) Performs its functions in a timely and cost-effective manner	(Indicator 8) Ensures that a well established quality management system exists	(Indicator 9) Ensures that adequate resources are available for performing its functions and Technical Support Centre is available for specialist assistance when required
(Indicator 10) Performs its functions in a manner that ensures confidence of the operating organizations	(Indicator 11) Performs its functions in a manner that ensures confidence of the general public	(Indicator 12) Performs its functions in a manner that ensures confidence of the Government

Rating Scale

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

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start of IRRS mission. Keeping all these factors in view, PNRA maintained a "Satisfactory" rating on this indicator.

Indicator 4 (*Takes appropriate actions to prevent degradation of safety and to promote safety improvements*): PNRA reviewed various safety related modifications; technical and safety analysis reports; event reports and other safety related documents submitted by NPPs. As required by PNRA, NPPs conducted safety review of plant systems based on Fukushima accident. K-1, C-1 and C-2 identified the vulnerable areas and prepared to implement the Fukushima Response Action Plan to further improve the safety of the nuclear power plants. PNRA conducted 3 certificate training courses for radiographers for familiarization of regulatory requirements of radiation protection at Islamabad, Karachi, and Lahore. 47 out of 72 participants successfully completed the courses. This year, the number of defaulters has been observed to decrease appreciably. The number of X-ray machines brought into the licensing net have also increased. Based on the steps taken by PNRA to prevent degradation of safety at nuclear and radiation facilities, the performance of PNRA has improved from "Needs improvement" to "Minimally acceptable".

Indicator 5 (*Takes appropriate steps for human resource development and has competent and certified regulatory staff*): PNRA is taking appropriate action to increase strength as well as to enhance the technical capability of the existing staff keeping in view the future programs. During 2012, four fellows joined PNRA after completion of their MS studies at PIEAS and KINPOE, two officers were sent abroad for MS and Ph. D. studies and fourteen (14) officers were awarded new fellowships for MS degrees in PIEAS, KINPOE and other institutes. PNRA arranged 25 training courses and around 560 officials from PNRA, PAEC and other stakeholder organizations participated in these courses. 145 PNRA officials participated in 57 technical and

management courses at various national institutes. In addition, PNRA coordinated with IAEA for training of 74 officers in 35 training courses/workshops in various countries and 36 foreign experts in 14 events, visited for training of PNRA staff and stakeholders and for establishment of Laboratories at PNRA. Therefore, PNRA's performance against this indicator remained "Satisfactory".

Indicator 6 (*Ensures that legal actions are taken in case of violations of regulatory requirements*): To deal with the increasing trend of defaults, enforcement regulations have been Gazette-notified and enforcement procedure has been prepared. 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. During the reported period, PNRA issued legal notices to all the defaulters. As a result, a substantial decrease in defaults has been observed. Although efforts have been made to bring all the defaulters back into the licensing net and to register all the unregistered radiation facilities, a lot is still to be done. Therefore, this indicator remained in "Needs Improvement" band this year.

Indicator 7 (*Performs its functions in a timely and cost-effective manner*): PNRA has performed most of its regulatory activities and achieved targets set for the year 2012 within estimated budgets and schedules. PNRA reviewed various safety related design modifications and conducted daily/routine inspections/surveillances at all nuclear installations. In addition, planned inspections of C-1, C-2 and K-1, and control point inspections of C-3/C-4 and HMC-3 were also conducted. PNRA issued safety class 1 equipment manufacturing license to HMC-3. The regional directorates conducted more than 2300 inspections of radiation facilities including X-ray in the country as per annual plan and issued operating licenses to the operators of K-1, C-1, C-2 and PARR-I in a timely manner. Therefore, this

indicator has been retained as “Satisfactory” this year as was done during the previous year.

Indicator 8 (*Ensures that a well established quality management system exists*): The Management System Manual (MSM) was developed in 2010 and work on its implementation was started immediately afterwards. During the reported period, presentations were made to all PNRA Directorates/Projects for its complete understanding and obtaining feedback for its improvement. Based on this manual, short term strategic goals were identified and gap analysis was conducted to identify missing areas for revision of manual. Some of the directorates/projects conducted self-assessment during the reported period. Procedures to conduct self-assessment and to develop, implement, monitor, assess and revise manual are still needed to be developed. Safety culture policy statement and its attributes were to be developed and the manual was to be revised last year; however, this could not be done and the implementation of MSM was extended for one more year. Based on the delay in activities required to be done under management system, this indicator has been lowered by one step from “Minimally Acceptable” to “Needs improvement”.

Indicator 9 (*Ensures that adequate resources are available for performing its functions and technical support centre is available for specialist assistance when required*): The Public Sector Development Project (PSDP) on establishment of technical support organization in the name of “Centre for Nuclear Safety (CNS)”) to strengthen and enhance PNRA's existing regulatory capabilities for the licensing of future NPPs in the country was successfully completed during the reported period. CNS remained available for specialist assistance to PNRA's technical directorates regarding Review & Assessment of C-1, C-2, C-3, C-4, K-1 and HMC-3. Now PNRA is solely capable to review the safety analysis reports of NPPs and to conduct relevant audit calculations without any assistance from the

vendor countries. PNRA had established another technical support organization in the name of Safety Analysis Centre (SAC) for the southern region of the country in 2009, which would perform safety related analysis both for regulatory body as well as for the operating organization. In 2012, the centre continued to develop expertise in deterministic and probabilistic safety analyses. Both the technical support organizations have started contributing in the safety review and assessment. Therefore, performance of PNRA has improved by two steps from “Unsatisfactory” to “Minimally acceptable”.

Indicator 10 (*Performs its functions in a manner that ensures confidence of the operating organization*): In 2012, PNRA conducted coordination meetings with the licensees of NPPs, to discuss the progress of safety activities being performed at the plants, hindrance in implementation of necessary corrective actions and to check the performance of the regulatory staff responsible for regulatory inspections. PNRA arranged two training courses for personnel working at radiation facilities. Personnel from NPPs participated in various training courses arranged by PNRA and vice versa. PNRA routinely shares the draft regulations with the NPPs' licensees for their feedback and share the international feedback on safety related issues. However, PNRA lacks in disseminating information regarding radiation related events in the world to radiation facilities. Therefore, PNRA's performance on this indicator is lowered by one step from “Satisfactory” to “Minimally Acceptable” during 2012.

Indicator 11 (*Performs its functions in a manner that ensures confidence of the general public*): PNRA keeps the general public informed about its activities through its annual report and by placing relevant information at PNRA's web page (www.pnra.org). PNRA conducted lectures/seminars at more than ten public sector institutions/ universities for awareness & training of the common masses during the reported period.

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More than 1500 students attend these lectures/seminars. Any significant event at radiation facilities and protective measures taken are shared with the public through print and electronic media. It is felt that PNRA's web page needs to be revised to get public comments on PNRA activities. PNRA assessed its performance against this indicator as "Needs Improvement".

Indicator 12 (*Performs its functions in a manner that ensures confidence of the Government*): At international front PNRA continued to fulfil Pakistan's obligations under the four international conventions related to nuclear and radiation safety, to which Pakistan is a signatory. At national level, PNRA regularly holds meetings with Ministry of Foreign Affairs & Finance, Strategic Plans Division,

and other related government authorities on various issues. Against this indicator, PNRA judges its performance as "Satisfactory" for the reported period.

Overall Performance

Based on the evaluation of all the twelve performance indicators, PNRA assess overall performance, against a rating scale of five levels i.e. Not acceptable (pink), Unsatisfactory (red), Needs improvement (yellow), Minimally Acceptable (white) and satisfactory (green). A comparison of its overall performance during the last ten years is given in Figure 40.

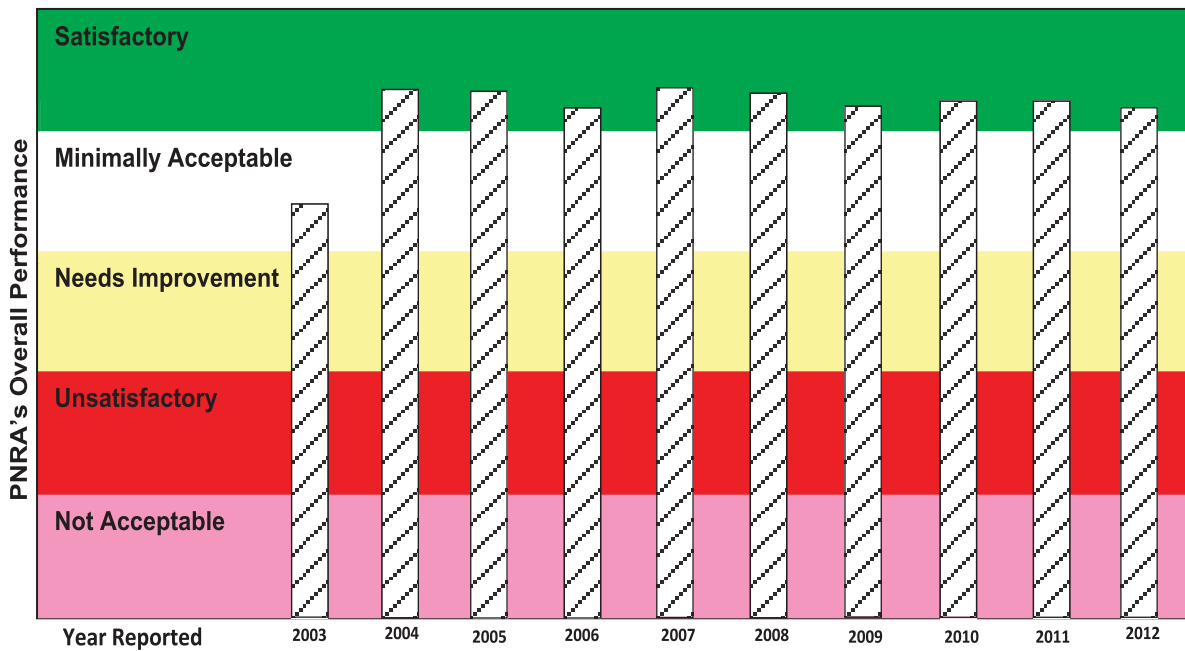
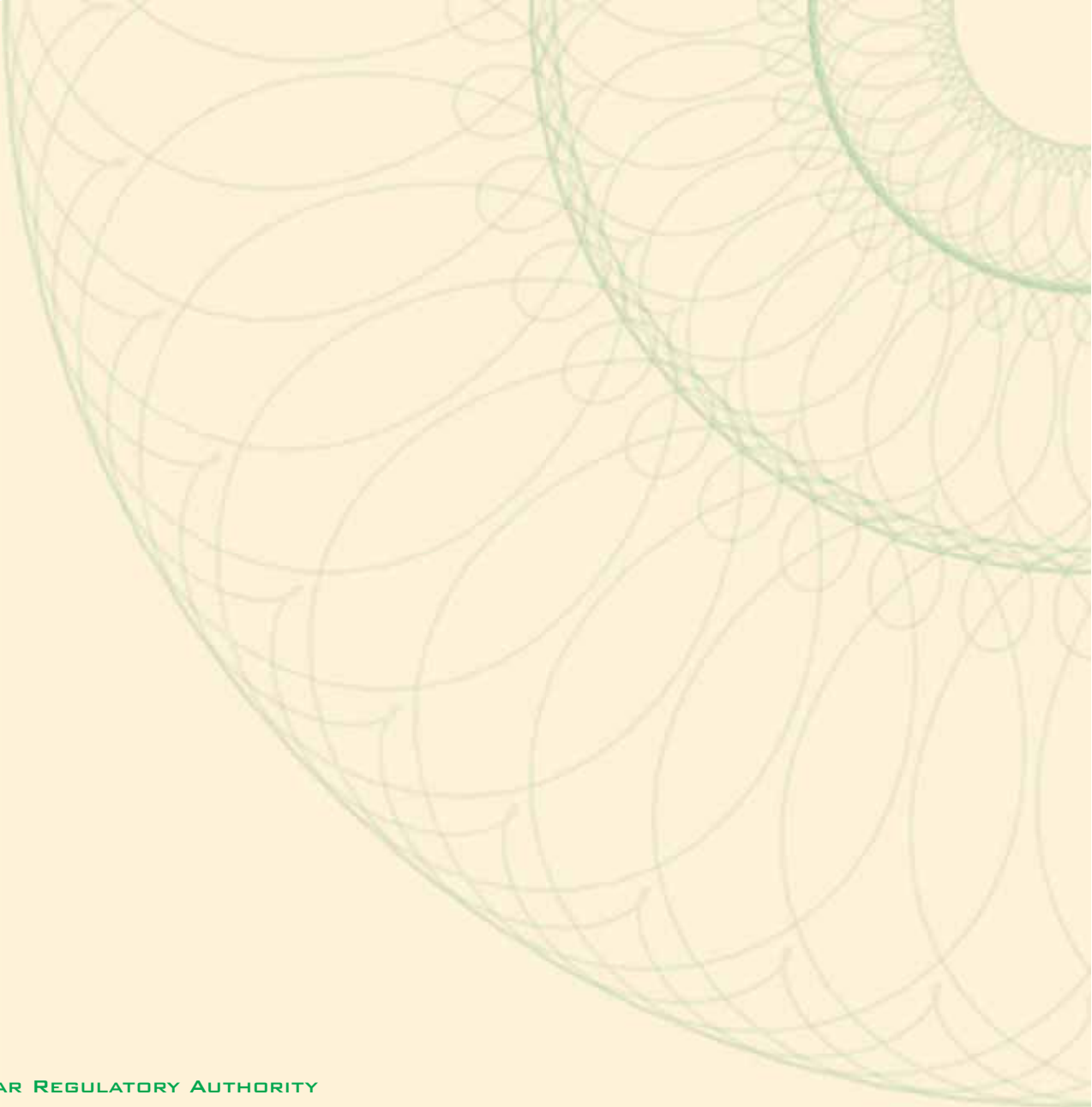


Figure 40: Overall Performance of PNRA Since 2003



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