



ANNUAL REPORT 2017



PAKISTAN NUCLEAR REGULATORY AUTHORITY

Present Members of the Authority



Zaheer Ayub Baig
Chairman



Faizan Mansoor
Member Executive



Mohammad Saleem Zafar
Member Corporate



Lt. Gen. Sarfraz Sattar, HI(M)
Part-time Member



Dr. Muhammad Nuruddin Qazi
Part-time Member



Hussain Ahmad Siddiqui
Part-time Member



Prof. Dr. Tariq Mahmood
Part-time Member



Syed Yusuf Raza
Part-time Member



Farzana Altaf
Part-time Member

Message from the Chairman

I feel honored to present the 17th Annual Report of the Pakistan Nuclear Regulatory Authority for the year 2017. I am delighted for my three decades long association with the nuclear community, responsible for the protection of human health and environment from the harmful effects of radiation, and for presenting the significant achievements of the year as Chairman of the organization.

Regulating nuclear installations, radiation facilities and associated activities is a highly technical and challenging task and requires competent, skilled, devoted and motivated professionals to work in unison and zeal. I am much happy for having a well versed and experienced group of specialists for performing this important obligation in an efficient and effective manner. As a result, PNRA has successfully evolved, from a nascent organization to one of the world's renowned nuclear regulator.

Regulatory decisions require the existence of a comprehensive regulatory framework to control all types of nuclear installations and radiation facilities. Issuance of one revised regulation and three new regulatory guides during this year has further enhanced the regulatory framework. Work on the revision of more regulations and guides for the coming year is in progress.

Regulatory oversight of facilities and activities during the year remained remarkable. Based on satisfactory completion of regulatory process, PNRA has issued a number of authorizations and licences to nuclear installations. I am delighted to share that licensing network of radiation facilities has been increased to around 5000 as a result of rigorous efforts of PNRA.

Because of the technological advancement and day to day innovations in nuclear science and technology, capacity building of regulatory officials is essential for strengthening regulatory control over nuclear activities. I am satisfied with the competence building programme being organized for the regulatory officials during this year. In addition, conduct of a large number of seminars for awareness of public regarding the role of PNRA for ensuring safety is encouraging.

Maintaining close liaison with the international community in various events and activities related to technical support remained above satisfactory during the year. Participation of a significant number of PNRA officials in different IAEA technical activities for supporting and sharing expertise with other Member States is a symbol of PNRA's trust-worthiness at the international front which needs to be further enhanced.

Monitoring and evaluation of organizational performance is pivotal for maintaining and sustaining the progress of the organization. I am glad to share that PNRA has continuously monitored and evaluated the performance of its organizational units and ensured implementation of its strategic plan. In addition, implementation of recommendations and suggestions of IRRS Mission to Pakistan is satisfactory.

I understand and recognize that efficient fulfillment of organizational responsibilities mainly depends on provision of a comfortable work environment and facilitation of workforce. It is appreciating that we have completed more than 90% construction work on residential colony to accommodate our officials at Chashma site during 2017. Similarly, we have significantly improved office infrastructure at HQs. by providing a conducive environment at work places to improve performance.

In the end, I thank the PNRA's management and all employees for their consistent, untiring and dedicated efforts for the upcoming challenges and carrying forth PNRA's legacy and obligation to serving the public. I would also like to reaffirm my commitment to the PNRA's cause of effectively regulating all nuclear installations, radiation facilities and associated activities in the country. To realize this aim, myself and my team feel proud and committed to face and tackle the challenges arising in the course of our activities and determined to enhance regulatory compliance for ensuring protection of workers, public and environment from harmful effects of ionizing radiation.



(Zaheer Ayub Baig)

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

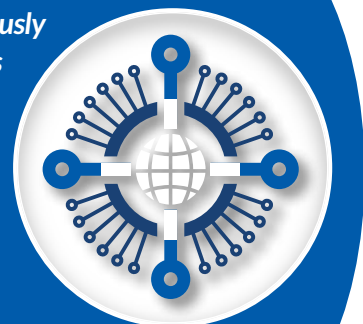
To ensure the safe operation of nuclear facilities and protect the radiation workers, general public and the environment from the harmful effects of radiation by formulating and implementing effective regulations and building a relationship of trust with the licensees and maintaining transparency in 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





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1. Introduction

Background

Pakistan Nuclear Regulatory Authority (PNRA) was established in 2001 through promulgation of Pakistan Nuclear Regulatory Authority Ordinance to regulate all nuclear installations, radiation facilities and associated activities in Pakistan. Though, PNRA was established in 2001 as a national nuclear regulator, independent from the promoters, however, regulatory setup existed for more than four decades in Pakistan even before PNRA's creation. The importance of nuclear safety was realized as early as Pakistan started research and development for "Atoms for Peace" program in the country in early 1960's. Pakistan's first milestone in using nuclear energy for the benefit of mankind was the installation of first Research Reactor by Pakistan Atomic Energy Commission (PAEC), Islamabad.

Before its commissioning, a small safety body namely "Pakistan Nuclear Safety Committee (PNSC)" was established in 1964 within PAEC with the responsibilities to look after the safety issues of the Research Reactor. Meanwhile, the Government of Pakistan signed an agreement, in mid 60s, with the Government of Canada for the construction of Karachi Nuclear Power Plant (KANUPP). In order to carry out the safety evaluation and grant permission for the startup and power operation to power plants in Pakistan, a "Nuclear Safety and Licensing Division (NSLD)" was established within PAEC in 1970.

The responsibilities of NSLD were limited to the safety issues within the establishments of PAEC and there was a need to bring all the users of radioactive materials and radiation generators under the regulatory net. In view of this, the Government of Pakistan promulgated Pakistan Nuclear Safety and Radiation Protection (PNSRP) Ordinance in 1984, under which the Directorate of Nuclear Safety and Radiation Protection (DNSRP) was established for regulating nuclear safety and radiation protection in the country. This body continued its functions under the administrative control of PAEC.

Pakistan signed the Convention on Nuclear Safety in 1994 which required the Member States to ensure effective separation between the regulatory body and the organizations responsible for the promotion of nuclear energy. As a first step, the Government of Pakistan established "Pakistan Nuclear Regulatory Board (PNRB)" in 1994 as a quasi independent regulatory body, as partial

fulfillment of the obligations of the Convention. Finally, in 2001, complete fulfillment of international obligation was made when the Government of Pakistan established PNRA as an independent regulatory body in Pakistan. Various phases of evolution of nuclear regulatory regime in the country are graphically depicted in Figure - 1.

PNRA Ordinance delineates the composition of the Authority which consists of a Chairman, two full-time Members, seven part-time Members and a Secretary as a non-voting Member. The Chairman and Members of the Authority are designated by the Federal Government. The part-time Members of the Authority include one eminent professional each from the science, engineering and medical sectors; and a representative each from the Ministry of Health, Pakistan Environmental Protection Agency, Pakistan Atomic Energy Commission; and Strategic Plans Division of the Joint Staff Headquarters.

The Ordinance entrusts PNRA with various functions and defines the scope and domain of vested regulatory powers. The regulatory paradigm for nuclear installations and radiation facilities and activities in Pakistan is quite multifarious which includes nuclear power plants, research reactors, radioisotope production facility, nuclear medicine centers, radiotherapy centers, irradiators, industrial and agricultural facilities using radioactive materials, diagnostic radiology centers, etc. The Ordinance mandates the Authority to ensure protection of life, health and property against the potential risk of ionizing radiation from all such installations, facilities and activities by formulating and implementing a comprehensive regulatory framework.

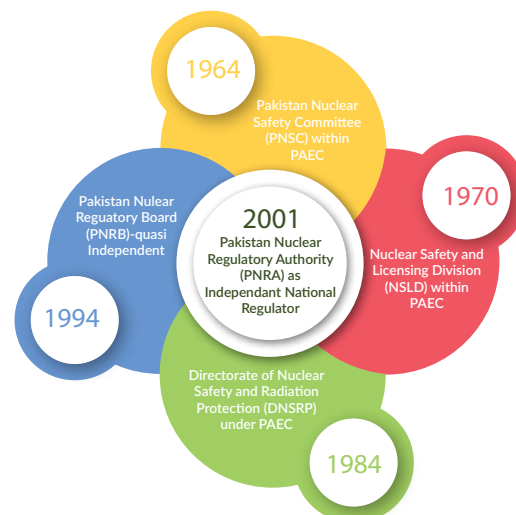


Figure-1: Evolution of Independent Regulatory Regime in Pakistan

The regulatory functions and domains of PNRA are graphically summarized in Figure - 2.

PNRA Headquarters is located in Islamabad. It houses various departments with responsibilities for development of regulatory framework; licensing; review and assessment; technical support; human resource development; administration; and finance. In addition, PNRA has regional offices in Islamabad, Karachi, Kundian, Multan, Peshawar and Quetta which are mainly tasked with inspection and enforcement responsibilities. The organizational structure of PNRA is shown in Figure - 3.

Structure of PNRA Annual Report 2017

Every year, PNRA monitors the progress of its activities and evaluates its performance against defined indicators. This progress and evaluation is presented in PNRA's Annual Report. This document is the Annual Report of PNRA for the year 2017 which presents activities and accomplishments of PNRA during this year.

Chapter one of this report summarizes the evolution of nuclear safety, functions of PNRA and highlights major achievements of the reported year and the anticipated targets for the upcoming year.

Chapter two describes the activities and regulatory framework of PNRA for the safety of nuclear installations, radiation facilities and associated activities. It highlights PNRA's efforts for the development of regulatory framework. This chapter also provides insight on the management system of PNRA.

Chapter three presents PNRA activities in respect of controlling and regulating nuclear installations and associated activities along with the trend and analysis of

worker's exposures. Chapter four covers details regarding licensing, inspections and exposure of workers in radiation facilities along with the details regarding licensing and authorizations issued for import and export of radiation sources in the country.

Chapter five summarizes PNRA activities related to regulatory control of radioactive effluents and management of radioactive waste. Chapter six of this report presents description of activities related to operation and maintenance of national radiation emergency coordination centre, review and approval of emergency response plans, conduct and evaluation of drills/exercises and related activities.

Chapter seven of this report highlights PNRA efforts for the capacity building of professionals through in-house, national and international trainings; and infrastructure development made during 2017. It also describes the in-house training capabilities, training linkages and arrangements with other institutions and organizations.

Chapter eight of this report covers information about PNRA's coordination with Government organizations, education and research institutes; its public outreach campaign at national level; and with other countries and organizations at international level. It also highlights PNRA contributions towards international community for promoting and strengthening global nuclear safety and security regime.

Chapter nine of this report presents the activities and progress made by technical support centres, PNRA laboratories and development projects during 2017. Chapter ten of this report summarizes PNRA's performance and its corresponding indicators based on the achievements made and shortcomings identified during the year 2017.

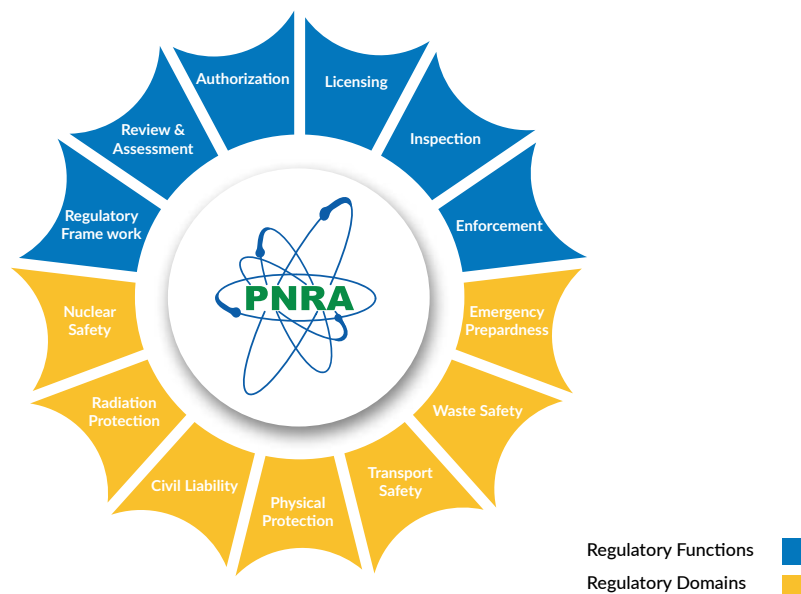


Figure-2: Regulatory Functions and Domains of PNRA

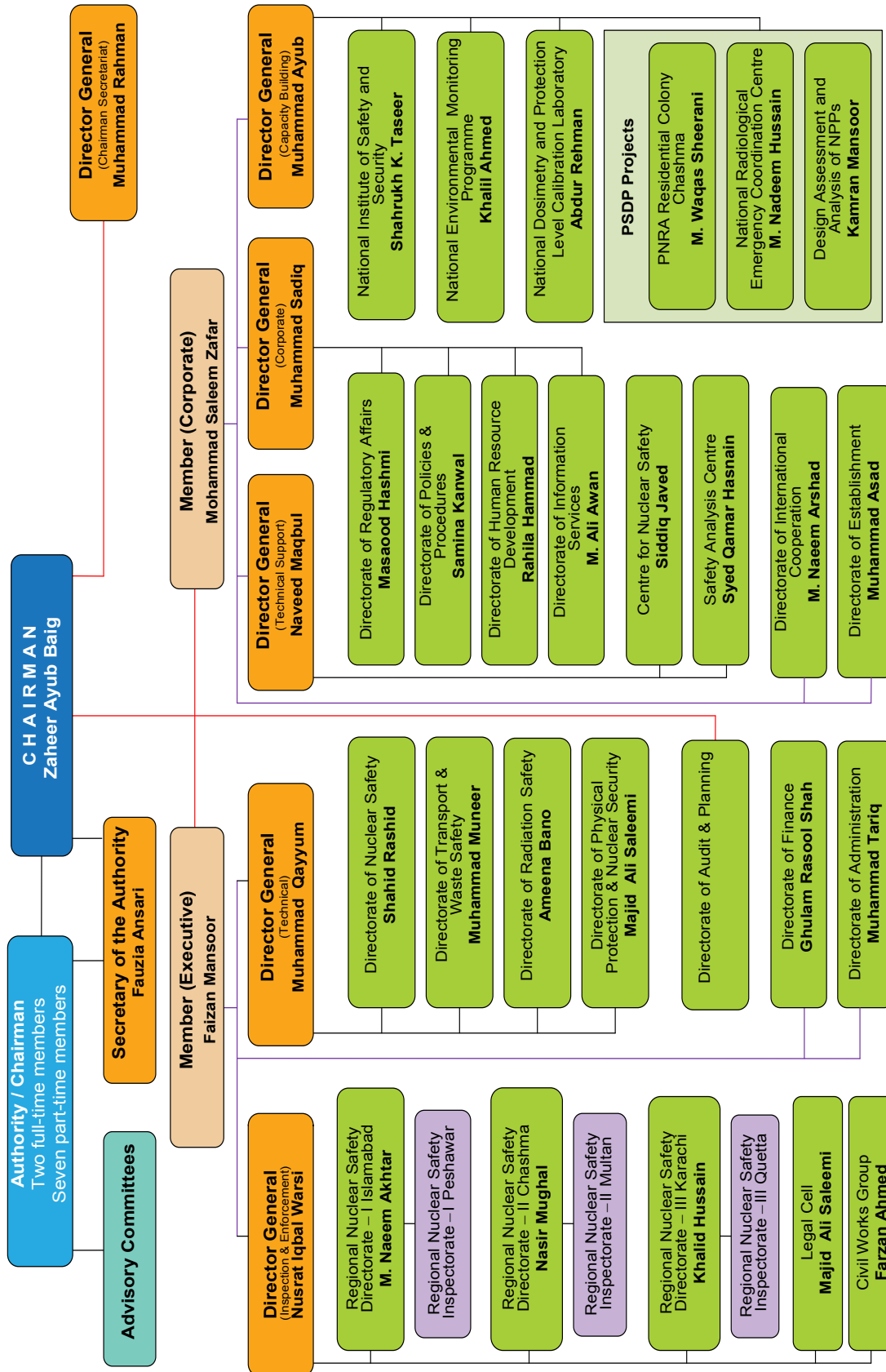


Figure - 3: Organizational Structure of PNRA



Former Chairman Handing Over Charge of Chairman PNRA to Mr. Zaheer Ayub Baig

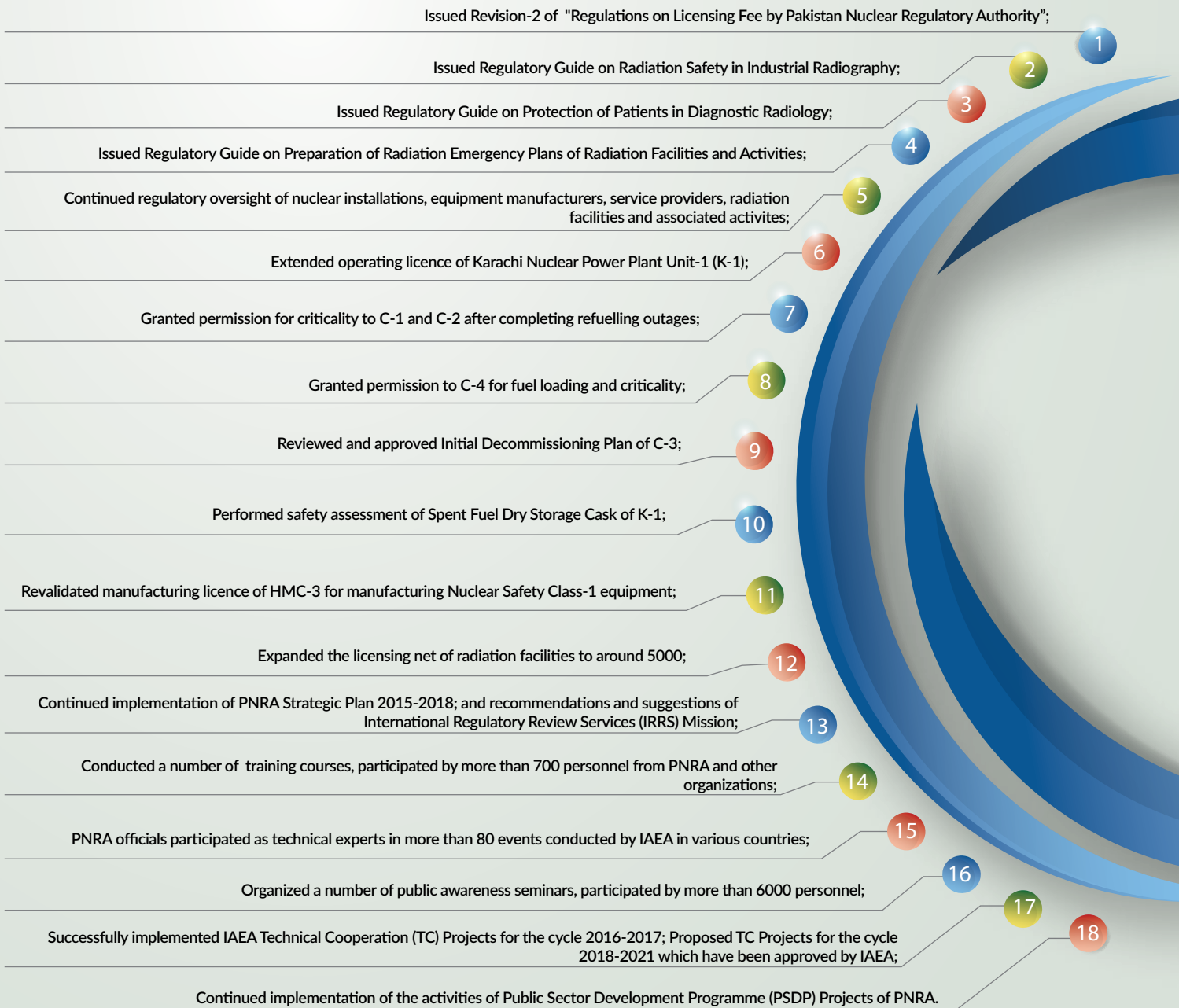


Mr. Zaheer Ayub Baig Addressing PNRA Officials After Taking Charge as Chairman PNRA



Major Activities in 2017

Major achievements of PNRA during 2017 are summarised as follows:





Targets for 2018

The targets set for 2018 are summarised as follows:

- 1 Issuance of Pakistan Nuclear Regulatory Authority Dispute Resolution Regulations;
- 2 Issuance of Regulations for Licensing of Nuclear Safety Class Equipment and Components Manufacturers (Rev.1);
- 3 Issuance of Regulations on Radioactive Waste Management (Rev.1);
- 4 Issuance of Regulatory Guide on Format and Contents of Radiation Protection Programme of Radiation Facilities / Activities;
- 5 Issuance of Regulatory Guide on Format and Contents of Physical Protection Programme of Nuclear Installation(s);
- 6 Issuance of Operating Licence to Chashma Nuclear Power Plant Unit-3;
- 7 Issuance of Operating Licence to Chashma Nuclear Power Plant Unit-4;
- 8 Issuance of Nuclear Safety Class equipment manufacturing licence to NEW-2;
- 9 Grant design approval certification of Spent Nuclear Fuel Dry Storage Cask for K-1 spent fuel;
- 10 Site Registration of Spent Fuel Dry Storage Facility at Chashma site;
- 11 Perform safety assessment of Dry Storage Cask for CNPGS spent nuclear fuel;
- 12 Further expanding the licensing net of diagnostic radiation facilities;
- 13 Conduct of 4th regulatory audit of PNRA departments;
- 14 Continue regulatory oversight of nuclear installations, equipment manufacturers, service providers, radiation facilities and associated activities;
- 15 Continue implementation of PNRA Strategic Plan 2015-2018;
- 16 Continue implementation of recommendations and suggestions of International Regulatory Review Services (IRRS) Mission;
- 17 Continue cooperation with national and international organizations;
- 18 Continue implementation of activities of PSDP Projects of PNRA.



2. Regulatory Framework and Management System

The Government of Pakistan has established PNRA to supervise, control and regulate all matters related to nuclear safety and radiation protection in the country. This regulatory control requires availability of necessary legislation, regulations and guides for governing nuclear installations, radiation facilities and associated activities. PNRA regulatory framework originates from its Ordinance, which is a top level document and empowers the Authority to develop, issue and enforce necessary regulations for ensuring nuclear safety and radiation protection. PNRA

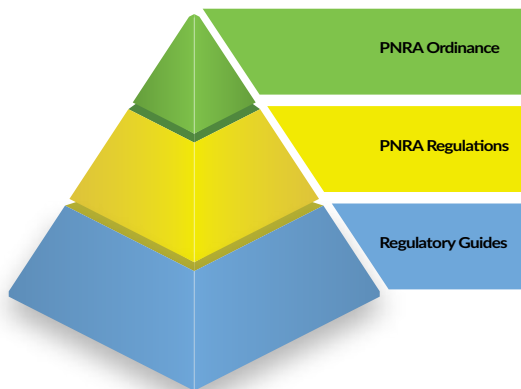


Figure - 4: Statutory Framework for the PNRA's Regulatory Operations

continuously enhances its regulatory framework through development of new regulations and revision of existing regulations. This has significantly strengthened effective regulatory control over nuclear installations and radiation facilities.

The regulatory framework of PNRA is depicted by the pyramid given in Figure - 4. The top tier of the pyramid comprises PNRA Ordinance, promulgated by the Government of Pakistan in 2001. The Ordinance delineates the composition, objectives, structure, powers and functions of the Authority. The second tier of the pyramid represents the regulations. The regulations establish administrative and technical requirements which are mandatory and their compliance is ensured through regulatory inspections; review and assessment; and enforcement mechanisms / processes. The third tier of the pyramid illustrates the regulatory guides. The regulatory guides are not mandatory, however, are developed to guide the licensees in situations where they face difficulties in implementing the regulatory

requirements. The regulatory guides present the acceptable methodology for compliance with such regulatory requirements. The licensees have the freedom to choose alternate method for fulfillment of regulatory requirements, however, they have to demonstrate that the adopted method will provide similar or higher level of safety as that presented in PNRA regulatory guide.

PNRA Regulations

Regulations are developed to set out safety requirements for the applicants / licensees of nuclear installations, equipment manufacturers, service providers and radiation facilities with the aim to perform such activities in a safe manner ensuring protection of workers, public and environment from the harmful effects of ionizing radiation. The development of regulations follows a rigorous process which also includes feedback from all concerned stakeholders including public. The draft regulations are uploaded on PNRA website for comments from the public, licensees and interested parties. This process has been very useful in improving the regulations and gaining public acceptance.

The regulations once approved by the Authority are notified in the official gazette and are placed at PNRA website (www.pnra.org) for information and use by all concerned.

The "Regulations on Licensing Fee by Pakistan Nuclear Regulatory Authority - (PAK/900) (Rev.2)" was revised and gazette notified during the year 2017. During the reporting year, development of following new regulations remained in progress:

1. Pakistan Nuclear Regulatory Authority Dispute Resolution Regulations - (PAK/902);
2. Regulations on Authorization of Organizations for Non Destructive Examination (NDE) of Safety Class Equipment for Nuclear Installation(s) - (PAK/906);
3. Regulations for the Safe Management of Spent Nuclear Fuel - (PAK/918);
4. Regulations on Physical Protection of Nuclear Material(s) and Nuclear Installation(s) - (PAK/925); and

- Regulations on Security of Radioactive Source(s) - (PAK/926).

Moreover, the regulations which remained in the process of revision, during reporting year, include:

- Regulations on Radiation Protection - (PAK/904);
- Regulations for Licensing of Nuclear Safety Class Equipment and Components Manufacturers - (PAK/907);
- Regulations for the Licensing of Radiation Facility(ies) other than Nuclear Installation(s) - (PAK/908);
- Regulations on the Safety of Nuclear Power Plant Design - (PAK/911);
- Regulations on the Safety of Nuclear Power Plants Operation - (PAK/913);
- Regulations on Management of a Nuclear or

Radiological Emergency - (PAK/914);

- Regulations on Radioactive Waste Management - (PAK/915); and

- Regulations for the Safe Transport of Radioactive Material - (PAK/916).

PNRA Regulatory Guides

Regulatory guides play a significant role in developing the understanding and effective implementation of regulatory requirements set forth under PNRA regulations. These guides are issued by PNRA for facilitating its licensees to comply with the regulatory requirements. These bear a non-mandatory status and are placed in the lowest tier of PNRA's regulatory framework.

PNRA has adopted an affable approach for regulating nuclear installations in the country by allowing its licensees to follow the latest versions of applicable IAEA Safety and Security Standards or the US-NRC regulations and

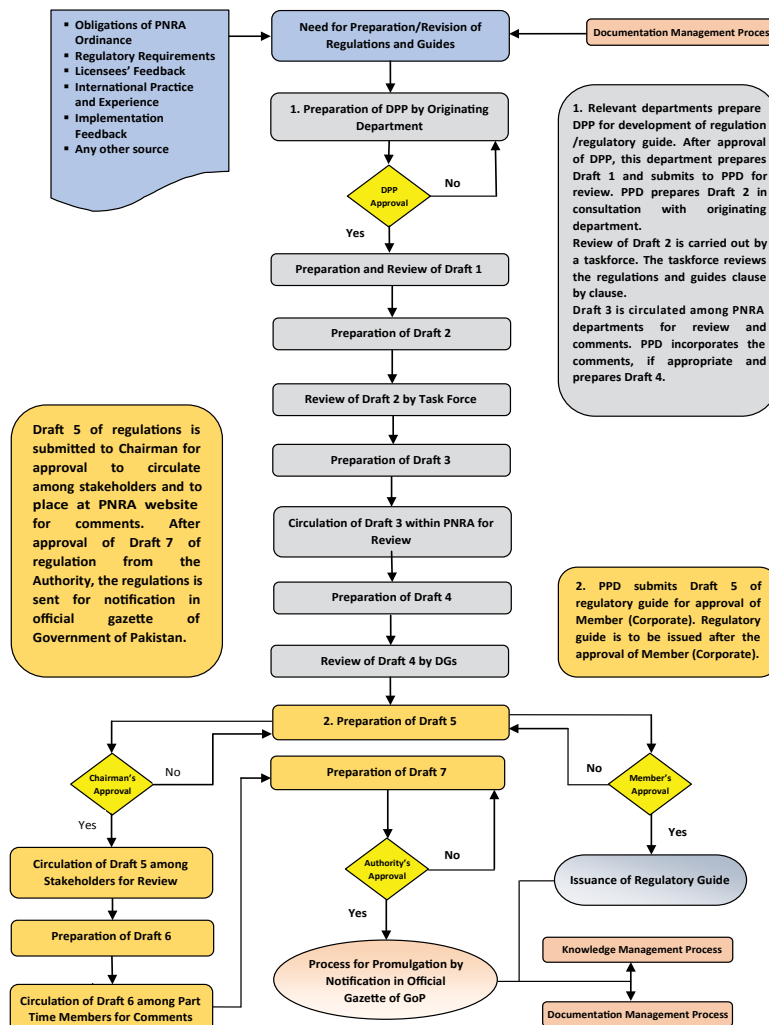


Figure - 5: Process for Development of PNRA Regulations and Guides

regulatory guides in the areas where PNRA regulations and regulatory guides have not been developed, so far.

PNRA issued following new regulatory guides, during the year 2017:

1. Radiation Safety in Industrial Radiography (PNRA-RG-904.03);
2. Protection of Patients in Diagnostic Radiology (PNRA-RG-904.05);
3. Format and Contents of Radiation Emergency Plans of Radiation Facilities and Activities (PNRA-RG-914.02);

Progress on development of following guides continued during the reporting year:

1. Radiation Protection and Safety in Radiotherapy (PNRA-RG-904.06);
2. Format and Contents of Radiation Protection Programme of Radiation Facilities/Activities (PNRA-RG-904.07);
3. Guidelines for Medical Professionals on Transport, Diagnosis & Management of Overexposed & Contaminated Individuals in Radiological Emergency (PNRA-RG-904.08);
4. Format and Contents of Physical Protection Programme of Nuclear Installation(s) (PNRA-RG-909.02);
5. Format and Contents of Radioactive Waste Management Programme of Nuclear Medicine Centers (PNRA-RG-915.01);
6. Format and Contents of Radioactive Waste Management Programme of Nuclear Installation(s) (PNRA-RG-915.02); and
7. Format and Contents of Environmental Monitoring Programme of Nuclear Installation(s) (PNRA-RG-915.03).

Moreover, a regulatory guide on "Format and Contents of Application for Design and FSAR Modification in Nuclear Installations" is currently in the process of revision based on the experience feedback. The process for preparation and issuance of PNRA regulations and regulatory guides is presented in Figure - 5.

PNRA Management System

PNRA management system is a framework of processes and procedures developed and established to ensure that PNRA is executing its functions and responsibilities

for ensuring nuclear safety and radiation protection in a systematic, effective and efficient manner.

The PNRA Management System Manual (MSM) is a top level document in the documentation structure of PNRA management system. It determines organizational structure, policies, processes, activities, resources and related procedures which provide direction to all individuals on how to carry out assigned tasks in order to achieve PNRA's vision, mission and goals. The PNRA MSM covers the whole PNRA organization and is aimed to be applicable to all processes and activities of PNRA.

The PNRA MSM describes the processes and procedures for performing regulatory functions and responsibilities in a systematic and effective manner. This ultimately leads to ensuring safety at nuclear installations and radiation facilities to protect the radiation workers, public and the environment from harmful effects of ionizing radiation. It integrates all elements of management including vision, mission, core values, organizational structure, tasks and functions; leadership and management for safety; approach towards monitoring, assessment and improvement; etc.

During the year 2017, PNRA initiated an awareness programme on its updated Management System Manual (MSM) with the aim of its understanding among PNRA officials and its implementation within PNRA. Accordingly, awareness sessions on MSM were conducted in a number of departments at PNRA HQs.

Monitoring & Assessment of PNRA Regulatory Processes & Activities

PNRA has developed a detailed mechanism for monitoring and assessment of all the regulatory processes with pre-defined frequencies in order to evaluate their effectiveness. In this regard, PNRA performs different types of monitoring and assessments of its processes and activities such as annual progress monitoring of strategic plan, quarterly performance evaluation, self assessment, annual performance assessment, independent assessment, etc. The monitoring and assessment activities of PNRA Management System are summarized below:

Monitoring of PNRA Regulatory Processes & Activities

PNRA has established a Long Term Strategic Plan 2015-2018 which describes strategic goals, strategies and means to support the strategies to be achieved over the next four years. PNRA monitors the performance review of strategic plan on annual basis and provides feedback to senior / top management and relevant departments for necessary action(s). During the reporting period, PNRA evaluated annual progress of the implementation of the

strategies and activities mentioned in the Strategic Plan 2015-2018 and issued second yearly progress report.

PNRA monitors monthly progress reports of all PNRA departments on quarterly basis against annual work plans of the respective departments. The output of this activity is communicated to relevant departments to take necessary action(s), where required; and to senior & top management for information. During the year 2017, PNRA monitored quarterly performance of all departments and issued four quarterly performance evaluation reports to reflect progress and implementation status of their annual work plans.

In addition, top management holds meetings (Directors' meeting and Chairman's meeting with each department) to monitor the performance of the departments, to get input on issues and future plans. Regional directors' meeting is also conducted periodically to monitor progress of regional activities; and discuss & resolve different regional issues. During the reporting year, Chairman's meetings with each department and two Regional directors' meetings were conducted.

Assessment of PNRA Regulatory Processes and Activities

Self Assessment

Self assessment is conducted to identify and rectify the weaknesses and to enhance safety culture and effectiveness of the processes and activities. PNRA management system requires all departments to conduct their self assessment on biennial basis. During the reporting period, a number of PNRA departments performed their self assessment on the basis of pre-defined criteria and procedures.

The safety culture and leadership self assessment is carried out after every five years. The results of the assessment are communicated in the organization to ensure promotion and continual improvement of safety culture and leadership within PNRA. During the year 2017, PNRA shared its safety culture self assessment results in the 7th review meeting of the Convention on Nuclear Safety held at IAEA Vienna, Austria.

Furthermore, PNRA has established a process of performance evaluation to assess the efficacy of its regulatory business against defined criteria comprising 12 Strategic Performance Indicators (SPIs) and subsequent Specific Performance Elements (SPEs). The overall integrated performance of PNRA during annual performance assessment is presented in its annual report. PNRA conducted its annual performance assessment for the year 2017 and presented it in this annual report.

Based on the evaluation, the overall rating of PNRA is assessed as "Satisfactory" for the year 2017.

Independent Assessment

PNRA conducts independent assessment through regulatory audit of its departments and also invites international organizations for the overall performance evaluation based on IAEA safety standards.

During the year 2017, the follow-up of 3rd regulatory audit was conducted. Furthermore, progress against action plan of International Regulatory Review Services (IRRS) Mission Report was prepared and circulated among all PNRA departments.

Management System Documentation

The management system and the associated documents such as vision, mission, core values, manuals, policies, plans, procedures, guidelines, reports, etc. are controlled and made available to all PNRA employees. These documents are reviewed and revised, if needed, based on feedback; lessons learned; and changes in organizational policies & strategies.

The documentation structure of PNRA comprises three tiers. First tier is known as Level-1 documents which include ordinance, management system manual, vision, mission, core values, organizational structure, tasks and functions, strategic plan, policies, etc. Second tier is Level-2 documents which include processes, programmes, procedures, etc. Third tier is Level-3 documents which include job descriptions, work plans, flow charts, guiding documents, checklists, reports, records, office orders, etc. PNRA management system documentation structure is shown in Figure - 6.

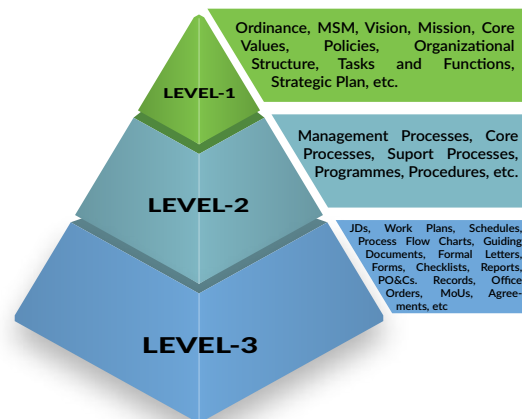


Figure - 6: Management System Documentation at PNRA

Policies

Organizational policies are principles, rules, and guidelines formulated or adopted for achieving its objectives. The policies of PNRA are developed in a systematic manner, documented and implemented to meet the objectives of the organization.

PNRA has issued certain policies to take its position on a particular aspect of compliance with the prevailing rules, regulations and standards for its routine internal working. Such policies usually describe a strategy adopted, by PNRA, from amongst various alternatives to determine and guide present and future decisions on matters of public interest or social concern. These policies have been developed to create common understanding for deciding a course of action, thus ensuring a uniformity of actions within the organization. PNRA has issued nine policies, so far.

During the year 2017, PNRA revised its policy on higher education for technical officers (PNRA-Policy-004/17). Furthermore, following policies remained in process of development:

1. National Safety Policy,
2. Policy on Higher Education of Staff,
3. Policy for Awards on Outstanding Academic Performance,
4. Policy on provision of resource persons to universities / institutions / organizations.

Procedures

Procedures are prepared to identify and define various steps to be carried out by its manpower for completing a specific routine task in an effective manner. PNRA's procedures are of two types. The first are "PNRA Level Procedures" which deal with the tasks involving more than one department; whereas second type of procedures are the "Department Level Procedures" which deal with tasks within a single department. As of yet, PNRA has developed 360 technical and administrative procedures for the effective management of its routine technical and administrative affairs.

Central Registry for Regulatory and Management System Documents

All the documents generated within the regulatory and management system framework of PNRA are controlled as per documentation management process defined in PNRA Management System Manual. All the regulatory documents and various management system documents are centrally registered and maintained. These documents include regulations, regulatory guides as well as policies, and procedures.

The overall status of PNRA regulations, regulatory guides, policies and procedures registered in the central registry is given in the Figure - 7.

List of gazette notified regulations is given in Table - 1 and regulatory guides are listed in Table - 2.

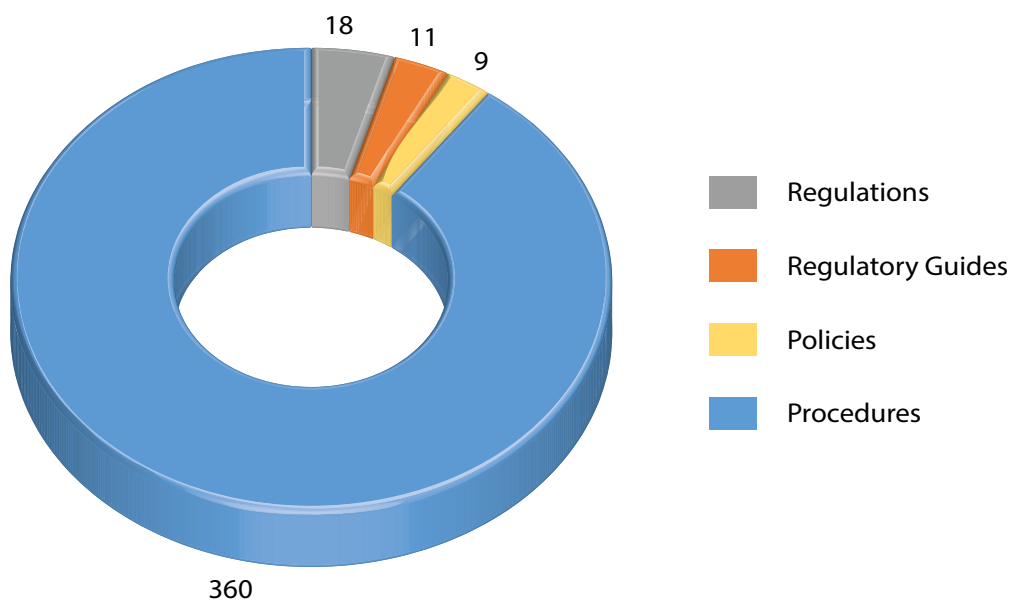


Figure - 7: Status of PNRA Central Registry

Table - 1: List of Gazette Notified Regulations

1	Regulations on Licensing Fee by Pakistan Nuclear Regulatory Authority - (PAK/900)	10	Regulations on Safety of Nuclear Power Plants-Operation - (PAK/913)
2	Regulations on Transaction of Business of Pakistan Nuclear Regulatory Authority - (PAK/901)	11	Regulations on Management of a Nuclear or Radiological Emergency - (PAK/914)
3	Regulations on Radiation Protection - (PAK/904)	12	Regulations on Radioactive Waste Management - (PAK/915)
4	Regulations for Licensing of Nuclear Safety Class Equipment and Components Manufacturers - (PAK/907)	13	Regulations for the Safe Transport of Radioactive Material - (PAK/916)
5	Regulations for the Licensing of Radiation Facilities other than Nuclear Installations - (PAK/908)	14	Regulations on the Safety of Nuclear Research Reactor(s) Operation - (PAK/923)
6	Regulations for Licensing of Nuclear Installation(s) - (PAK/909)	15	Regulations on Decommissioning of Facilities using Radioactive Material - (PAK/930)
7	Regulations on Safety of Nuclear Installations - Site Evaluation - (PAK/910)	16	Pakistan Nuclear Regulatory Authority Enforcement Regulation - (PAK/950)
8	Regulations on the Safety of Nuclear Power Plant Design - (PAK/911)	17	Pakistan Nuclear Safety and Radiation Protection Regulations, 1990
9	Regulations on the Safety of Nuclear Power Plants-Quality Assurance - (PAK/912)	18	Pakistan Nuclear Safety and Radiation Protection (Treatment of Food by Ionizing Radiation) Regulations, 1996

Table - 2: List of Regulatory Guides

1	Quality Assurance in Nuclear Medicine (PNRA-RG-904.01)
2	Guidance for the Users of Iodine - 131 in Nuclear Medicine Centers (PNRA-RG-904.02)
3	Radiation Safety in Industrial Radiography (PNRA-RG-904.03)
4	Protection of Patients in Diagnostic Radiology (PNRA-RG-904.05)
5	Probabilistic Safety Assessment of Nuclear Power Plants Level-1 (PNRA-RG-911.01)
6	Format and Contents of Application for Design Modifications in Nuclear Power Plants (PNRA-RG-913.02)
7	Format and Contents of Application for Modifications in Technical Specifications and Operating Policies and Principles of Nuclear Power Plants (PNRA-RG-913.03)
8	Dosage and Distribution of Potassium Iodide Tablets (a Thyroid Blocking Agent) in Radiation Emergencies (PNRA-RG-914.01)
9	Preparation of Radiation Emergency Plan for Radiation Facilities and Activities (PNRA-RG-914.02)
10	Transportation of Radioactive Material by Road in Pakistan (PNRA-RG-916.01)
11	Registration/Licensing and Issuance of NOC to the Exporter(s) of Radiopharmaceuticals (PAK/9801)



3. Oversight of Nuclear Installations & Associated Activities

PNRA regulates all civilian nuclear installations, nuclear safety class equipment manufacturers and nuclear service providers in the country under the Pakistan Nuclear Regulatory Authority Ordinance, 2001. Nuclear installations in Pakistan include nuclear power plants, research reactors and isotope production facility. Currently, there are eight operational nuclear installations in Pakistan which include five nuclear power plants, two research reactors and one molybdenum production facility. Two nuclear power plants are under construction in the country. Furthermore, two nuclear safety class equipment manufacturers and one service provider for

nuclear installations are also in the regulatory purview of PNRA. In order to regulate nuclear installations and associated activities in accordance with national regulations, PNRA performs various regulatory functions such as licensing & authorization; review & assessment; and inspection & enforcement. A summary of nuclear installations and associated activities in the country under the regulatory purview of PNRA is presented in Table - 3.

Licensing and Authorization

PNRA conducts licensing and authorization of all civilian

Table - 3: Civilian Nuclear Installations and Associated Activities in the Country

S. No.	Licensee / Applicant	Status	Type	Capacity	Start of Operation
1.	Karachi Nuclear Power Plant Unit 1 (K-1)	In Operation	Pressurized Heavy Water Reactor	137 MWe	1972
2.	Karachi Nuclear Power Plant Unit 2 (K-2)	Under Construction	Pressurized Light Water Reactor	1100 MWe	2020 (expected)
3.	Karachi Nuclear Power Plant Unit 3 (K-3)	Under Construction	Pressurized Light Water Reactor	1100 MWe	2021 (expected)
4.	Chashma Nuclear Power Plant Unit 1 (C-1)	In Operation	Pressurized Light Water Reactor	325 MWe	2000
5.	Chashma Nuclear Power Plant Unit 2 (C-2)	In Operation	Pressurized Light Water Reactor	340 MWe	2011
6.	Chashma Nuclear Power Plant Unit 3 (C-3)	In Operation	Pressurized Light Water Reactor	340 MWe	2016
7.	Chashma Nuclear Power Plant Unit 4 (C-4)	In Operation	Pressurized Light Water Reactor	340 MWe	2017
8.	Pakistan Research Reactor-1 (PARR-1)	In Operation	Swimming Pool Reactor	10 MWt	1965
9.	Pakistan Research Reactor-2 (PARR-2)	In Operation	Tank-in-Pool Reactor	30 KWt	1991
10.	Molybdenum Production Facility (MPF)	In Operation	Isotope Production	100 Ci	2013
11.	Heavy Mechanical Complex - 3 (HMC-3)	Authorized	NSC-1 Equipment Manufacturer	--	2016
12.	Nuclear Equipment Workshop - 1 (NEW-1)	Authorized	Service Provider	--	2017
13.	Nuclear Equipment Workshop - 2 (NEW-2)	Authorization in Process	NSC-1 Equipment Manufacturer	--	2018 (expected)

nuclear installations and associated activities in the country. This regulatory oversight encompasses all stages of the lifetime of nuclear installations and includes various licences and authorizations e.g. site registration, construction licence, fuel load permit, operating licence, revalidation of operating licence, etc. This is to ensure that nuclear installations remain under regulatory control from site registration till completion of decommissioning and removal of the site from regulatory control.

As per regulatory framework, these authorizations and licences are issued based on verification of safe design and operation practices. The licences and authorizations normally also impose generic and specific conditions according to the outcome of regulatory processes. PNRA also conducts licensing of operating personnel for nuclear installations in order to ensure that qualified and trained personnel operate these installations according to national regulations and applicable codes & standards.

Nuclear Power Plants

At present, there are two major sites in the country, Karachi and Chashma, where nuclear power plants are located. At Karachi site, one nuclear power plant namely Karachi Nuclear Power Plant Unit-1 (K-1) is in operation and two nuclear power plants namely Karachi Nuclear Power Plant Unit-2 (K-2) and Karachi Nuclear Power Plant Unit-3 (K-3) are under construction phase. At Chashma site, four nuclear power plants namely Chashma Nuclear Power Plants Units 1, 2, 3 and 4 are in operation.

Karachi Nuclear Power Plant Unit-1 (K-1) is operating beyond its design life since 2003. K-1 operating licence (OL) expired on December 31, 2016. During the reporting year, K-1 applied to extend its operating licence which was conditionally extended by PNRA up to September, 2018.

Chashma Nuclear Power Plant Unit-1 (C-1) was disconnected from grid on March 28, 2017 for its 11th Refueling Outage (RFO) and remained shut down for 50 days during the reported year. After successful completion of all planned outage jobs under the regulatory oversight of PNRA, C-1 was granted permission to be made critical on May 15, 2017. Similarly, Chashma Nuclear Power Plant Unit-2 (C-2) which completed its 4th Refueling Outage (RFO) in the year 2017 after successful completion of refueling activities to the satisfaction of PNRA, was connected to grid on January 05, 2017.

Chashma Nuclear Power Plant Unit-3 (C-3), during the reported year, submitted application for issuance of Operating Licence (OL) subsequent to grant of permission by PNRA for grid connection. Subject to satisfactory completion of the review, operating licence is expected to be issued in 1st quarter of 2018. Chashma Nuclear Power

Plant Unit-4 (C-4) was granted permission by PNRA to load fuel after satisfactory completion of its regulatory process. Subsequently, permission to make reactor critical was also granted on March 14, 2017 in order to perform low power and power ascension tests, and subsequent power operation. Consequently, formal grid connection of C-4 was made on July 01, 2017 and achieved its full power (100%) on August 18, 2017. PNRA regulatory oversight continued during all these activities.

Karachi Nuclear Power Plant Unit-2 (K-2) and Karachi Nuclear Power Plant Unit-3 (K-3) are under construction and their fuel loading is expected in 2019 and 2020 respectively. During the reporting period, the major construction activities for K-2 project included construction of containment, safeguard, fuel and electrical buildings; installation of reactor pressure vessel and steam generators; and placement of containment dome. While at K-3, construction of containment and other civil structures remained in progress.

Research Reactors and Molybdenum Production Facility

Currently, Pakistan has two research reactors in the regulatory purview of PNRA. These include Pakistan Research Reactor-1 (PARR-1) which is a swimming pool type research reactor and Pakistan Research Reactor-2 (PARR-2) which is a tank-in pool type research reactor. Licences issued to PARR-1 and PARR-2 are valid till December 2018 and December 2024 respectively.

Molybdenum Production Facility (MPF) is an isotope production facility licensed as a nuclear installation by PNRA. This facility is meant for production of Molybdenum-99 (Mo99) isotope as the mother product for production of Technetium-99m (Tc99m) which is used for diagnosis of different types of cancer. Licence issued to MPF is valid till December 2022.

Nuclear Equipment Manufacturers and Service Provider

At present, there are two equipment manufacturers and one nuclear service provider in the country for manufacture of Nuclear Safety Class-1 equipment and for provision of specialized services to nuclear power plants respectively. These include Heavy Mechanical Complex-3 (HMC-3) and Nuclear Equipment Workshop-2 (NEW-2) as equipment manufacturers and Nuclear Equipment Workshop-1 (NEW-1) as service provider.

Heavy Mechanical Complex-3 (HMC-3) is authorized to manufacture Nuclear Safety Class-1 (NSC-1) equipment for nuclear power plants under construction in the country. The Manufacturing Licence (ML) of HMC-3 expired in

September 2017. HMC-3 submitted application for revalidation of ML during the reported year and after satisfactory completion of the regulatory process ML was revalidated for further five years i.e., till June 2022.

Nuclear Equipment Workshop-2 (NEW-2) submitted an application (along with relevant documents) for obtaining licence to manufacture NSC-1 equipment in the reporting year. The assessment of licensing application and subsequent inspections have been completed. Licensing decision is expected to be finalized in the first half of 2018.

Nuclear Equipment Workshop-1 (NEW-1) has been granted authorization by PNRA to perform Non Destructive Examinations (NDE) during Pre-Service and In-Service Inspections (PSI/ISI) of Nuclear Safety Class 1, 2 and 3 components and systems of nuclear power plants. The authorization is valid till December 2020.

Licensing of Operating Personnel

Licensing of operating personnel for nuclear installations ensures that operating personnel are qualified and trained according to PNRA regulations and applicable codes & standards. Therefore, this licensing process - among other regulatory processes - plays pivotal role for safe and secure operation of nuclear installations in the country.

PNRA conducts oral and operating examinations for award of operating licences to Reactor Operators (RO), Shift Engineers (SE) and Shift Supervisors (SS). The operating licence, once issued, is renewed annually based on verification of technical and professional competence of licensed operating personnel. Furthermore, PNRA keeps continuous oversight on the compliance of retraining and medical fitness requirements of the operating personnel.

Figure - 8 shows the detail of new licences issued to operating personnel whereas, Figure - 9 presents renewed licences to nuclear power plant operating personnel. Similarly, Figure - 10 reflects the issuance and renewal of licences to operating personnel of research reactors

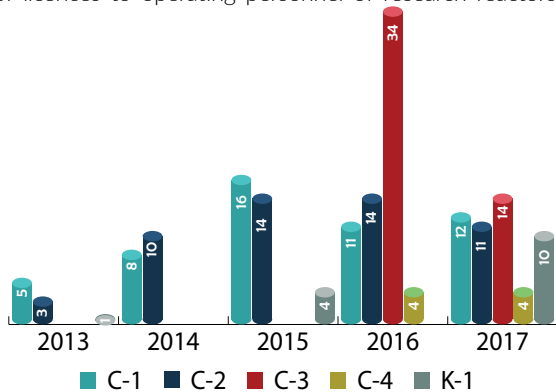


Figure - 8: New Licences Issued to Operating Personnel of NPPs

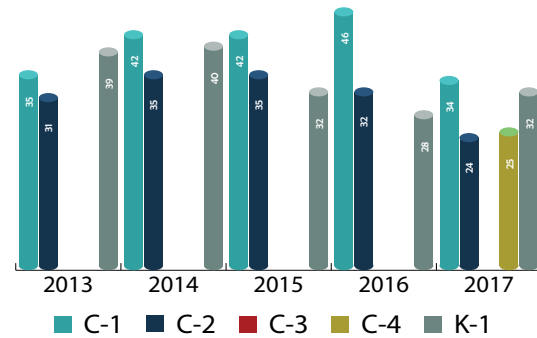


Figure - 9: Renewal of Licences to Operating Personnel of NPPs

during the reported year.

In addition, PNRA conducts oral examinations for the conversion of operating licence of similar plants from one unit to another subject to the fulfillment of applicable regulatory requirements. During the reporting period, PNRA converted 19 licences of operating personnel from C-1 and C-2 to C-4 after oral examinations.

Review and Assessment

The basic objective of regulatory review and assessment is to determine whether the licensee's / applicant's submissions demonstrate that it complies with all the regulatory requirements (i.e. regulations, licence conditions, applicable codes and standards, etc.) throughout its lifetime. In case of non-compliance with regulatory requirements, PNRA may suspend or cancel a licence or authorization or may take any other enforcement action necessary to ensure the safety of the installation, radiation workers, public and the environment.

Regulatory review and assessment of various documents submitted to support application for licensing or authorization is required under PNRA regulations. In addition, PNRA also reviews modifications in design and technical specifications, event reports, routine reports,

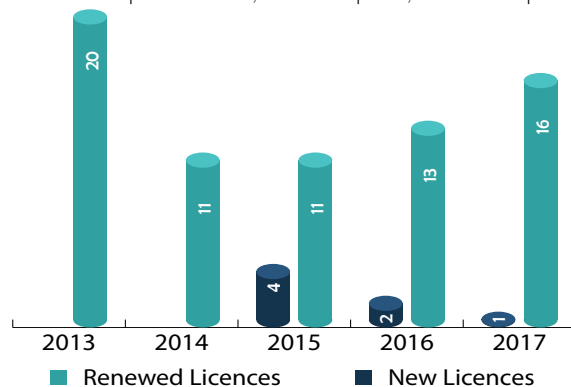


Figure - 10: Issuance and Renewal of Licences to Operating Personnel of PARR-1 & 2



PNRA's Management along with Regional Inspectors During Site Visit to K-2 and K-3

and other documents required under various regulations, licence conditions and directives/policies issued from time to time.

During the reporting year, PNRA conducted integrated safety assessment of K-1, C-1 and C-2; and operational safety trend analysis of K-1 to identify actions for preventing degradation of safety and promoting safety improvements.

Nuclear Power Plants

During the year 2017, PNRA reviewed several submissions by nuclear power plants. These included reports on implementation of radiation protection principles; comparison and assessment of radiation doses during refueling outages; environmental monitoring results; annual occupational exposures of workers; safety and technical parameters; and event or incident reports.

PNRA reviewed several submissions of K-1 including revised Final Safety Analysis Report (KFSAR); Probabilistic Safety Analysis Level-1 Report (KPSA Level-1); Severe Core Damage Frequency (SCDF) target compliance reports; and spent fuel dry storage cask submissions. PNRA also reviewed numerous documents submitted by C-1 and C-2 including internal fire and flood Probabilistic Safety Analysis (PSA) reports and revised radiation protection programme of C-1; and low power and shutdown PSA reports of C-1 and C-2.

In 2017, a number of submissions of C-3 including containment leak rate testing programme were reviewed while its physical protection plan, initial decommissioning plan and several submissions for operating licence award remained under review by the end of reporting year. Similarly, radiation protection programme and monitoring & maintenance programme of class-1E batteries submitted by C-4 was reviewed during the reported year.



PNRA Inspection Team Conducting Regulatory Inspection at K-2

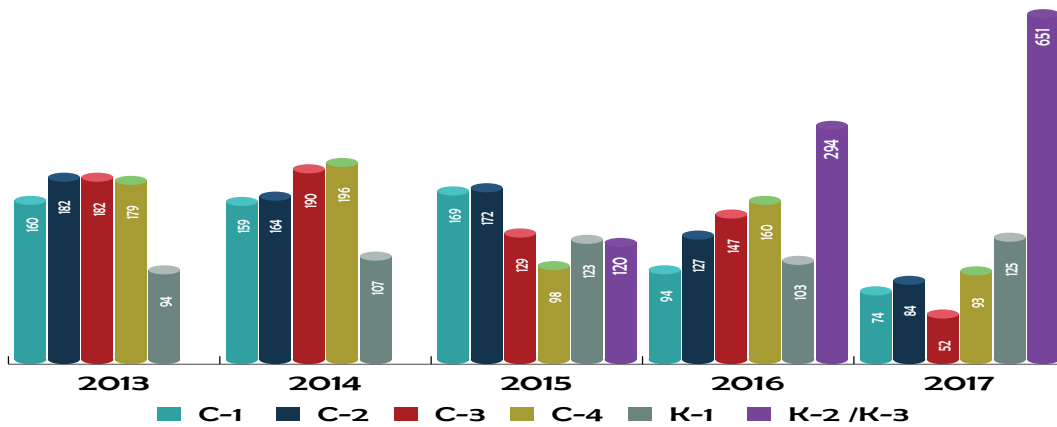


Figure - 11: Regulatory Inspections Conducted at Nuclear Power Plants

Research Reactors and Molybdenum Production Facility

With respect to review and assessment of research reactor’s submissions, during the reporting year, PNRA reviewed six licensing submissions of PARR-1 and two licensing submissions of PARR-2. PNRA approved Quality Assurance Programme (QAP) and In-Service Inspection (ISI) Programme of PARR-1; and Quality Assurance Programme (QAP) and Emergency Preparedness Plan (EPP) of PARR-2 during the reporting year. Further, regulatory review of revised Final Safety Analysis Report (FSAR), Physical Security Plan (PSP), Nuclear and Radiological Emergency Plan and Initial Decommissioning Plan (IDP) of PARR-1; and Physical Security Plan (PSP) and Initial Decommissioning Plan (IDP) of PARR-2 remained in progress during the year. In addition, monthly technical reports, quarterly safety performance indicator reports and annual safety reports describing operation history, reportable incidents, system performance, personal radiation exposures, QA activities, etc., of research reactors were also reviewed during the year 2017.

Several submissions of Molybdenum Production Facility (MPF) were reviewed and approved by PNRA during this year which included Quality Assurance Programme (QAP), Operational Limits and Conditions (OLCs) and design modification regarding duplication of Hot Cell-1 of MPF. During the reporting year, review of Revised Final Safety Analysis Report (FSAR) and Emergency Preparedness Plan (EPP) of MPF remained in progress at PNRA.

Equipment Manufacturers and Service Provider

During reported year, PNRA reviewed HMC-3 submissions related to manufacturing licence revalidation for next five years (2017-2022). Furthermore, quality plans of several equipment including compressed air tank, chemical additive tank, steam separator, demineralizers,

air buffer tank, and decay tank etc., were reviewed. PNRA also reviewed quality plans of NEW-1 as service provider for radiographic testing and physical testing of nuclear safety class equipment during 2017.

Regulatory Inspections

PNRA maintains continuous surveillance of nuclear installations to verify safe operation in-line with national regulations, industrial codes & standards, IAEA safety standards, licence conditions and directives issued by PNRA from time to time. In order to conduct this surveillance effectively, PNRA has established three Regional Nuclear Safety Directorates (RNSDs)– namely RNSD-I (Islamabad), RNSD-II (Kundian) and RNSD-III (Karachi). Resident inspectors from these regional directorates conduct inspections of nuclear installations in their respective jurisdictions. The departments located at PNRA headquarters also provide technical support during the conduct of regulatory inspections as and when required. In addition, the regulatory inspections of equipment manufacturer and service providers for nuclear installations are controlled through the departments located at PNRA HQs.

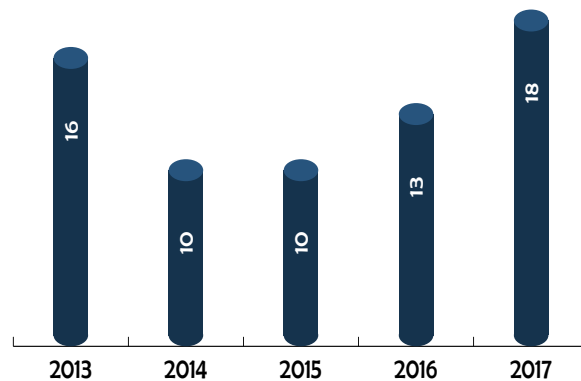


Figure - 12: Regulatory Inspections of Research Reactors

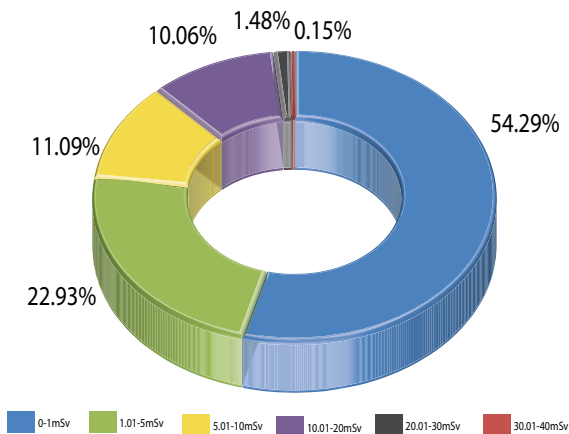


Figure - 13: Radiation Doses to K-1 Workers

Regulatory Inspections are conducted in all phases of a nuclear installation's life cycle, i.e., construction, commissioning, operation, etc. The regulatory inspections conducted by PNRA inspectors are planned in advance, however, if needed, reactive inspections are also conducted. These inspections may be announced or unannounced. PNRA inspectors perform inspections according to approved inspection programme, annual inspection plan, procedures, and checklists. In case of any deficiency or non-compliance with national regulations, licence conditions, agreed codes & standards, facility quality assurance plan or procedures (administrative/technical) observed during inspections, PNRA issues directives to the licensees through inspection reports for implementation of necessary corrective actions within due course of time. A follow-up process is in place to ensure satisfactory implementation of corrective actions in the light of PNRA directives.

PNRA resident inspectors conduct control room inspections and general surveillance of nuclear installations on daily basis; periodic inspections of plant systems and processes at a defined frequency; participate in daily strategic meetings of the plants; also perform control point inspections of selected licensee's activities.

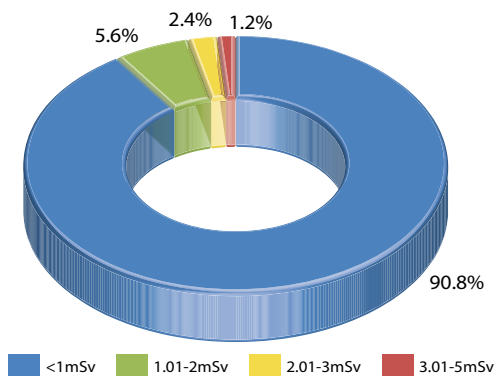


Figure - 14: Radiation Doses to C-1 Workers

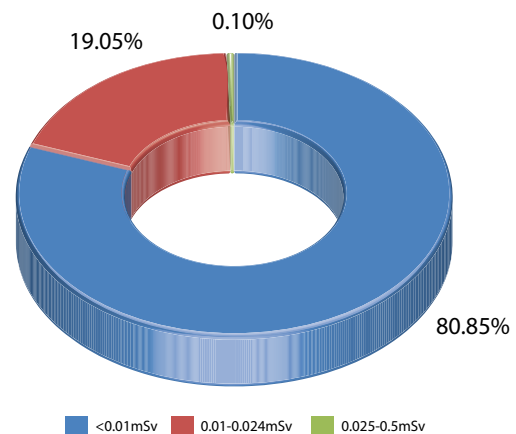


Figure - 15: Radiation Doses to C-2 Workers

Figure - 11 presents number of inspections conducted at all nuclear power plants in 2017.

Similarly, PNRA inspectors conduct regulatory inspections at research reactors in the areas of reactor utilization, operating policies & procedures, safety systems, emergency preparedness, fire fighting, radiation safety, physical protection, etc. During the year 2017, PNRA conducted a number of regulatory inspections at PARR-1 and PARR-2. Figure - 12 presents an overview of inspections conducted at PARR-1 and PARR-2 in 2017. PNRA also conducted two regulatory inspections at Molybdenum Production Facility in the areas of operation and radioactive releases to the environment.

Furthermore, PNRA also conducts inspections to verify effectiveness of quality assurance system of its licensees and their contractors/sub-contractors. PNRA also conducts inspections of equipment manufacturing at manufacturers premises. During the reporting period, PNRA conducted a number of inspections during the manufacturing of nuclear safety class equipment of K-2 and K-3 at equipment manufacturing sites in vendor country, China and at equipment manufacturers in Pakistan. In this regard, PNRA selects certain points during manufacturing of equipment, called control points, for carrying out

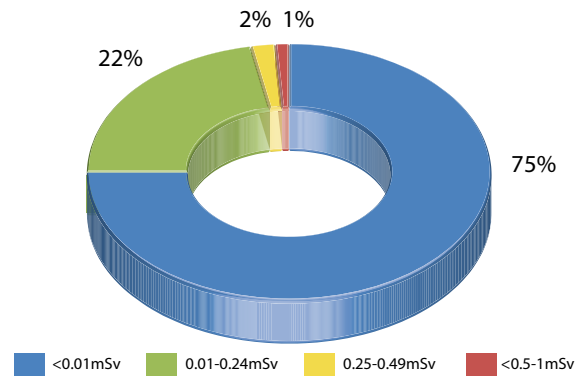


Figure - 16: Radiation Doses to C-3 Workers

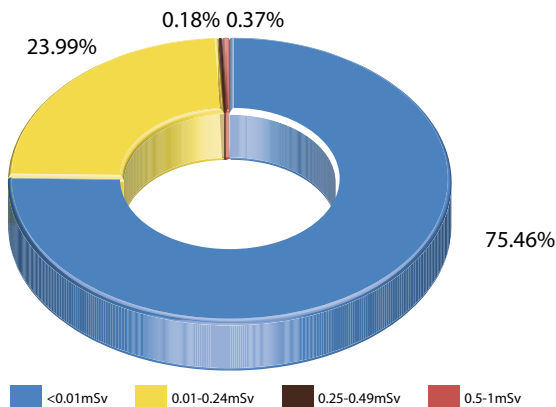


Figure - 17: Radiation Doses to C-4 Workers

inspections. PNRA inspectors performed nine control point inspections in China, 29 control point inspections at HMC-3 and 12 inspections at NEW-2. These inspections cover important manufacturing processes, testing, qualification and performance examinations.

PNRA inspectors also conducted seven control point inspections of ISI activities performed by NEW-1 during refueling outages at C-1 and C-2. Furthermore, PNRA also conducted an inspection to verify effectiveness of QA system of NEW-1 during the reporting period.

Occupational Exposures at Nuclear Installations

PNRA closely monitors occupational exposures of radiation workers at nuclear installations in the country. In this regard, licensees are required to provide detailed data including information about number of persons exposed, collective dose, average dose and maximum individual dose received by radiation workers at their installations on periodic basis. During the reporting year, doses received by radiation workers were noted to be within the regulatory limit at all nuclear installations.

At K-1, more than 54% workers received dose below one

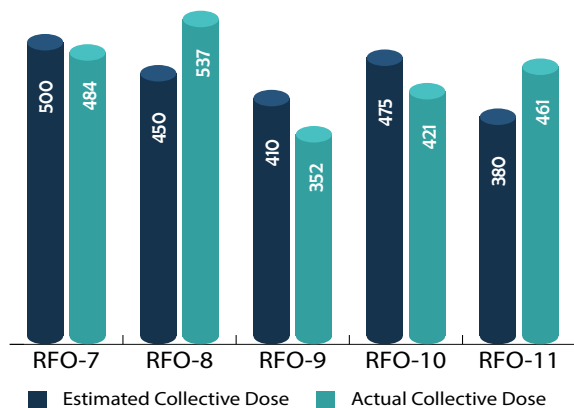


Figure - 18: Collective Doses (Man-mSv) During Last Five Refueling Outages at C-1

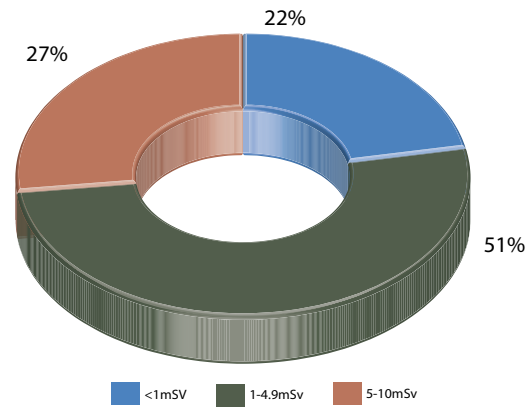


Figure - 19: Radiation Doses to Research Reactor Workers

mSv whereas around 45% workers were between 1-20 mSv as detailed in Figure - 13. Dose to a small fraction, 1.63% of workers exceeded 20 mSv during 2017. However, in such cases it is ensured that five year average dose to such workers is within regulatory limit. Nevertheless, licensees in such cases, are advised to take corrective actions to prevent such occurrences in future.

At C-1, more than 90% workers received dose below one mSv whereas less than 10% workers were between 1-5 mSv. At C-2, the dose received by all workers during 2017 was below one mSv. The dose distribution at C-1 and C-2 is graphically represented in Figures - 14 and 15 respectively. Similarly, radiation doses to C-3 and C-4 workers also remained below 1 mSv during the reported year as reflected in Figures - 16 and 17.

PNRA also monitored the activities during Refueling Outage (RFO) specifically with focus on estimated and actual collective doses. Trend of these doses for last five RFOs at C-1 is reflected in Figure - 18.

Occupational exposure of radiation workers at research reactors and MPF for the year 2017, were also well within the regulatory limits as reflected in Figures - 19 and 20 respectively which represent the percentage of workers exposed to different dose ranges.

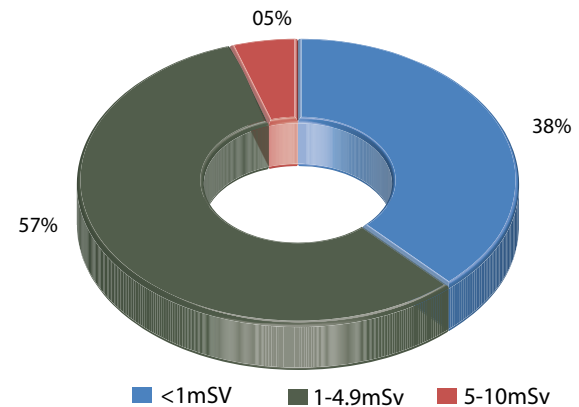


Figure - 20: Annual Radiation Doses to MPF Workers

4. Oversight of Radiation Facilities

Radiation facilities utilize radiation sources i.e. radioactive sources, materials and radiation generators for the benefit of mankind in various sectors such as medicine, industry, agriculture, security, education and research, etc. Based on the peculiar nature of radiation sources, there is a potential of risk or hazard to workers involved, general public and the environment, if safety precautions are not adopted appropriately. This very aspect warrants that such facilities as well as the activities involving radiation sources are effectively regulated. In Pakistan, the legislative and regulatory framework has empowered Pakistan Nuclear Regulatory Authority (PNRA) to regulate all facilities, activities and practices involving radiation sources. Under this framework, all such radiation facilities and activities, in Pakistan, are required to obtain license or authorization from PNRA.

The paradigm of radiation facilities that operate in Pakistan is quite diverse. It consists of diagnostic radiology centers; radiotherapy centers; nuclear medicine centers; industrial radiography facilities; blood, food and material irradiators; oil well logging units; educational institutes and agricultural research centers, etc. Various types of radiation facilities operating in Pakistan under the licensing network of PNRA along with the number of registered radiation workers in these facilities is depicted in Table - 4.

The regulatory requirements specified by PNRA for radiation facilities and activities are developed and implemented in accordance with a graded approach. This approach is based on safety significance, associated hazards and complexity involved with each facility or activity. The regulations issued by PNRA in this area include regulations on licensing / authorization; radiation

protection; radioactive waste management; transport of radioactive material; management of radiological emergencies; decommissioning; and enforcement. These regulations are legally binding on all the users / licensees of radiation sources.

PNRA has put in place a well-established system and mechanism for ensuring safe use of radiation sources. This multi-tier system is composed of licensing / authorization, review & assessment of licensing submissions, maintaining database of occupational exposures, conduct of inspections, and taking enforcement actions against any non compliance wherever necessary.

Licensing and Authorization

The regulatory framework necessitates that all radiation facilities and activities in Pakistan are licensed or authorized by PNRA. PNRA is responsible to issue such licenses / authorizations after conducting detailed review and assessment of applicant's submissions, followed by inspections of the actual work / site and equipment involved. The licence once issued has to be revalidated from PNRA periodically. Almost all the radiation facilities and activities involving radiation sources in Pakistan are licensed by PNRA. The only exception is the medical diagnostic X-ray facilities, a number of which are out of the licensing net, as yet. However, PNRA is striving hard to bring such facilities within its licensing net.

By the end of year 2017, more than 4300 diagnostic X-ray facilities are in the licensing net of PNRA. Similarly, 82 nuclear medicine and radiotherapy facilities; 181 industrial facilities and 68 education and research facilities

Table - 4: Radiation Facilities under PNRA's Purview

Sr. No.	Type of Radiation Facility	Licensed Facilities	Registered Radiation Workers
1.	Nuclear Medicine and Radiotherapy Centers	82	2326
2.	Diagnostic and Dental Radiology Facilities	4326	7063
3.	Industrial Radiography Facilities	46	1048
4.	Nuclear Gauges, Oil Well Logging and other Industrial Facilities	135	790
5.	Educational and Research Institutes	68	391
6.	Others (Importers, Scanners, Calibrations, Isotope Production)	273	786

are operating in the country under the licence issued by PNRA. Table - 4 reflects the number of various types of radiation facilities in the licensing network of PNRA and registered radiation workers in these facilities.

PNRA has adopted a cradle-to-grave approach for maintaining the data of all radiation sources in the country. Pursuant to this approach, PNRA regulations require that import and export of such sources can only be carried out, if explicitly authorized by PNRA. Necessary mechanism in this regard is in place at all international entry/exit points throughout the country. PNRA authorizes the import/export of radiation sources through issuance of "No Objection Certificate" (NOC) to the consignee which is verified by the relevant law enforcement agencies at international entry/exit points. According to the regulatory requirements, only licensed entities are authorized to import or export radiation sources for the licensed/authorized end users, whereas the NOC is issued after verification of the intended end use, the user, and the technical specifications of the source being imported/exported. Furthermore, as a prerequisite for issuance of import NOC, it is ensured that a high activity radioactive source can only be acquired/imported upon provision of undertaking by the supplier/manufacturer to accept its return at the end of its useful life as part of the purchase contract.

During the reporting period, PNRA issued 1227 NOCs for the import of new radiation sources and 100 NOCs for the export of empty containers/disused radiation sources. Figure - 21 reflects trend of NOC's issued during past five years.

PNRA also maintains an inventory of sealed radioactive sources used in all types of radiation facilities and activities in Pakistan. Figure - 22 presents an overview of distribution of sealed radioactive sources with respect to their use in industrial, medical, education and other sectors as per the inventory maintained at PNRA.

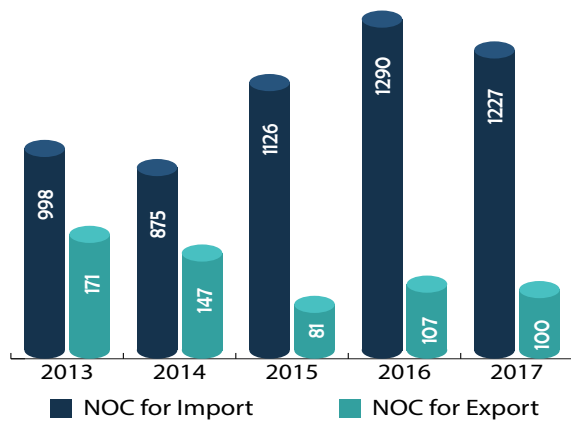


Figure - 21: NOCs for Import-Export of Radiation Sources



DG Inspection & Enforcement Conducting Hearing of Defaulters at PNRA HQs.

For the specific cases of import of radiation sources from other countries, some countries require special permit issued by the regulatory body of the country of destination prior to placement of purchase order for such procurement. In case such requests are received from importers or end users, PNRA verifies the necessary credentials and issues permit(s) to its licensees for acquisition of desired radiation source(s). During the reporting year, PNRA issued more than 100 permits for acquisition of radiation sources to its licensees.

Review and Assessment

One of the main components of regulatory oversight is review and assessment of licensing submissions through which PNRA ensures and verifies the arrangements of the applicant / licensee to conform applicable regulatory requirements and measures to be employed for radiation protection at radiation facilities / activities. These measures include radiation shielding, personal protective gears, radiation monitoring equipment, radiation dosimetry, health surveillance, etc. In line with the graded approach viz-a-viz potential hazards associated with the facility or activity and its safety significance; PNRA requires different submissions from various radiation facilities. These submissions include radiation protection

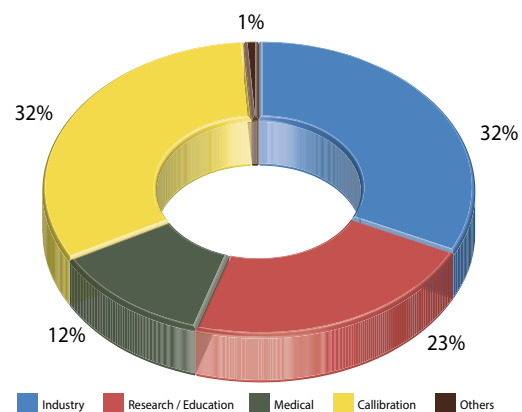


Figure - 22: Sealed Radiation Sources by Usage

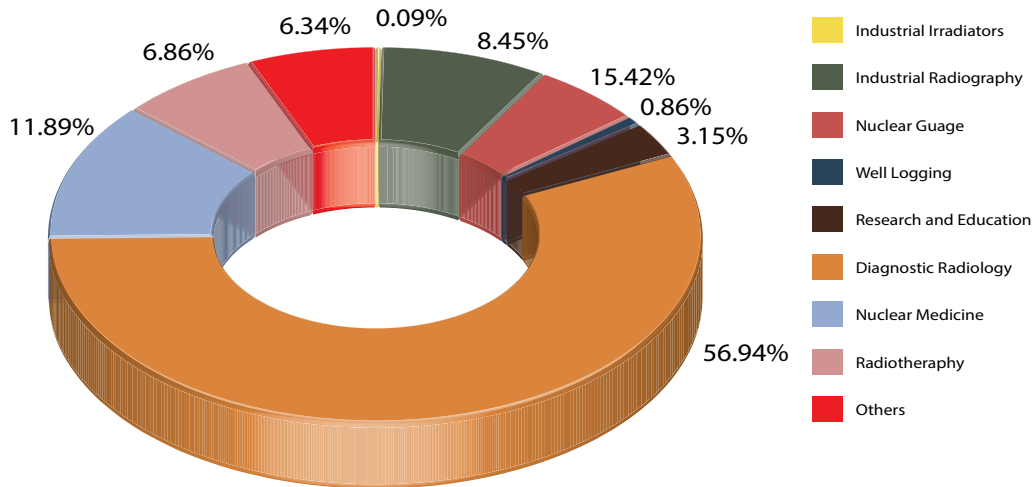


Figure - 23: Distribution of Radiation Workers in Radiation Facilities

programme, radiation emergency plan; physical security plan; qualification, experience and training credentials of workers; and personal exposure records. Review and assessment of these submissions is conducted to verify compliance with the regulatory requirements thereby ensuring protection of workers, public and the environment from harmful effects of ionizing radiation.

Some of the significant review and assessment activities conducted during this year include:

- Review and approval of safety analysis reports of PET-Cyclotrons;
- Review and approval of radiation protection programmes / security plans / quality assurance programmes of various radiation facilities;
- Review and assessment of investigation reports for suspected high exposure cases of occupational workers;
- Review and subsequent acceptance of specific requests / case studies regarding disposal and custody of nuclear moisture density gauge; and health surveillance of personnel working in radiation areas etc.;
- Review of shielding calculations of LINAC system;
- Review of safety assessment reports of medical radiation facilities; and
- Review of the case regarding registration / licensing of importers / users of smoke detectors.

Occupational Exposure at Radiation Facilities

PNRA has developed occupational exposure database for maintaining dose record of radiation workers at

national level. The database containing dose record is utilized to evaluate trends in occupational exposures, effectiveness of radiation protection programme of licensee and the ALARA implementation. Currently, the database has occupational exposure records of 12404 radiation workers of various types of radiation facilities. Distribution of workers in different radiation facilities is shown in Figure - 23.

According to the dose record available to date, annual radiation doses to 96.14 percent of radiation workers remained less than 5 mSv while 3.32 percent of workers received doses between 5-20 mSv. A small fraction of workers i.e. 0.54 percent received doses greater than 20 mSv. However, five years average annual dose of such workers remained within the prescribed regulatory dose limit. Nevertheless, licensees are advised to take corrective actions to prevent occurrence of such cases in future. A representation of radiation workers in different dose ranges is given in Figure - 24.

Inspections of Radiation Facilities

Inspection of radiation facilities is an important tool employed by PNRA to effectively perform its assigned

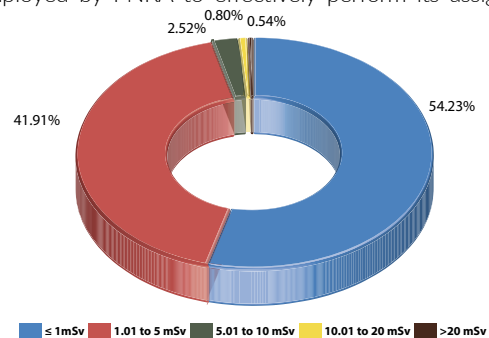


Figure - 24: Dose Ranges of Workers in Radiation Facilities



PNRA Team Conducting Inspections at Industrial Radiation Facilities

function of regulatory oversight. The inspections of all facilities and activities using radiation sources are conducted to ensure that these are used safely without posing any undue risk to the workers, public or the environment. The focus of these inspections is to verify the implementation of regulatory requirements regarding structural shielding; facility design/layout; inventory of radiation sources; worker credentials; QA system, etc. In addition, work practices, ALARA implementation, adequacy of security measures, transportation and storage aspects are also assessed during these inspections.

PNRA conducts various types of inspections at all radiation facilities according to its inspection programme utilizing graded approach. Planned inspections are conducted periodically as per defined frequency while the inspection programme also includes provision for special inspections to cater for the circumstances where reactive or investigative inspections are required in case of a non-compliance or occurrence of an event. The inspections performed by PNRA could be announced inspections which are intimated in advance to the licensee or unannounced inspections which are conducted without prior intimation. The licensing process of radiation facilities is also complemented with mandatory initial inspections for verification of pre-licensing requirements which is subsequently followed-up by planned inspections to ensure continuous compliance of applicable regulatory requirements.

In order to implement the inspection programme throughout the country, PNRA has established its regional directorates and inspectorates in various cities across Pakistan. Currently, PNRA has three regional directorates located at Islamabad, Kundian and Karachi; while three regional inspectorates are located in Peshawar, Multan and Quetta.

In line with PNRA Inspection Programme, regional directorates and inspectorates chalk out their annual

inspection plan for radiation facilities and activities within their respective area of jurisdiction utilizing a graded approach. According to this approach, the frequency of inspection of facilities varies with potential hazards, ranging from biannual to biennial inspections.

The annual inspection plan for the year 2017 envisaged inspections of radiation facilities including medical, industrial, educational and research centers throughout the country. The regional directorates and inspectorates of PNRA succeeded in implementing this plan effectively by conducting more than 3100 inspections of all types of radiation facilities and activities. The significant findings and compliance gaps observed during these inspections along with the directives for improvement were communicated to the inspected facilities through post inspection reports which were appropriately followed up during the year. This regulatory surveillance has led to notable improvements in the safety infrastructure at radiation facilities and activities. During the reporting year, PNRA issued 212 show cause notices, 210 offence reports to the violators and conducted 263 hearing proceedings. As a result of these enforcement actions, most of the issues raised were resolved and disposed off accordingly. Figure - 25 reflects an overview of regulatory inspections conducted during last five years.

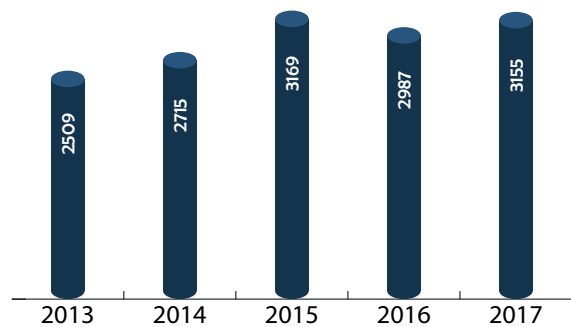


Figure - 25: Regulatory Inspections of Radiation Facilities

5. Oversight of Waste, Spent Fuel, Decommissioning and Transport

PNRA regulates the management of radioactive waste generated from nuclear installations, radiation facilities and associated activities in Pakistan as well as spent nuclear fuel, decommissioning and transport of radioactive materials in the country. PNRA requires every licensee to keep the generation of radioactive waste, both the activity and volume, to the minimum practicable. PNRA focuses on continuous improvement in safety of these domains and strives to ensure that these are managed in accordance with applicable regulatory requirements. Various PNRA activities covered in this regard are graphically depicted in Figure - 26.

Management of Radioactive Waste

PNRA pays paramount importance to the safe management of radioactive waste generated in the country. This includes regulatory oversight of radioactive waste management at nuclear installations, radiation facilities and radioactive waste storage facilities.

Radioactive Waste at Nuclear Power Plants

PNRA ensures safety in managing the radioactive waste at nuclear power plants through its regulatory oversight processes. PNRA ensures that all licensees manage radioactive waste generated at their installations appropriately by taking suitable measures for its

classification, segregation, treatment, conditioning and storage. PNRA also maintains a comprehensive inventory of radioactive waste generated for its safe management. Radioactive waste generated as a result of operation of nuclear power plants is of two basic types; solid radioactive waste and radioactive effluents.

Solid Radioactive Waste

PNRA ensures that nuclear power plants manage the solid radioactive waste generated in accordance with the approved Radioactive Waste Management Programme (RWMP) and that the generation of solid radioactive waste is kept at minimum possible level. The solid radioactive waste generated at nuclear power plants mostly comprises contaminated materials such as spent resins, filters, tools, wooden and metal pieces, dungarees, rubber gloves and shoes, plastic overshoes, cotton, papers, etc.

The solid radioactive waste generated at K-1 such as dungarees, rubber gloves, rubber shoes, papers, contaminated metal parts, etc., is compacted in Mild Steel (MS) drums; whereas waste comprising of spent resin is collected in portable tanks. The MS drums and portable tanks are stored at radioactive waste storage area at plant site. Figure - 27 shows the number of the compacted solid waste drums at K-1.

The solid radioactive waste generated at Chashma Nuclear Power Generation Station (CNPGS) which comprises four units namely C-1, C-2, C-3 and C-4, is categorized as compacted waste and solidified waste. The waste comprising tissue papers, dungarees, rubber shoes,

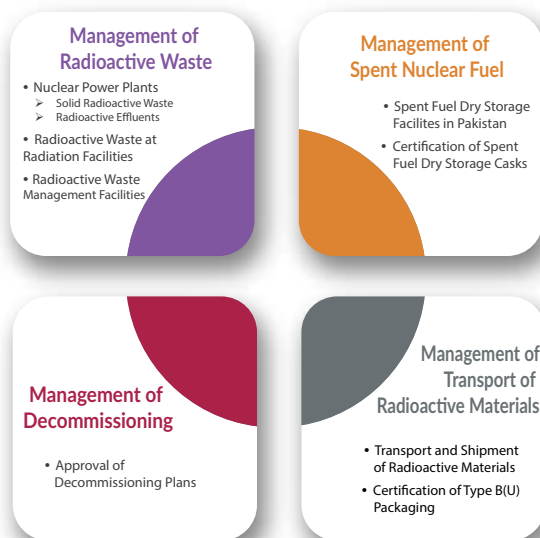


Figure - 26: PNRA Activities Regarding Waste, Spent Fuel, Decommissioning and Transport

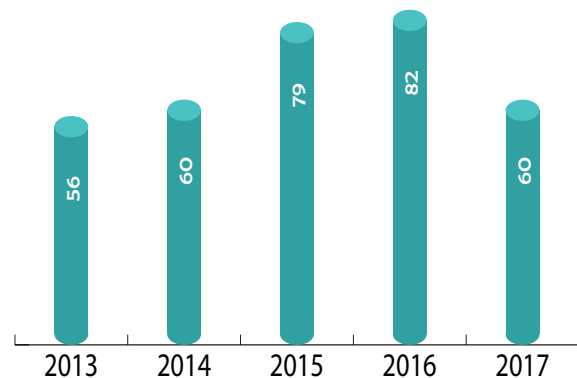


Figure - 27: Number of Compacted Solid Waste Drums at K-1

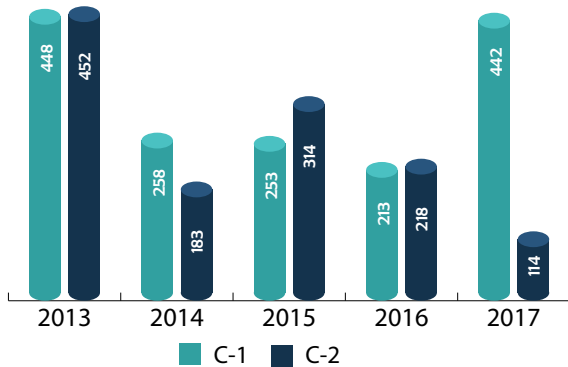


Figure - 28: Number of Waste Drums Generated at CNPGS

gloves, etc., is compacted whereas the waste comprising resins and concentrates is solidified. The compacted and solidified waste is stored in MS drums in the radioactive waste storage building at the plant site. Figure - 28 shows the number of compacted and solidified waste drums at CNPGS.

Radioactive Effluents

PNRA regulates radioactive effluents, i.e. gaseous and liquid discharges to the environment, from nuclear power plants through its rigorous regulatory process, thereby ensuring that the effluent releases to the environment are kept within the permissible level and as low as reasonably achievable. During the reporting period, the gaseous and liquid radioactive effluents discharged to the environment from K-1, C-1, C-2, C-3 and C-4 remained well below the authorized limits. Figure - 29 and Figure - 30 represent the gaseous and liquid radioactive effluents from K-1; whereas Figure - 31 and Figure - 32 shows the gaseous and liquid radioactive effluents respectively from CNPGS during the year 2017.

Radioactive Waste at Radiation Facilities

PNRA makes every effort to ensure safe management of radioactive waste generated at radiation facilities. Radiation facilities use a broad variety of radioisotopes

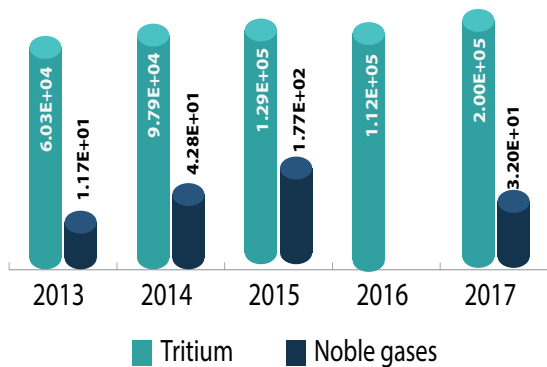


Figure - 29: Gaseous Effluents (GBq/yr) from K-1

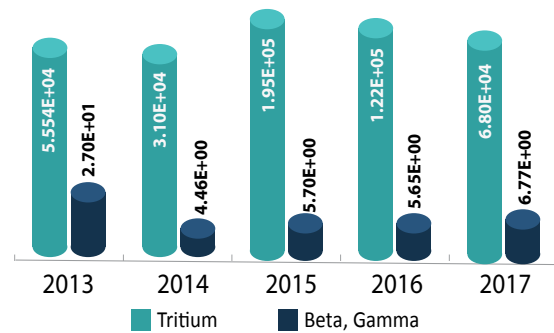


Figure - 30: Liquid Effluents (GBq/yr) from K-1

for various purposes. Under the regulations, radiation facilities are required to execute safe and secure storage of radioactive waste. PNRA ensures the implementation of regulatory requirements through inspections and record review.

Disused Sealed Radioactive Sources (DSRS)

PNRA requires the users / importers of radioactive sources having a half life of more than 1 year and initial activity greater than 100 GBq, to return back such sources to supplier / manufacturer when the sources are no longer useful. PNRA ensures the inclusion of this condition in the purchase contract at the time of issuance of NOC for procurement of radioactive sources. The disused radioactive sources with half life less than 1 year and activity less than 100 GBq; orphan sources; and sources which could not be returned to the supplier are stored at designated storage sites in the country. The DSRS store at these sites mainly include Co-60, Cs-137, Ir-192 and Ra-226.

PNRA maintains the inventory of sealed radioactive sources in the country. Accordingly, by the end of year 2017, around 32 percent of total SRS in the country are in use; 62 percent were safely stored at designated storage sites; and 6 percent of total SRS were returned to original

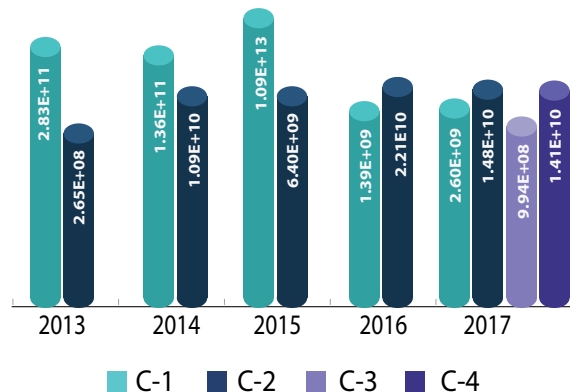


Figure - 31: Gaseous Effluents (Bq/yr) from CNPGS

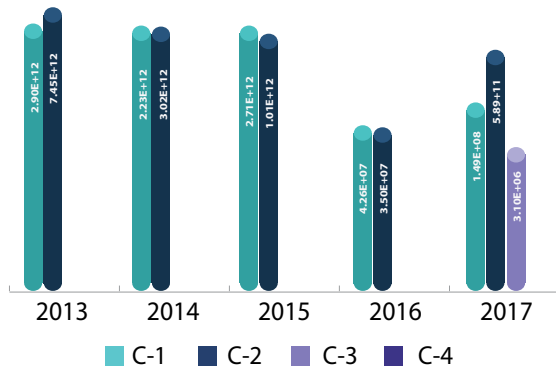


Figure - 32: Liquid Effluents (Bq/yr) from CNPGS

suppliers / manufactures of radioactive sources. Figure - 33 shows the graphical representation of the status of SRS in use in the country and DSRS stored at designated storage sites.

Radioactive Waste Management Facilities

Currently, there are two designated radioactive waste management facilities in the country, namely KANUPP Radioactive Waste Storage Area (RAWSA) and PINSTECH Predisposal Radioactive Waste Management Facility (PPRWMF). These facilities store radioactive waste generated from their own facilities and from all private / public sector organizations in the country.

KANUPP Radioactive Waste Storage Area (RAWSA) is designated radioactive waste management facility for storage of radioactive waste generated from K-1 and radiation facilities in the southern part of the country.

PINSTECH Predisposal Radioactive Waste Management Facility (PPRWMF) is an interim storage facility. It is authorized for the management of low and intermediate level radioactive waste generated from research reactors, isotope production facility and radiation facilities in the northern part of the country including disused sealed radiation sources. The radioactive waste is stored in

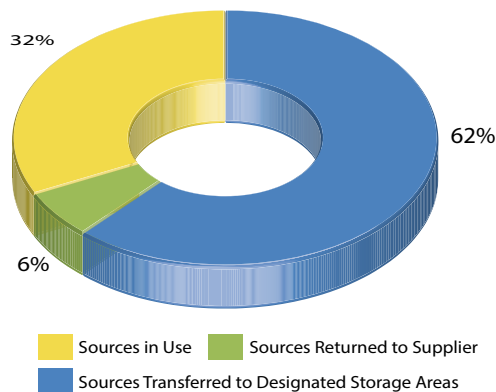


Figure - 33: Status of Sealed Radioactive Sources

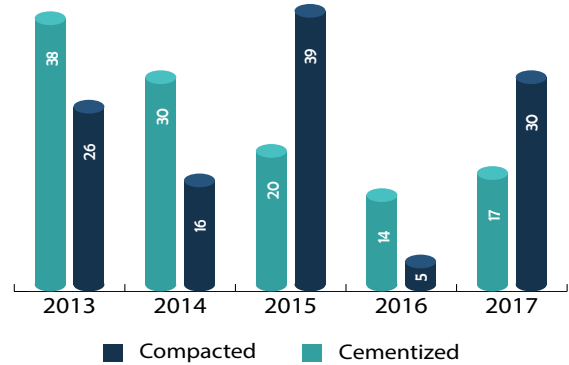


Figure - 34: Radioactive Waste Containers at PPRWMF

Reinforced Cement Concrete (RCC) barrels and MS drums at this facility. The number of cementized and compacted containers of radioactive waste stored at PPRWMF during last five years is shown in Figure - 34.

Management of Spent Nuclear Fuel (SNF)

Spent Nuclear Fuel, generated by the operation of nuclear power plants, is the fuel that is considered no longer useful for further utilization in the nuclear power plants. Presently, in Pakistan, nuclear power plants utilize wet storage system, as an interim arrangement, for the storage of SNF in on-site spent fuel pools. However, dry storage system is being adopted globally for long term management of SNF. Accordingly, dry storage facilities for long term storage of SNF are in the process of establishment in Pakistan.

Dry storage system consists of dry storage facility and dry storage casks for safe management of spent nuclear fuel in the dry environment. The independent spent fuel dry storage facilities require licence from PNRA while design of spent fuel dry storage casks also requires PNRA certification. PNRA issues these licences and certifications based on its satisfaction that all applicable technical and administrative requirements are fulfilled by the licensees.

Spent Fuel Dry Storage Facilities in Pakistan

The spent fuel generated at K-1 is managed and stored in K-1 spent fuel dry storage facility at plant site. Whereas, for management of spent fuel generated at CNPGS, PAEC initiated establishment of a Spent Fuel Dry Storage Facility (SFDSF) at Chashma site. This activity is first of its kind in Pakistan and possesses many challenges for operator as well as regulator.

During the reporting year, a number of meetings were held between PNRA and PAEC to pursue the licensing process in an effective and efficient manner. Site Evaluation Report (SER) of this facility was submitted to

PNRA during reporting year. The initial phase of review of SER was completed during 2017 following which PNRA communicated its comments to the applicant. The detailed review of SER remained in progress during reporting year.

Certification of Spent Nuclear Fuel Dry Storage Cask

The design and manufacture of spent nuclear fuel dry storage casks for storage and transfer of SNF generated from nuclear power plants is required to be certified from PNRA as per regulatory requirements.

During the reporting year, PAEC submitted its intention for design and manufacturing of storage cask and transfer cask for SNF generated from CNPGS. These casks are to be used for storage and transfer of spent nuclear fuel from power plants to spent nuclear fuel dry storage facility. After establishment of interface between PNRA and PAEC, the process of finalization of list of applicable codes & standards for preparation of Safety Analysis Report (SAR) remained in progress during the reporting period.

Furthermore, design approval certification of KANUPP Spent Nuclear Fuel Dry Storage Cask remained in progress during the reporting year. PNRA completed the review of Safety Analysis Report (SAR) of this spent fuel dry storage cask and consequently granted permission for manufacturing of prototype cask. To ensure compliance with applicable standards during manufacturing of prototype cask, PNRA selected 25 control points for inspections during manufacturing activities. By the end of this year, five control point inspections were conducted.

Management of Decommissioning of Nuclear Installations

The process of decommissioning starts after the permanent shutdown of the installation followed by termination of operation licence and ends at a level that permits the release of the site from regulatory control. It involves decontamination, dismantling, cutting, packaging & transportation of plant equipment and materials and handling, treatment, conditioning, storage / disposal of waste generated to a state where the site no longer possesses radiation risks for the general public and environment.

As per the regulatory requirements, nuclear installations are required to submit an initial decommissioning plan for approval of PNRA prior to introduction of nuclear material or fuel into the installation. This plan is required

to be periodically revised and updated by the licensee after every five years until it is submitted as the final decommissioning plan with the application of acquiring licence for decommissioning of the installation. During the reporting year, PNRA reviewed and approved initial decommissioning plan of C-3 while initial decommissioning plans of PARR-1 and PARR-2 remained under review at PNRA. Whereas, Final Decommissioning Plan of K-1 is expected to be submitted to PNRA for its review and approval in near future.

Management of Transport of Radioactive Material

PNRA regulates transport of radioactive material at the national level according to regulatory requirements for safe transport of radioactive material. Furthermore, PNRA also grants certification of transport packages designed and manufactured in the country; authorizes shipments of radioactive materials; and grants acceptance of transportation plans and relevant shipping documents for safe transport of radioactive material.

Transport and Shipment of Radioactive Materials

During the year 2017, more than 650 shipments of radioactive material, radiopharmaceuticals and SRS were reported to PNRA. Accordingly, PNRA reviewed compliance assurance programme and verified relevant shipping documents for safe transport of radioactive materials in order to assess that the measures taken by the licensees are in conformance with the regulatory requirements.

Certification of Type B(U) Packaging

Transport packages are designed for the transportation of radioactive material. These packages are required to be capable to bear accidents and prevent damage to radioactive material; thereby ensure protection of workers, public and environment. As per regulatory requirements, the packages manufactured in Pakistan require the design approval from PNRA.

During the year 2017, PNRA continued the regulatory oversight of manufacturing of these packages and conducted inspections of manufacturing of transport packages. In this regard, control point inspections in the area of welding, dimensional inspections and Non Destructive Testing (NDT) examinations were conducted. PNRA also maintains the record of Type B(U) packages being used in the country.



6. Emergency Preparedness & Response

Nuclear materials and radioactive sources are widely used in the country for the benefit of society mainly for electricity generation; medical diagnosis and treatment; industrial applications; security purposes; and research & development activities. As long as these materials and sources are used with necessary precautions and safety measures, they pose no harm to human health and environment. Nevertheless, the possibility of any event or incident cannot be totally ruled out which may endanger the human health and the environment. In view of this, there is a need for availability of reliable emergency measures and appropriate preparedness to immediately respond to nuclear or radiological emergencies at national level. The existence and functionality of such measures are ensured through stringent regulatory oversight.

The Government of Pakistan has empowered PNRA to ensure that the licensees have necessary emergency preparedness plans; arrangements of necessary resources; and capabilities for handling nuclear accidents or radiological emergencies, commensurate with their activities. PNRA, in order to fulfill its national obligation effectively, has established a full set of regulatory requirements and employs various regulatory tools. Among others, these tools specifically include review and assessment for acceptance / approval of emergency preparedness and response plans; and verification of the adequacy and effectiveness of these emergency plans and necessary preparedness arrangements through witnessing emergency exercises and drills.

PNRA also maintains a National Radiation Emergency Coordination Centre (NRECC) for coordination of emergency response at national and international level. It is responsible for conducting independent assessment of incidents involving radiation exposures; provision of technical assistance to local and national organizations; and to advise the Federal Government and other concerned authorities regarding implementation of necessary safety and protective measures to mitigate the consequences of such accidents, when needed.

Regulatory Requirements for Emergency Preparedness and Response Arrangements

PNRA has promulgated detailed regulatory requirements in order to effectively regulate emergency preparedness.

These requirements are in line with the international standards and require the licensees to have in place emergency plans, necessary workforce, essential preparedness arrangements and requisite radiation detection and protective equipment for handling such emergencies. Regulations also require the licensees to maintain close liaison with the offsite response organizations responsible for implementing protective measures.

The licensees are also required to demonstrate the adequacy, implementability and effectiveness of emergency preparedness and response arrangements before introducing nuclear material into the systems of a nuclear installation or, in case of radiation facility, before a radioactive material is brought into the facility. PNRA authorizes the commencement of operation only after emergency preparedness and response arrangements are demonstrated by the licensees through conduct of emergency exercises and drills to its entire satisfaction.

Review and Assessment for Approval / Acceptance of Emergency Response Plans

All nuclear installations and radiation facilities with significant potential of hazards are required to submit their emergency preparedness and response plans to PNRA for review and acceptance / approval. In this regard, onsite emergency plans of nuclear installations as well as of the radiation facilities are reviewed by PNRA to ensure that these plans are executable and commensurate with the regulatory requirements. Recommendations for improvement are shared with licensees and upon satisfaction, these plans are accordingly approved. The offsite emergency plans, which deal with the measures and arrangements for mitigating the consequences of emergency in case these surpass the boundary of installation, are approved by the Government at appropriate levels and reviewed for acceptance by PNRA. During 2017, PNRA reviewed four emergency response plans of nuclear installations; two of these plans were approved while for remaining two, comments have been communicated to the licensee for improvement. Moreover, PNRA reviewed and approved emergency response plans of 20 radiation facilities and activities which include hospitals, industries, irradiators, industrial radiography practices, etc.

Witnessing the Conduct of Emergency Exercises and Drills

In order to verify the effectiveness of emergency preparedness measures and to ensure the implementability of emergency response arrangements, PNRA requires its licensees to conduct drills and exercises at regular intervals. The frequency of emergency drills and exercises is agreed upon by PNRA in the approved emergency plans. PNRA witnesses some of these drills / exercises to assess the licensee’s capabilities for executing their emergency plans, as and when required.

Nuclear installations conduct partial or integrated emergency exercises with defined frequencies as agreed with PNRA. In partial emergency exercise, either on-site or off-site emergency response plans are tested; while in integrated emergency exercise, both the on-site and off-site plans are tested simultaneously. During the year 2017, PNRA evaluated emergency exercises of K-1, CNPGS and PARR-1.

Obligations under the International Conventions

Pakistan is a State Party to Convention on Early Notification of a Nuclear Accident and Convention on Assistance in the case of a Nuclear Accident or Radiological Emergency since 1989. These Conventions require the state parties to designate a Competent Authority and make available a continuous point of contact, authorized to make and receive requests for and to accept offers of assistance in case of nuclear accidents or radiological emergencies.

On behalf of the Government of Pakistan, PNRA is the designated National Warning Point while Chairman PNRA is the designated National Competent Authority for notification and coordination under these Conventions. For fulfillment of obligations of these Conventions and the responsibilities assigned to PNRA under the national legislative framework, the NRECC acts as the National

Warning Point (NWP).

IAEA’s Response and Assistance Network (RANET)

Since 2008, Pakistan is a registered member of Response and Assistance Network (RANET) established by IAEA Incident and Emergency Centre (IEC) under the Convention on Assistance in the case of a Nuclear Accident or Radiological Emergency to provide international assistance, upon request from a Member State in case of a nuclear or radiological emergency. As the National Assistance Coordinator for RANET activities in Pakistan, PNRA is responsible to coordinate activities related to RANET with other stakeholders in Pakistan as well as with the IAEA. PNRA has registered its National Assistance Capabilities (NACs) with RANET in four areas, i.e. Radiological Assessment and Advice; Source Search and Recovery; Radiation Monitoring; and Environmental Sampling and Analysis. During the reporting period, PNRA initiated the revision of registered National Assistance Capabilities (NACs) with RANET. In this regard, PNRA identified some more areas to be registered as NACs at national level which remained in the process of finalization at the end of reporting year. PNRA prepared a procedure to coordinate RANET related actions with national stakeholders during 2017.

National Radiation Emergency Coordination Centre (NRECC)

NRECC is located at PNRA Headquarters in Islamabad which remains available and operational round the clock for receipt/dissemination of emergency notifications and initiation/coordination of necessary emergency response at national and international level. NRECC is equipped with various communication tools, radiation detection equipment and personal protection gadgets. It has a dedicated, experienced and trained team with specialized capabilities. NRECC workforce is augmented by designated technical support teams comprising of experts from various PNRA departments. PNRA has established



Demonstration of NRECC Emergency Preparedness and Response Capabilities to Visitors from External Organizations

a network of six field response teams which are located in major cities across the country including Islamabad, Kundian, Karachi, Peshawar, Multan and Quetta. These teams are composed of trained manpower with Mobile Radiological Monitoring Laboratories (MRMLs) and are capable of conducting independent assessment of any incident involving radiation exposures and provision of technical assistance to local and national response authorities, if needed.

NRECC also receives information on radiation incidents and emergencies occurring worldwide through IAEA's Nuclear Events Web-based System (NEWS) and Unified System for Information Exchange (USIE). These incidents are usually related to overexposure of workers/members of the public, theft / loss of radiation sources, contamination/spill of radioactive material, malfunction of equipment, etc. NRECC analyzes the information, identifies the lessons learnt and disseminates these information among the licensees and relevant stakeholders for improvement of radiation safety in the country. During this year, information about a number of events were shared.

Emergency Exercises conducted by NRECC

In order to maintain the preparedness and to regularly test communication and response arrangements for various anticipated emergency scenarios, NRECC periodically conducts emergency exercises. One type of these exercises is Communication Test Exercises (COMTEX) which are conducted, thrice a year, to check availability and reliability of modes as well as means to communicate with the licensees and other relevant national response organizations. The other type is Mobile Radiological Monitoring Laboratory (MRML) Field Exercises which are conducted biannually to test the procedures and operation of field response teams during diverse emergency situations. Such field exercises are conducted



Field Exercise on Search and Recovery of Radiation Sources

at various places and cities across Pakistan in coordination with respective regional directorates by involving their field response teams. This year, three Communication Test Exercises were conducted during February, June and October while two MRML Field Exercises were conducted during August and November.

Participation of NRECC in International Level Emergency Exercises

NRECC actively participates in the exercises conducted by IAEA under Early Notification and Assistance Conventions, called Convention Exercises (ConvEx). These exercises are regularly conducted by the Incident and Emergency Centre of IAEA with varying scope and objectives including testing communication arrangements; response capabilities, and mechanisms in place to offer and receive international assistance under the Conventions. In 2017, PNRA participated in various ConvEx exercises conducted by IAEA.

A summary of all exercises evaluated, conducted or participated by PNRA during the year 2017 is shown in Figure - 35.



Figure - 35: Emergency Exercises Evaluated, Conducted or Participated by PNRA During 2017

7. Competence Development at PNRA

Regulating nuclear installations and radiation facilities is a highly complex task and requires well qualified, knowledgeable, experienced and skilled professionals. Because of the technological advancement and day to day innovations, rigorous and continuous education and training of the regulatory officials is needed. Similarly, mentoring, coaching and hands on training of the junior officials as well as senior professionals is also considered necessary for enhancing the efficiency and effectiveness of the organization and strengthening regulatory oversight of nuclear installations, radiation facilities and associated activities in the country.

PNRA believes that knowledge is a valuable asset for the organization that needs to be developed, maintained and enhanced systematically through a well oriented programme. It has adopted various initiatives for the competence development of regulatory officials in different regulatory areas. PNRA periodically conducts competence need assessment to identify areas for further improvement and accordingly chalks out plans for competence development. The competence development programme includes education, training and expertise development through in-house endeavors along with competence building through training opportunities

offered at national and international institutions and organizations. PNRA's competence development matrix is graphically illustrated in Figure - 36.

Competence Development through In-House Resources

PNRA confers great emphasis on in-house competence development of its officials in all domains of regulatory envelope. PNRA utilizes resources available at PNRA Headquarters in the form of National Institute of Safety and Security (NISAS) for the competence development of its manpower in the fields of nuclear safety, radiation safety, transport and waste safety, regulatory control, nuclear security and management skills, etc. PNRA also employs in house knowledge sharing programme and leadership development programme for the purpose of knowledge retention and enhancement of leadership competencies.

National Institute of Safety and Security (NISAS)

National Institute of Safety and Security (NISAS) is an ISO 9001:2008 certified training institute of PNRA capable of conducting quality trainings in the regulatory domains



Figure - 36: Competence Development Matrix of PNRA

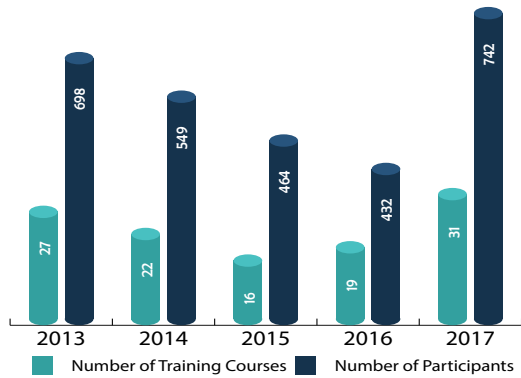


Figure - 37: Trend of Training Courses Conducted by PNRA

of PNRA. The institute also offers training opportunities for officials from other national and international stakeholders. The institute has state of the art training facilities with capable faculty and necessary training aids. NISAS has established various laboratories for training and education purposes. These include physical models laboratory with scaled down models of vital components of nuclear power plants; mechanical and non-destructive testing laboratory with training instruments and probes; radiation detection equipment laboratory with sensitive radiation monitoring and measurement instruments; and physical protection interior laboratory featuring intrusion detection devices, access control technology, and nuclear installation mock-up security model. The institute also possesses NPP Soft Panel Training Simulator (SPTS) for understanding plant behaviour during normal and abnormal conditions and providing hands-on training to regulatory inspectors.

Based on periodic competence need assessments and specific requests of different departments, PNRA develops annual training calendar of NISAS comprising specifically designed training courses and special lectures by subject specialists for the specific needs of PNRA's



Participants of a Training Course Conducted at RNSI-3, Quetta

new inductees, mid career officials and management level professionals. Prominent among them are the "Basic Professional Training Course Level-I" and "Professional Training Course Level-II".

During the reporting year, PNRA conducted a number of training courses at NISAS in the areas of medical response in emergency situations; safe uses of ionizing radiation in industrial and medical field; physical security at nuclear facilities; radiation safety in radiotherapy; decommissioning of nuclear installations; and safety culture. More than 700 professionals from various organizations participated in these training courses. Figure - 37 represents the number of training courses conducted during the last five years along with the number of participants. NISAS also attracts visitors and dignitaries from different national and international organizations. During the reporting year, 15 delegations visited NISAS to witness its training capabilities and state of the art facilities.

However, due to lack of financial resources, some of the activities have been affected which included set-up of radiation safety laboratory at NISAS; extension of physical models laboratory; and extension of SPTS.



Participants of Workshop on Capability Development on Level-2 PSA of NPPs



Signing of MoU with PIEAS for Education and Training of PNRA Fellows

Knowledge Sharing and Mentoring Programme

PNRA knowledge sharing and mentoring programme aims on capturing, retention and sharing of life experiences and tacit knowledge of senior professionals to build organizational competence and information reservoir. PNRA believes that knowledge retention is essential for long term sustainability of the organizational achievements. In order to transform the tacit knowledge into the explicit knowledge under this programme, seasoned and experienced professionals are invited from within and outside PNRA for sharing their experiences with PNRA employees to improve the organization's performance.

During this year, PNRA arranged two knowledge sharing sessions. One of these knowledge sharing sessions was arranged for sharing the experience of Pakistan's delegation that participated in the Seventh Review Meeting of the Convention on Nuclear Safety held at the IAEA Vienna in April this year. Chairman PNRA, who led the Pakistan's delegation at this important podium, shared the insights and experiences of preparation and participation in this meeting with mid career and junior PNRA officials. Similarly, in another such sharing session a senior PNRA official who was departing to serve IAEA shared his life experiences and essences of successful careers with the participants.

Leadership Development Programme

An effective leadership is considered as a key for the organizations to achieve their goals in an effective and efficient manner. In order to develop and enhance the leadership capabilities of PNRA officials, PNRA has been implementing a well-thought leadership development programme since 2007. This programme has productively contributed towards the overall enhancement of the leadership capabilities within PNRA. Up-to the end

of reporting year, PNRA has successfully completed mentoring of two batches of its leadership development programme whereas training of third batch under this programme remained in progress during the reporting year.

In year 2017, PNRA conducted feedback analysis of junior officials selected for third batch of this leadership development programme. Various projects designed by the young aspirants of third batch which were aimed to abridge the competency gaps identified as a result of feedback analysis, were evaluated and approved during the reported year. These are currently in the implementation phase. Moreover, in 2017, PNRA also launched a book club under this programme to enhance and supplement the reading habits of PNRA officials.

Competence Development through National Organizations

PNRA effectively utilizes the education and training opportunities provided by other national institutions and organizations for capacity building of its manpower. These endeavours include higher education and training at national institutions through collaboration agreements for education, training and skill development.

Higher Education at National Institutions and Universities

PNRA understands the importance of higher education in relevant fields of nuclear engineering and health sciences. Therefore, PNRA has a regular scholarship programme for talented young graduates. In this regard, PNRA has inked special agreements with Karachi Institute of Nuclear Power Engineering (KINPOE) and Pakistan Institute of Engineering and Applied Sciences (PIEAS) for enrolment of selected candidates as PNRA sponsored fellows in Master's degree programmes offered by these institutes. This fellowship programme is organized in the fields of



Briefing to DG Strategic Plans Division on NISAS Training Laboratories During his Visit to PNRA HQs.

nuclear engineering, nuclear power engineering, systems engineering and medical physics.

During the year 2017, PNRA awarded scholarships to 10 new selected engineers and scientists for pursuing master’s degrees in different fields at PIEAS and KINPOE. During the reporting year, 13 engineers and scientists joined PNRA after successful completion of their masters degree programmes whereas degree programmes of 21 fellows are in- progress at PIEAS and KINPOE.

PNRA also encourages its employees to avail higher education opportunities at national universities in areas relevant to PNRA. During the reporting year, 15 PNRA officials enrolled in various national universities for post-graduate and doctoral degree programmes.

Trainings at National Organizations

PNRA benefits from the specific training capabilities of various national institutes and organizations to enhance competencies, knowledge, skills and abilities of its technical workforce. Currently, PNRA has collaboration agreements with more than 25 national institutes for the competence development of its workforce in technical and management areas. These include well known national organizations and institutions like Pakistan Welding Institute (PWI); National Centre for Non-Destructive Testing (NCNDT); Pakistan Institute of Management (PIM); Secretariat Training Institute (STI); Research Society of International Law (RSIL); Pakistan Computer Bureau (PCB); Pakistan Planning and Management Institute (PPMI); Pakistan Manpower Institute (PMI); and National University of Science & Technology (NUST).

Under these collaboration arrangements, more than 110 PNRA officials participated in 50 training courses conducted by national organizations and institutes in 2017. Figure - 38 highlights the previous five years trend of participation of PNRA officials in different training

courses organized by various national institutions.

Competence Development through International Organizations

PNRA believes that international acumen and understanding of latest standards and technological advancements introduced around the globe are key factors in competence development of its regulatory officials. In this regard, PNRA encourages its officials to avail higher education opportunities at international universities. PNRA also benefits from training courses, workshops and fellowship programmes offered by International Atomic Energy Agency (IAEA) for its Member States.

Higher Education at International Universities

PNRA facilitates its employees for higher education in the areas relevant to regulatory functions at reputed international universities; to pursue post-graduate and doctoral degree programmes. Currently, three PNRA officials are pursuing their masters degree & PhD programmes at KAIST University, Korea in the area of nuclear and radiation safety; whereas, three officials are

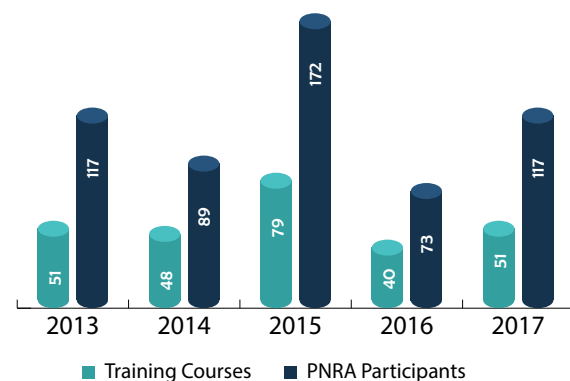


Figure - 38: Participation of PNRA Officials in Training Opportunities at Various National Institutions



Signing of Contract Between PNRA and CNPO for Conduct of Training Workshops for PNRA Officials

enrolled in PhD degree programmes at universities in USA, Switzerland and South Korea.

Training, Workshops and Fellowships at International Institutions

PNRA benefits from training opportunities offered by IAEA through wide spectrum capacity-building activities in various areas of regulatory importance including nuclear safety, radiation protection, nuclear security, and emergency preparedness and response. PNRA

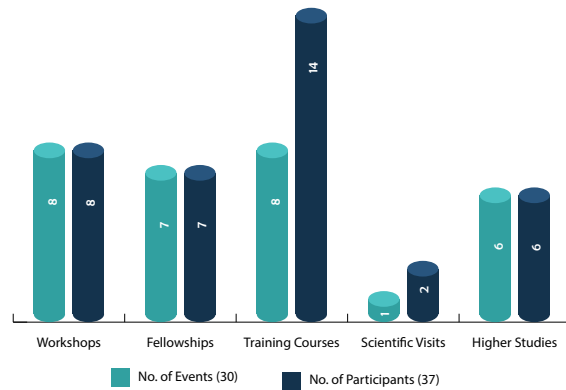


Figure - 39: Competence Development through International Organizations and Institutions

officials participate in IAEA sponsored training courses, workshops, fellowships and scientific visits arranged at different institutions and organizations in IAEA Member States. PNRA officials also participate in different capacity building activities under mutual arrangements with China which include fellowships, trainings and attachments. During the year 2017, 37 PNRA officials participated in 30 international events arranged in different countries. Figure - 39 represents graphically the competency development efforts of PNRA through international organizations during the year 2017.



IAEA Experts and Participants of Workshop on Safety Assessment of Gamma Knife, Cyber Knife and LINAC Systems



8. National and International Cooperation & Coordination

Nuclear regulatory bodies are assigned the mandate and responsibility to ensure safety of the public, workers and the environment from harmful effects of ionizing radiation by regulating the use of nuclear and radioactive materials at nuclear installations and radiation facilities. In order to adequately fulfill this national responsibility, regulatory bodies maintain appropriate cooperation and coordination with other organizations at national and international level. These cooperation and coordination mechanisms also support perpetual capacity-building of regulatory body through sharing of information, knowledge and experiences. Accordingly, PNRA strives to maintain effective cooperation with national and international stakeholders for effectively discharging its regulatory responsibilities.

At national level, PNRA maintains coordination with Government organizations, licensees and public. At international level PNRA interacts with various international organizations, regulatory bodies and other relevant institutes. Various elements of PNRA's cooperation and coordination at national and international levels is graphically represented in Figure - 40.

Cooperation and Coordination at National Level

PNRA considers the relationships with relevant state entities and organizations as an essential constituent for its effective organizational functioning. In this regard, PNRA coordinates with; provides input and advice to; and supports various Governmental organizations and ministries regarding organizational and policy issues. PNRA also maintains interaction with its licensees at various levels and strives to increase its communication with general public for enhancing public awareness about radiation risks and sharing information on important regulatory activities and decisions.

PNRA Coordination with Government Organizations

PNRA continued its coordination with Governmental departments and ministries for various organizational activities and policy issues. These include Strategic Plans Division (SPD), Office of the Accountant General of Pakistan Revenue, Ministry of Foreign Affairs (MoFA), Planning Commission, Ministry of Finance, law



Figure - 40: Cooperation and Coordination of PNRA at National and International Level



PNRA Official Conducting Public Awareness Seminar

enforcement agencies and other related Governmental organizations.

During the year 2017, PNRA issued four quarterly summary reports to apprise the relevant state entities including Prime Minister Secretariat about general situation in the areas of nuclear safety and radiation protection, regulatory oversight and safety significant issues related to nuclear power plants. Moreover, several senior officials from various Government departments visited PNRA during 2017 including Director General Strategic Plans Division.

Under the PNRA Ordinance, PNRA is required to coordinate and enforce emergency plans during nuclear and radiological emergencies; provide technical assistance to national organizations; and provide advice to the Federal Government regarding effective implementation of safety and protective measures. Details of PNRA activities in this regard are described in Chapter 6 of this report.

PNRA Interaction with Licensees

In order to maintain strong interaction with its licensees, PNRA conducts a series of periodic meetings at different levels with major licensees. In 2017, PNRA arranged two corporate level meetings at PNRA HQs. with the top management of PAEC; two coordination meetings with K-1; three coordination meetings with K-2, K-3; two coordination meetings with C-1, C-2; three coordination meetings with C-3, C-4; one coordination meeting with PINSTECH (PARR-1, PARR-2 and MPF); and one coordination meeting with HMC-3 and NEW-1.

PNRA acquires feedback of its licensees for the improvement of its performance and practices. During the reporting year, PNRA continued the process of revision of the survey questionnaire to be used for this purpose. PNRA invites representatives of licensees and other stakeholders for participation in training courses

and workshops conducted at PNRA. In the year 2017, more than 200 representatives from nuclear installations, radiation facilities and other stakeholders attended such events at PNRA.

During the reporting year, coordination with PIEAS regarding establishment of medical physics residency in the country remained in progress. Similarly, coordination was made with various radiation facilities and national Secondary Standards Dosimetry Laboratory (SSDL) regarding calibration of dosimetry equipment for an effective assessment of patient doses.

PNRA Public Awareness Programme

PNRA is implementing a public awareness programme with the objective to raise general awareness in public about ionizing radiation, its associated risks, benefits and protection of public from its hazardous effects.

During the reporting year, 30 lectures and seminars were organized at educational institutions and hospitals in different areas of the country. 6300 persons participated in these seminars. Figure - 41 represents the number of lectures / seminars conducted and participants of the

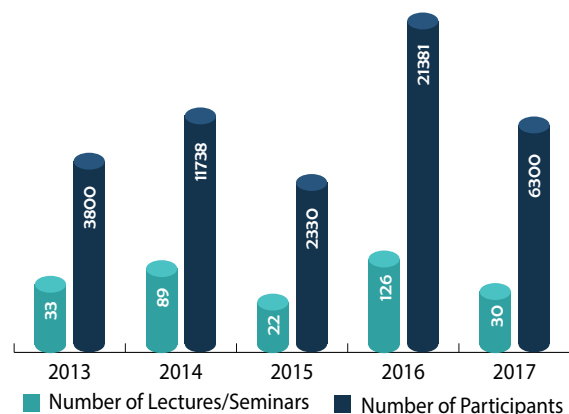


Figure - 41: Summary of PNRA's Public Awareness Campaign



Briefing to Chinese Delegation on Radiation Detection Equipment Laboratory

PNRA public awareness programme during the last five years.

Cooperation and Coordination at International Level

PNRA maintains strong cooperation, close liaison and effective coordination with regulatory bodies and technical support organizations of other countries; and International Atomic Energy Agency (IAEA). This cooperation and coordination is aimed to fulfill obligations under the international conventions to which Pakistan is party and for experience sharing with other countries in relevant domains.

Fulfilling Obligations under International Conventions

Pakistan is party to four international conventions related to safety and security of nuclear materials and installations. These include Convention on Early Notification of a Nuclear Accident; Convention on Assistance in the case of a Nuclear Accident or Radiological Emergency; Convention on Nuclear Safety; and Convention on Physical Protection of Nuclear Materials and its amendment. Pakistan has also voluntarily committed to implement codes of conduct related to safety of research reactors and safety and security of radioactive sources.

PNRA is the lead organization and contact point from Pakistan to coordinate with the international community on these conventions. PNRA plays a pivotal role in fulfilling the international obligations of Pakistan and actively supports the Government of Pakistan in execution of the activities related to these obligations.

PNRA, in capacity of designated national warning point, fulfills the obligations of Pakistan under the Conventions on “Early Notification of a Nuclear Accident” and “Assistance in the Case of a Nuclear Accident or Radiological Emergency”.

During 2017, Pakistan delegation comprising officials from PNRA, PAEC, MoFA and SPD participated in seventh meeting of the Contracting Parties to the Convention on Nuclear Safety. Chairman PNRA led Pakistan’s delegation and highlighted the measures taken by Pakistan to ensure safety at its nuclear power plants. Pakistan’s efforts in this regard were highly commended by the meeting participants. In addition, two officials from PNRA also served as Officers of the Review Meeting in the capacity of country group vice chair and country group coordinator to support the conduct of country group sessions.

Pakistan ratified the amendment to the Convention on the Physical Protection of Nuclear Materials in 2016. During the reporting year, PNRA remained involved in the activities related to implementation of the obligations of amendment. Several coordination meetings at national level were held for implementation of amended requirements and for delineation of national responsibilities.

PNRA is also implementing obligations arising from Pakistan’s commitment to follow the Code of Conduct on Safety and Security of Radioactive Sources. During the reporting year, PNRA reviewed the Supplementary Guidance on Import and Export of Radioactive Sources.

Bilateral Cooperation

PNRA maintains liaison with nuclear regulatory body and technical organizations of China for experience sharing, capacity building of its officials and cooperation in the fields of nuclear safety and security. In this regard, PNRA has bilateral cooperation arrangements with National Nuclear Safety Administration (NNSA), the Nuclear Regulatory Body of China; and China Nuclear Power Operation Technology Corporation, Ltd. (CNPO), a technical support organization.

During the reporting year, President of CNPO along with his team visited PNRA to further extend the mutual



PNRA Expert in IAEA Occupational Radiation Protection Appraisal Service (ORPAS) Mission held in Malaysia

cooperation. PNRA and CNPO jointly organized two workshops in Islamabad during the year 2017 in the areas of inspections and ageing management of nuclear power plants.

Collaboration with International Organizations

PNRA has strong liaison and working relationship with International Atomic Energy Agency (IAEA) in the capacity of national nuclear regulatory body of Pakistan. PNRA actively participates in various IAEA safety and security standards committees and related forums. PNRA collaborates with IAEA in sharing of experiences with other Member States by providing expert support in various regulatory domains. PNRA also benefits from IAEA Technical Cooperation and Regional Asia Projects; and Nuclear Security Cooperation Programme. Pakistan is also a member of United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and PNRA represents Pakistan at this forum.

a. Participation in IAEA General Conference

During the reporting year, PNRA as part of Pakistan's delegation, actively participated in 61st Regular Session of the IAEA General Conference. PNRA officials also took part in various sideline events such as briefing of IAEA Project for Multi-Unit Probabilistic Safety Analysis; plenary of Global Nuclear Safety and Security Network; meeting with representatives of Technical Cooperation Division IAEA; and meeting with representatives of Korea Institute of Nuclear Safety (KINS) - Korea Advanced Institute of Science and Technology (KAIST) on experience sharing about their MS Nuclear Engineering Programme.

b. Participation in IAEA Committees and Forums

PNRA remains actively engaged in various IAEA committees and forums where PNRA officials are designated as representatives and contact points from Pakistan. During 2017, PNRA officials participated in various meetings including Steering Committee Meeting of Regulatory Cooperation Forum (RCF), 12th Steering

Committee Meeting of Technical Support Organizations Forum (TSOF), 44th Meeting of Nuclear Safety Standards Committee (NUSSC), 35th Meeting of Transport Safety Standards Committee (TRANSSC), 43rd Meeting of Radiation Safety Standards Committee (RASSC), 4th Meeting of Emergency Preparedness and Response Standards Committee (EPReSC), and 10th & 11th Meeting of Global Nuclear Safety and Security Network (GNSSN). PNRA experts also participated in the activities related to technical working group on electrical and I&C components during 3rd Meeting of International Generic Ageing Lessons Learned (IGALL).

c. Expert Support in IAEA Missions and Consultancies

During the reporting year, PNRA provided expert support to IAEA in conducting its various missions, consultancies, workshops, seminars, conferences, meetings and training courses for IAEA Member States; and development of nuclear safety and security standards, training material, and other IAEA documents.

During the reporting year, 95 PNRA officials participated as technical experts in 83 events conducted by IAEA in various countries across the globe including Integrated Regulatory Review Service (IRRS) Mission; Occupational Radiation Protection Appraisal Service (ORPAS) Mission; and International Physical Protection Advisory Service (IPPAS) Mission. Figure - 42 represents the graphical detail of expert support provided by PNRA to IAEA during the reported year.

d. IAEA Technical Cooperation, Regional Asia and Research Projects

Pakistan takes benefit of IAEA expertise for strengthening of infrastructure and updating regulatory framework through IAEA's Technical Cooperation (TC) Projects; Regional Asia (RAS) Projects; and Coordinated Research Projects (CRP).

PNRA is part of two TC projects, one in the areas of radiation, transport and waste safety (TC Project

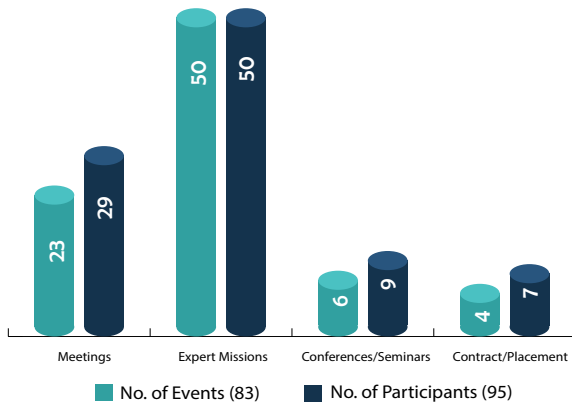


Figure - 42: Expert Support in International Events

PAK/9/040); and the other in nuclear safety (TC Project PAK/9/041). During the year 2017, seven workshops were arranged at PNRA, in which 21 international experts shared their expertise while four PNRA officials availed fellowships / scientific visit under these technical cooperation projects. During this year, a five member delegation of IAEA visited Pakistan to discuss and finalize the design of a comprehensive Technical Cooperation (TC) Project. Moreover, PNRA's National Counterparts of TC projects also participated in project coordination meetings.

During the reporting year, PNRA officials attended three workshops and four training courses under Regional Asia (RAS) Projects. Furthermore, PNRA officials also remained engaged in IAEA CRP on "Improved Assessment of Initial Alarms from Radiation Detection Equipment".

e. IAEA-Pakistan Nuclear Security Cooperation Programme

Pakistan has a strong cooperation with IAEA in the area of nuclear security regime in the country. PNRA is the

designated focal point of this cooperation to coordinate at international level with IAEA and relevant suppliers; and at national level with all stakeholders including relevant Government divisions, nuclear installation licensees, educational organizations, research centers and training institutes.

During the reporting year, PNRA continued the coordination of physical protection upgrades at civil nuclear power plants and 12 nuclear medical centers in Pakistan. During 2017, PNRA also coordinated for successful completion of the project for establishment of Physical Protection Interior Laboratory and Radiation Detection Equipment Laboratory at PIEAS for MS Nuclear Security. Furthermore, upgradation of other existing laboratories; and procurement of equipment and radiation sources was also made under this programme.

During the year 2017, PNRA coordinated the conduct of three project coordination meetings to oversee the progress of ongoing projects while an IAEA delegation, that visited Pakistan to review progress of this programme, highly appreciated Pakistan's efforts.

f. Representation in United Nations Scientific Committee on Effects of Atomic Radiation

Pakistan is a permanent member of the United Nations Scientific Committee on the Effects of Atomic Radiations (UNSCEAR) since 2011. PNRA has been representing the country in UNSCEAR. During the reporting period, a PNRA official participated in the 64th Annual Session of UNSCEAR. Technical documents and submissions of the Committee were reviewed at PNRA and proposals and suggestions for improvement were shared during the session. During the year 2017, Pakistan also officially designated a PNRA official as National Contact Person for UNSCEAR Surveys.



Visit of IAEA Delegation from Division of Nuclear Security to PNRA HQs.

9. TSO, Laboratories & Development Projects

Regulating nuclear installations and radiation facilities is a highly complex phenomenon involving safety review and assessment of technical submissions; audit calculations; analysis of existing and emerging safety issues; and safety research and development to support regulatory decision making process. It is a worldwide practice to hire external technical support organizations for providing such support to the regulatory bodies.

In Pakistan, there is no other organization which may provide technical support to PNRA in regulatory matters, therefore, PNRA realized the need for the establishment of an internal technical support organization with sufficient manpower; competent and skilled enough to be able to indigenously assist in regulatory decision making process.

Similarly, the need for availability of advanced laboratories at PNRA for independent monitoring and verification of radiation exposure of workers and environmental monitoring for establishing background radiation levels across the country was also recognized.

Accordingly, a technical support organization and two advanced laboratories are established at PNRA through Public Sector Development Programme (PSDP) of Government of Pakistan. In addition, three more PSDP projects are also being executed for enhancing PNRA's infrastructure for technical and logistical facilitation.

Technical Support Organization (TSO)

PNRA established a Technical Support Organization (TSO) comprising two support centres, namely Centre for Nuclear Safety (CNS) and Safety Analysis Centre (SAC) for review and assessment of licensee submissions and audit of safety analysis. The TSO possesses sufficient technical manpower with diverse qualifications, expertise and requisite tools including codes and standards and state of the art analytical computer codes.

Centre for Nuclear Safety (CNS)

Centre for Nuclear Safety (CNS) provides technical and scientific support to various departments of PNRA in review and assessment of various submissions of licensees and applicants. CNS has a highly qualified and experienced team, with adequate skills which is responsible for detailed review, assessment and independent audit calculations. During the reporting period, CNS has performed

regulatory review of more than 60 licensing submissions and 35 design modifications related to NPPs and Research Reactors, including:

- Site Evaluation Report (SER) of spent fuel dry storage facility of CNPGS;
- Safety Analysis Report (SAR) of spent fuel dry storage cask of K-1;
- C-1 design modification related to embedded plates and spent fuel storage racks;
- Initial decommissioning plan of C-2;
- Quality Assurance Programme (QAP) Rev-1 of C-2;
- Revised K-1 FSAR and PSA Level-1 Report (Rev. 03); and
- Revised Final Safety Analysis Report (FSAR) of PARR-1.

CNS also remained engaged in different research and development activities. During the reporting year, CNS has completed assessment of fuel behavior under Loss of Coolant Accident (LOCA) conditions without the availability of safety systems and assessment of seismic hazards.

Safety Analysis Centre (SAC)

Safety Analysis Centre (SAC) performs design and audit safety analysis such as Deterministic Safety Analysis; Structural and Seismic Analysis; Design Base Accidents (DBAs) Analysis; and Electrical and Fire Hazard Analysis to support regulatory decision making process. During the year 2017, SAC remained involved in the following major activities:

- Audit of Design Basis Accident (DBA) Analysis of K-2, K-3 and C-3;
- Severe Accident Mitigation Systems Analysis of K-2 and K-3;
- Dose Calculations at Site Boundary of K-2 and K-3;
- Containment Building Stress Analysis of K-2 and K-3;
- Reactor Coolant Pump Room Fire Analysis of C-2; and
- EDG Step Loading Sequence Analysis of C-3 and C-4.

During the reporting year, SAC has developed a database for PNRA namely “PNRA Regulatory Inspection Database (PRIDE)” for inspection planning, preparations and follow-up. Furthermore, the development of independent Regulator’s Full Power Level-I PSA Model of K-2/K-3 and desktop simulator with capabilities to simulate and analyze severe accidents remained in progress.

PNRA Laboratories

PNRA has established two laboratories namely National Dosimetry and Protection Level Calibration Laboratory (NDCL) and National Environmental Monitoring Programme (NEMP). NDCL is used for monitoring personnel radiation doses and cross verification of licensees’ results; and NEMP performs monitoring of environmental radioactivity levels and verification of the environmental monitoring data provided by the licensees.

National Dosimetry and Protection Level Calibration Laboratory (NDCL)

These laboratories are setup in Islamabad, Kundian, and Karachi and perform external and internal dosimetry and protection level calibration. These laboratories are also aimed to provide radiation dose monitoring services to the workers of first response organizations and law enforcement agencies who may be involved to cope with any nuclear accident/radiological emergency. In addition, these laboratories also verify that radiation doses to patients are in line with the prescribed levels; and independent assessment of worker’s radiation dose record submitted by the licensees.

During the reporting year, NDCL has conducted internal contamination monitoring of more than 800 personnel including radiation workers of nuclear power plants, foreign contractors and IAEA inspectors on Whole Body Counting (WBC) systems. External dosimetry services

were provided to a number of different licensed radiation facilities. Furthermore, NDCL initiated process of inter-comparison of results with secondary standard dosimetry laboratory in the country. During 2017, NDCL has successfully started calibration of radiation monitoring equipment.

National Environmental Monitoring Programme (NEMP)

Under its National Environmental Monitoring Programme (NEMP), PNRA has established environmental monitoring laboratories in Islamabad, Kundian and Karachi. These laboratories are aimed to conduct environmental radioactivity surveillance and establish background radiation levels all around the country.

During the year 2017, PNRA has conducted verification of K-1, PARR-1, PARR-2 and MPF environmental monitoring results by independently collecting and analyzing samples from soil and water adjacent to these facilities and performing comparative analysis with the data provided by licensees.

PNRA is working on establishment of countrywide national background radiation levels by assessing radiation levels in soil and drinking water. As per plan developed and methodology adopted to execute this task, the entire country is divided into a number of grids. During the reporting period, samples from various districts of Punjab, KPK and Sindh were collected. The analysis of these samples remained in progress till the end of 2017.

PNRA also performs survey of Naturally Occurring Radioactive Material (NORM) to keep vigilance of radiation hazards associated with NORM used in industries. During the reporting year, PNRA conducted survey based on sample analysis in a number of oil and gas fields, coal mining sites and coal fired power plants.



Briefing to Visitors on Internal Contamination Monitoring System

Public Sector Development Programme (PSDP) Projects

PNRA is currently executing three Public Sector Development Programme (PSDP) projects namely National Radiation Emergency Coordination Centre (NRECC); PNRA Residential Colony Chashma (PRC); and Design Assessment and Analysis of NPPs (DAAP).

National Radiation Emergency Coordination Centre (NRECC)

This project was initiated for upgrading National Radiation Emergency Coordination Centre (NRECC) of PNRA with the objective to improve the capabilities for effectively coordinating and advising the Government and relevant organizations in case of a nuclear accident or radiological emergency. This project aims to make available online critical parameters of nuclear power plants, meteorological data and environmental radiation levels at PNRA HQs. to be able to assess the plant conditions at all times. During the reporting year, following major activities were accomplished under this project:

- Procurement of radiation monitoring detectors for establishment of online radiation monitoring system;
- Finalization of contract for installing the system to receive necessary parameters on-line from the nuclear power plants and surroundings; and
- Acquired land for establishment of a state-of-the-art emergency coordination center at PNRA HQs. Islamabad.

PNRA Residential Colony Chashma (PRC)

PNRA is developing a residential colony in Chashma to facilitate the accommodation of its officials, thereby



Radiation Survey and Sample Collection at NORM Producing Industries

ensuring continuous on-site presence of regulatory officials at its regional office located at this site which houses four operating nuclear power plants.

During the reporting year, construction of several buildings was completed which were handed over for occupancy. On the whole, more than 90% of the project activities have been completed by the end of reporting year whereas work on remaining project activities is in progress and is scheduled to be completed in the first half of 2018.

Design Assessment and Analysis of Nuclear Power Plants (DAAP)

Design Assessment and Analysis of Nuclear Power Plants (DAAP) project is aimed to further strengthen PNRA's design assessment and analysis capabilities through capacity building and training of officials. The specific focus of this project is to augment existing assessment and analysis capabilities; acquire new software; fulfill future training needs and update the available analytical tools. During the reporting year, a number of trainings were arranged under this project for PNRA officials at national and international level. Furthermore, following major activities were also conducted under this project:

- Signing of a Memorandum of Understanding (MoU) with China Nuclear Power Organization (CNPO) for training and workshops at PNRA and placement of PNRA officials at CNPO;
- Renewal, up-gradation and procurement of several analytical software used for Computational Fluid Dynamics (CFD) analysis, stress analysis, structural analysis and Probabilistic Safety Analysis (PSA) respectively; and
- Procurement of latest design and construction codes.



Signing of Contract for Online Plant Parameter Display System at NRECC

10. Performance Review

In accordance with PNRA management system, PNRA conducts its overall performance assessment annually against 12 “Strategic Performance Indicators (SPIs)” and subsequent downstream “Specific Performance Elements (SPEs)” in order to assess and evaluate the effectiveness of its regulatory processes.

On the basis of this assessment, performance of PNRA against each indicator is evaluated on a five step rating scale i.e. Satisfactory, Minimally Acceptable, Needs Improvement, Unsatisfactory and Not Acceptable. This Chapter discusses the evaluation made against each indicator during the year 2017.

Assessment of Strategic Performance Indicators

Indicator 1 - “Ensures that acceptable level of safety is being maintained by licensees”

This indicator is assessed on the basis of SPE’s related to review and assessment; inspection and enforcement; and reporting of events.

The “Review and Assessment” is evaluated on the basis of effectiveness of review of licensees’ submissions conducted during the year; review findings identified and their satisfactory resolution; and directives issued and complied with by the licensees. During the reporting year, PNRA reviewed a number of submissions of nuclear installations and radiation facilities; and where required, communicated its findings in the form of review queries to the respective licensees. Based on successful resolution of all review queries for compliance with the regulatory requirements, PNRA granted various authorizations and licences accordingly. The details of these activities are presented in Chapters 3,4, 5 and 9 of this report.

The “Inspection and Enforcement” is assessed on the basis of conduct of regulatory inspections at nuclear installations and radiation facilities; issuance of inspection findings and directives for their compliance; and monitoring of emergency exercises. During the reporting year, PNRA conducted a number of inspections of nuclear power plants; research reactors; molybdenum production facility; equipment manufacturers; service providers and radiation facilities; and issued inspection reports reflecting deficiencies observed during these inspections. Further, PNRA issued several directives as a result of non-compliances by the licensees and the required actions were followed-up for implementation accordingly. Chapters 3 and 4 of this report provide details of activities

related to inspections.

During the reporting year, PNRA inspectors witnessed the emergency exercises of K-1, CNPGS and PARR-1 to assess the licensee’s capabilities for effectively executing the actions identified in their emergency plans to cope with a potential nuclear or radiological emergency. Chapter 6 of this report presents the details of these activities.

The performance element “Reporting of Events” is evaluated on the basis of timely reporting of events; critical review of event reports and implementation of corrective actions by licensees. During the reporting period, PNRA reviewed and assessed a number of event reports submitted by K-1, C-1, C-2, C-3 and C-4 for verification of compliance with regulatory requirements and ensured timely implementation of all corrective actions. Details are reflected in Chapter 3.

The above activities determined that the licensees are performing their activities in accordance with the regulations and licences issued by PNRA, meeting the safety requirements. Accordingly, PNRA performance against this indicator has been rated as “Satisfactory”.

Indicator 2 - “Ensures that regulations and guides are in position and understood by licensees”

The evaluation of this indicator is made on the basis of performance elements namely “Development of Regulations and Guides” and “Licensees’ Perception & Understanding of Regulations”.

The “Development of Regulations and Guides” is assessed on the basis of availability of required regulations and guides; and their continuous updation in line with the emerging technologies, international practices and feedback from experience. Until now, PNRA has issued 18 regulations and 11 regulatory guides in pursuance of PNRA Ordinance. During the reporting year, PNRA revised and issued the “Regulations on Licensing Fee by Pakistan Nuclear Regulatory Authority - (PAK/900) (Rev.2)”; and three new regulatory guides. Further, PNRA remained involved in development of five new regulations and seven regulatory guides and revision of eight existing regulations and one regulatory guide. Meanwhile, it was noted that the development / revision of regulations and regulatory guides somewhat lagged behind the targets set for the reporting year.

The “Licensees’ Perception & Understanding of

Regulations” is assessed on the basis of involvement of licensees in the process for the development of regulations; conduct of training courses for licensees, and feedback received from licensees during implementation of regulations. PNRA involves all its stakeholders in the process of development of regulations as defined in the management system. PNRA also gives due consideration to the feedback of licensees during implementation of regulations. During the reporting period, PNRA organized two training courses and a number of lectures for developing and enhancing the understanding of its regulatory framework among stakeholders. The details of these activities are presented in Chapters 2, 7 and 8 of this report. During the reporting period, PNRA did not receive any adverse feedback related to the licensees perception and understanding of the regulations.

In view of the above, PNRA's performance against this indicator is rated as **“Minimally Acceptable”**.

Indicator 3 - “Strives for continuous improvement of its performance”

This indicator is evaluated on the basis of SPE's related to improvement in regulatory processes & activities based on performance monitoring, self assessment, independent assessments, feedback from interested parties and international experience feedback.

In order to evaluate its regulatory effectiveness, PNRA has developed a detailed mechanism under its management system for monitoring and assessment of regulatory processes & activities. During the reporting year, PNRA evaluated annual progress of the implementation of Strategic Plan 2015-2018 and issued second yearly progress report. PNRA also monitored quarterly performance of all departments and issued four quarterly performance evaluation reports to reflect progress and implementation status of their annual work plans. During these evaluations, it was noted that most of the planned activities were progressing as scheduled while recommendations to expedite the implementation were issued where required. In addition, meetings of top management with each department and two Regional Directors' meetings were conducted to discuss & resolve different departmental concerns and issues related to regulatory oversight of nuclear installations and radiation facilities.

During the reporting period, a number of PNRA departments performed their self assessment on the basis of pre-defined criteria and procedures. PNRA also shared its safety culture self assessment results in the 7th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety held in Vienna, Austria in April 2017 which were widely acknowledged by the international community. Furthermore, a follow-up of third internal regulatory audit was conducted and progress report on actions taken for implementation of recommendations

and suggestions of the International Regulatory Review Services (IRRS) Mission was also issued which highlighted that most of planned actions are progressing as scheduled.

PNRA gives due importance to the feedback received from stakeholders / licensees. This feedback is captured during inspections, meetings and other interactions with various stakeholders. PNRA is also developing a questionnaire covering all aspects of regulatory oversight, to be distributed to the licensees of nuclear installations in order to get their feedback on regulatory effectiveness.

PNRA also considers and utilizes international experience feedback for the improvement of regulatory processes and activities. This feedback is an integral part of PNRA management system. In this regard, this feedback is made part of management, core and support processes defined in PNRA management system. Further, PNRA officials visiting international organizations and regulatory bodies of other countries share their experiences and suggestions for improvement at departmental level.

Chapter 2 of this report presents detail of these activities.

In view of the timely and effective progress of all scheduled activities regarding performance monitoring, self assessment, independent assessments, feedback from interested parties and international experience feedback, performance of PNRA for this indicator is rated as **“Satisfactory”**.

Indicator 4 - “Takes appropriate actions to prevent degradation of safety and to promote safety improvements”

The assessment of this indicator is made on the basis of performance elements related to periodic safety assessment of licensees; implementation of relevant international experience feedback; and implementation of necessary design modifications to prevent degradation of safety.

During the reporting year, PNRA reviewed various routine submissions of nuclear installations and radiation facilities including technical reports, dose reports, annual safety reports, environmental monitoring reports, etc. PNRA also conducted integrated safety assessment of K-1, C-1 and C-2; and operational safety trend analysis of K-1; to identify actions for preventing degradation of safety and promoting safety improvements. Details of these activities are reflected in Chapters 3, 4 and 5.

PNRA evaluates international Operating Experience Feedback (OEF) received from different international platforms and extracts appropriate lessons to enhance safety of nuclear installations in Pakistan by preventing occurrence of similar events to the extent practicable. During the reporting period, PNRA issued two reports, based on evaluation of international operating experience feedback, containing useful lessons for nuclear installations operating in Pakistan in order to prevent degradation of

safety and to make it consistent with international safety standards and practices.

Furthermore, a number of modifications in design and technical specifications submitted by the licensees were assessed and approved by PNRA.

The details of these activities are presented in Chapters 3, 4, 5 and 9 of this report.

Keeping the PNRA efforts in view, the performance rating for this indicator is maintained as **“Satisfactory”**.

Indicator 5 - “Takes appropriate steps for human resource development and has competent and certified regulatory staff”

This indicator is evaluated on the basis of performance elements namely human resource development; assessment of competency and training needs; and training & certification of regulatory personnel.

During the reporting year, PNRA developed the Human Resource (HR) Strategic Plan 2025 with the objective to identify the future HR needs of PNRA for fulfilling its regulatory activities. This year, 13 engineers and scientists joined PNRA after the successful completion of their Master degree programmes from PIEAS and KINPOE while 10 engineers and scientists were inducted for fellowship programmes at these institutions. Furthermore, a number of administrative and technical junior officials were also recruited during this year.

PNRA periodically conducts Competence Need Assessment (CNA) to identify areas for improvement and accordingly chalks out plan for competence development of its officials. In this regard, during the reporting period, the task analysis of PNRA departments; and preparation of competence profiles for management positions in the light of guidelines provided by IAEA competency framework were initiated.

During the reporting period, PNRA conducted a number of in-house training courses through NISAS to enhance the competency of its officials in the areas of emergency preparedness and response; regulatory framework; industrial and medical use of ionizing radiation; physical security at nuclear facilities; decommissioning of nuclear installations; safety culture; etc. In addition, a number of PNRA officials participated in training courses, workshops, fellowships and scientific visits conducted at national and international organizations and institutes.

Further, 15 PNRA officers are enrolled in various national universities for graduate, post-graduate, master’s and doctorate degree programmes while, 06 officers are pursuing their PhD and Masters degree programs at reputed international universities.

Chapter 7 of this report provides the details of all activities

related to competency development of PNRA personnel.

In view of the efforts made for human resource and competence development of regulatory officials, performance against this indicator is retained as **“Satisfactory”**.

Indicator 6 - “Ensures legal actions are taken in case of violations of regulatory requirements”

The assessment of this indicator is made on the basis of SPE’s related to availability of enforcement regulations & associated procedures; issuance of notices for compliance of regulatory requirements; and appropriate legal actions taken against violators.

PNRA promulgated Enforcement Regulations-PAK/950 and developed enforcement procedure which provide a mechanism for taking enforcement actions against the violators.

At present, almost all the facilities and activities in Pakistan involving radiation sources operate under licence issued by PNRA. The only exception are the medical diagnostic X-ray facilities, a number of which are out of the licensing net, as yet. However, PNRA is striving hard to bring such facilities within its licensing net.

PNRA ensures compliance of regulatory requirements by licensees / users of radioactive materials and radiation sources; and issues notices in case of non compliance. During the reporting year, PNRA issued 212 show cause notices, 210 offence reports to the violators and conducted 263 hearing proceedings. As a result of these enforcement actions, most of the issues raised were resolved and disposed off accordingly. Chapter 4 of this report reflects detail of these activities.

Keeping in view that a number of diagnostic X-ray facilities are still out of regulatory net and considering the on-going efforts of PNRA in this regard, PNRA’s performance against this indicator is retained as **“Minimally Acceptable”**.

Indicator 7 - “Performs its functions in a timely and cost-effective manner”

This indicator is evaluated based on SPE’s related to meeting pre-defined targets and schedules; conducting planned and impromptu activities; and optimization of resources.

During the reporting period, PNRA performed the regulatory oversight of nuclear installations and radiation facilities according to the targets and schedules set in annual work plans and also managed to perform some unplanned activities without affecting the scheduled activities. PNRA completed all the planned licensing and authorization activities including grant of extension in operating licence of K-1; granting permissions to load fuel and make the reactor critical to C-4; award / renewal of licences to operating personnel; and grant of permission

to HMC-3 for manufacturing of prototype cask.

In addition, PNRA performed review and assessment of different submissions of licensees and conducted several regulatory inspections at nuclear installations, equipment manufacturers, service providers and radiation facilities according to schedule. PNRA also completed many planned activities regarding development of regulatory and management system documents, monitoring and evaluation of regulatory processes and implementation of development projects. Inspections were also conducted according to the annual inspection plans.

These activities were accomplished cost effectively within the available resources, as almost all major targets and milestones for the year 2017 were achieved. Chapters 2, 3, 4, 5 and 6 of this report present all these activities in detail.

Considering the efforts made during the reporting period for on-time and cost effective accomplishment of its scheduled activities, the performance rating of PNRA against this indicator has been upgraded from "Minimally Acceptable" to "**Satisfactory**".

Indicator 8 - "Ensures that a well established quality management system exists"

This indicator is assessed on the basis of performance elements with respect to management system; its understanding among PNRA officials; and implementation within PNRA.

PNRA Management System Manual describes the responsibilities, processes and procedures for performing regulatory, support and management functions in a systematic and effective manner. PNRA has established a detailed mechanism for monitoring and assessment of implementation of management system.

During the reporting year, PNRA initiated an awareness programme for enhancing the understanding of Management System Manual (MSM) amongst PNRA officials for its effective implementation. Accordingly, a number of awareness sessions for various PNRA departments were conducted while some of such sessions are scheduled to be conducted in 2018.

In addition, PNRA issued second progress report of Long Term Strategic Plan 2015-2018; issued four quarterly performance evaluation reports; etc. Furthermore, a number of PNRA departments conducted self assessments; all departments updated their organizational structure, issued annual work plans, weekly plans, monthly progress reports; and developed several Level II and Level III documents including procedures, process flow charts, job descriptions, reports, etc.

Chapter 2 of this report reflects details of these activities.

In view of the efforts of PNRA for an effective

implementation of management system activities during the year 2017, the PNRA's performance against this indicator is retained as "**Satisfactory**".

Indicator 9 - "Ensures that adequate resources are available for performing its functions and technical support centre is available for specialist assistance when required"

The assessment of this indicator is made on the basis of performance elements related to financial & human resources; and availability of technical support to PNRA.

PNRA continues its efforts for the availability of appropriate financial resources; and development & enhancement of human resources. The annual budget of PNRA for the financial year 2017-2018 was approved and provided by the Federal Government and is being utilized judiciously for the accomplishment of targets. During the reporting year, all the regulatory functions and associated planned activities were sufficiently resourced and executed properly. All the three PSDP projects were also adequately funded by the Government and most of the planned project activities were successfully completed. However, due to limited financial resources, some of the activities were affected which included set-up of radiation safety laboratory; enhancement of Soft Panel Training Simulator (SPTS); and extension of physical models laboratory at NISAS.

Furthermore, PNRA ensures sustained availability of competent manpower for performing its functions by induction of new officials and their subsequent competence development. During the reporting year, PNRA inducted a number of technical and administrative officials; and provided appropriate trainings to its officials at national and international level. Chapter 7 of this report presents detail of these activities.

PNRA has two Technical Support Centres (TSOs) namely Centre for Nuclear Safety (CNS) and Safety Analysis Centre (SAC) to strengthen and enhance the existing capabilities of PNRA to discharge its regulatory responsibilities effectively. During the reporting year, CNS provided support in review and assessment of various licensing submissions while SAC provided technical support in safety and design analysis of nuclear installations. Chapter 9 of this report presents details of these activities.

Considering the efforts of PNRA regarding availability of adequate financial and human resources and sufficient technical support, PNRA's performance against this indicator has been upgraded from "Needs Improvement" to "**Minimally Acceptable**" for the reporting year.

Indicator 10 - "Performs its functions in a manner that ensures confidence of the operating organizations"

This indicator is assessed on the basis of SPE's on feedback acquired from the licensees of nuclear installations and radiation facilities; and participation of licensees in regulator's activities.

PNRA promotes and maintains close cooperation with all stakeholders. PNRA management system process for development of regulations and regulatory guides gives due consideration to the active involvement of its licensees in development process for acquiring and appropriately addressing their feedback and concerns. PNRA also acquires feedback of its licensees for the improvement of its work performance and practices. For this purpose, PNRA circulates feedback questionnaire among its licensees and accordingly develops strategies for improvement of regulatory practices and performance. During the reporting year, PNRA continued the process of revision of the survey questionnaire to be used for this purpose. Chapter 8 of this report reflects details of these activities.

PNRA organizes training courses for its licensees, radiation workers and other stakeholders. During the year 2017, PNRA arranged various training courses for the licensees and radiation workers to enhance understanding of the regulatory framework, importance of regulatory requirements and its implementation for maintaining safety. Chapter 7 of this report presents detail of training activities.

PNRA conducts periodic meetings at different levels with major licensees. Periodic coordination meetings were conducted with Pakistan Atomic Energy Commission, the owner and operator of all nuclear installations in Pakistan at the Corporate and plant levels, on regular basis with different frequencies. Chapter 8 of this report presents details of these meetings conducted during the year 2017.

In view of the efforts of PNRA for acquiring feedback of and interaction with licensees; while noting the ongoing process of revision of questionnaire to acquire this feedback, PNRA's performance against this indicator has been retained as **"Minimally Acceptable"**.

Indicator 11 - "Performs its functions in a manner that ensures confidence of the general public"

The assessment of this indicator is made against performance elements related to public awareness programme; dissemination of information among general public; and involvement of public in preparation of regulatory documents.

PNRA has developed a programme for enhancing public awareness about the ionizing radiation, its use in everyday life, associated hazards and protection measures. During the reporting year, a number of lectures and seminars were organized in different areas of the country. Chapter 8 presents details of the activities on public awareness.

PNRA shares information about major regulatory decisions and its activities through variety of means such

as its website (www.pnra.org), annual report, and through delivering lectures & seminars in different Government and private organizations all over the country.

PNRA strives for enhancement of public involvement in different regulatory processes. PNRA involves public in the development of regulatory documents by placing draft regulations at its website for feedback and comments. However, PNRA needs to enhance its outreach by developing a mechanism for active involvement of general public in the preparation of PNRA regulations.

In view of the above, the performance against this indicator is retained as **"Needs Improvement"**.

Indicator 12 - "Performs its functions in a manner that ensures confidence of the Government"

This indicator is evaluated based on performance elements with respect to timely provision of necessary information to the Government about regulatory decisions and provision of advice as and when required; and support for fulfillment of international obligations.

PNRA believes in the importance of effective coordination with concerned Governmental organizations in order to keep them informed about major regulatory decisions. PNRA periodically shares the status of nuclear power plants with the relevant Governmental organizations. During the year 2017, PNRA prepared four quarterly summary reports to apprise the relevant state entities including Prime Minister Secretariat about general situation in the areas of nuclear and radiation safety, regulatory oversight of industrial safety activities and safety significant issues.

During the reporting year, PNRA also coordinated with, provided input to and supported various Governmental organizations and ministries including Ministry of Foreign Affairs (MoFA), Strategic Plans Division (SPD), Planning Commission, Ministry of Finance and other relevant Governmental departments regarding organizational and national policy issues, development projects being undertaken, financial issues, etc.

Pakistan is party to a number of international conventions related to nuclear safety, radiological emergencies and physical protection, which are legally binding agreements under international law between sovereign states and international organizations. PNRA plays a pivotal role in fulfilling the international obligations of Pakistan and actively supports the Government of Pakistan in execution of activities related to these obligations.

Chapter 8 of this report provides details of all these activities.

In view of the above, the performance of PNRA against this indicator is rated as **"Satisfactory"**.

Overall Performance

Based on evaluation of all the twelve strategic performance indicators, the overall performance of PNRA

for the year 2017 is rated as **“Satisfactory”**. Figure - 43 represents the performance of strategic performance indicators on five step rating scale. Figure - 44 presents overall performance of last ten years.



Figure - 43: Assessment of PNRA's Performance in 2017

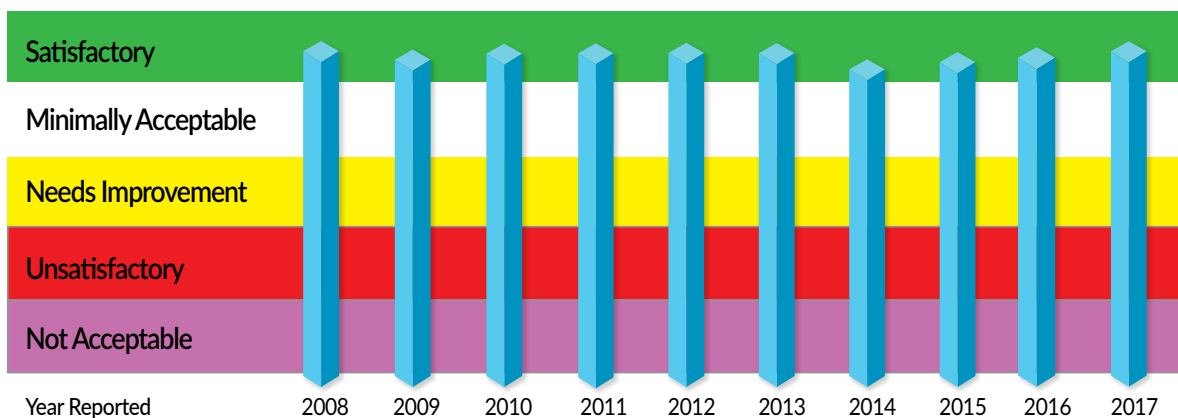


Figure - 44: Annual Performance Review of PNRA for Last Ten Years



Former Members of the Authority



Jamshed Azim Hashmi
Chairman, PNRA
(16.02.2001 – 15.02.2009)



Mohammad Anwar Habib
Chairman, PNRA
(16.02.2009 – 15.02.2017)



Jawad Azim Hashimi
Member, PNRA
(25.04.2001 – 24.04.2005)



Lt. Gen. R. Khalid Ahmed Kidwai
Part-time Member, PNRA
(28.02.2002 – 27.02.2014)



Dr. Inam-ur-Rahman
Part-time Member, PNRA
(28.02.2002 – 27.02.2010)



Dr. M. Younus Sheikh
Part-time Member, PNRA
(28.02.2002 – 27.02.2006)



Mr. Anwar Ali
Part-time Member, PNRA
(28.02.2002 – 27.02.2006)



Asif Shuja Khan
Part-time Member, PNRA
(28.02.2002 – 27.02.2014)



Prof. Dr. Mohammad Ali Maud
Part-time Member, PNRA
(28.02.2002 – 27.02.2010)



Dr. Qazi Abdus Saboor
Part-time Member, PNRA
(21.03.2002 – 20.03.2014)



Syed Badshah Husain
Member, PNRA
(23.06.2003 – 11.07.2007)



Muhammad Shakil ur Rahman
Member, PNRA
(25.04.2005 – 24.04.2011)



Prof. Dr. Inayat Shah Roghani
Part-time Member, PNRA
(23.02.2006 – 22.02.2010)



Zia-ul-Hasan Siddiqui
Part-time Member, PNRA
(01.07.2006 – 30.06.2011)



Dr. Shahid Ahmed Mallick
Member, PNRA
(16.02.2009 – 10.02.2011)



Prof. Dr. Mustafa Kamal
Part-time Member, PNRA
(29.04.2011 – 28.04.2015)



Mahboob Ali
Member, PNRA
(25.04.2011 – 24.04.2016)



Saeed Alam Siddiqui
Part-time Member, PNRA
(01.07.2011 – 31.07.2014)



Mohammad Iqbal
Member, PNRA
(08.05.2012 – 07.05.2015)



Lt. Gen. Zubair Mahmood Hayat
Part-time Member, PNRA
(01.03.2014 – 23.04.2015)



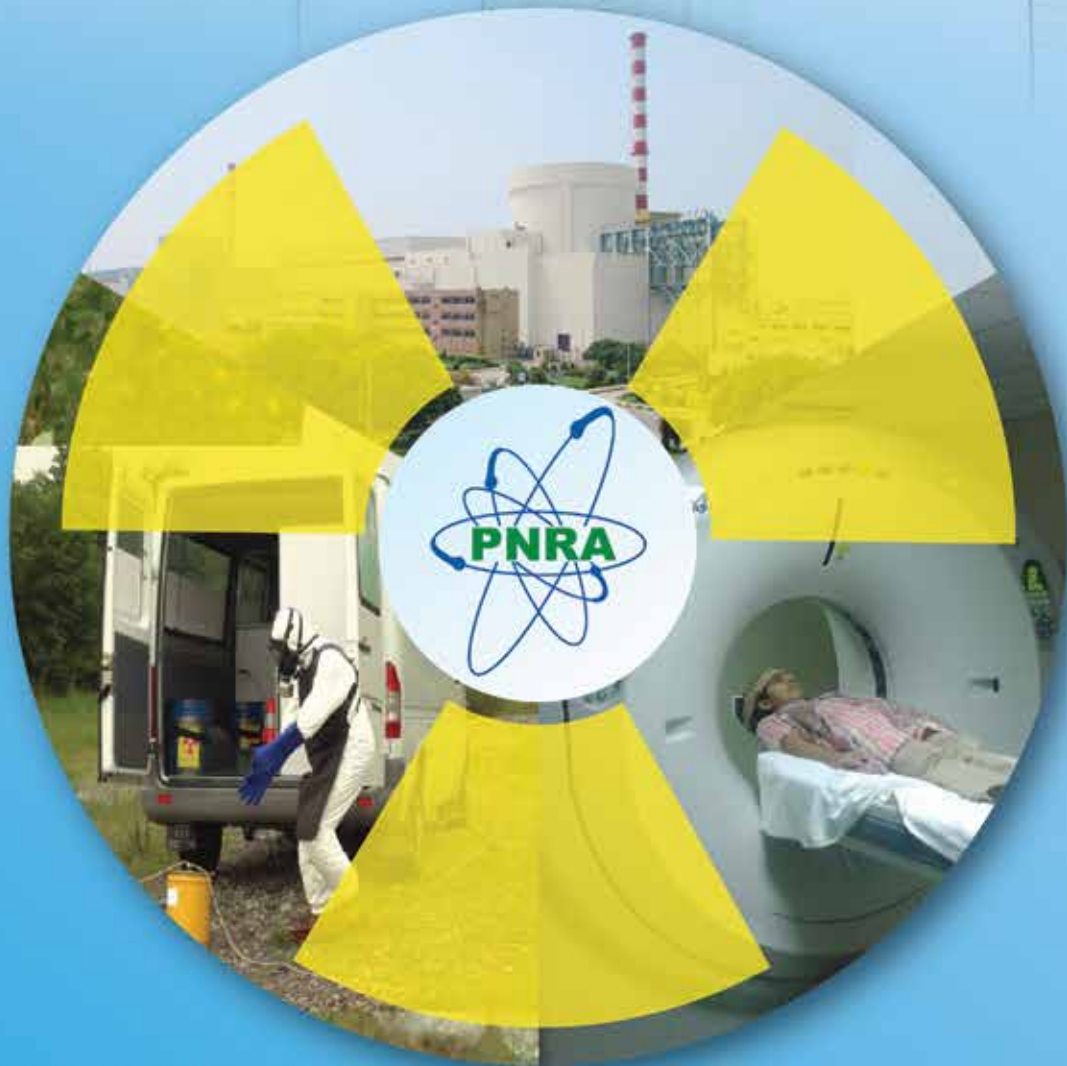
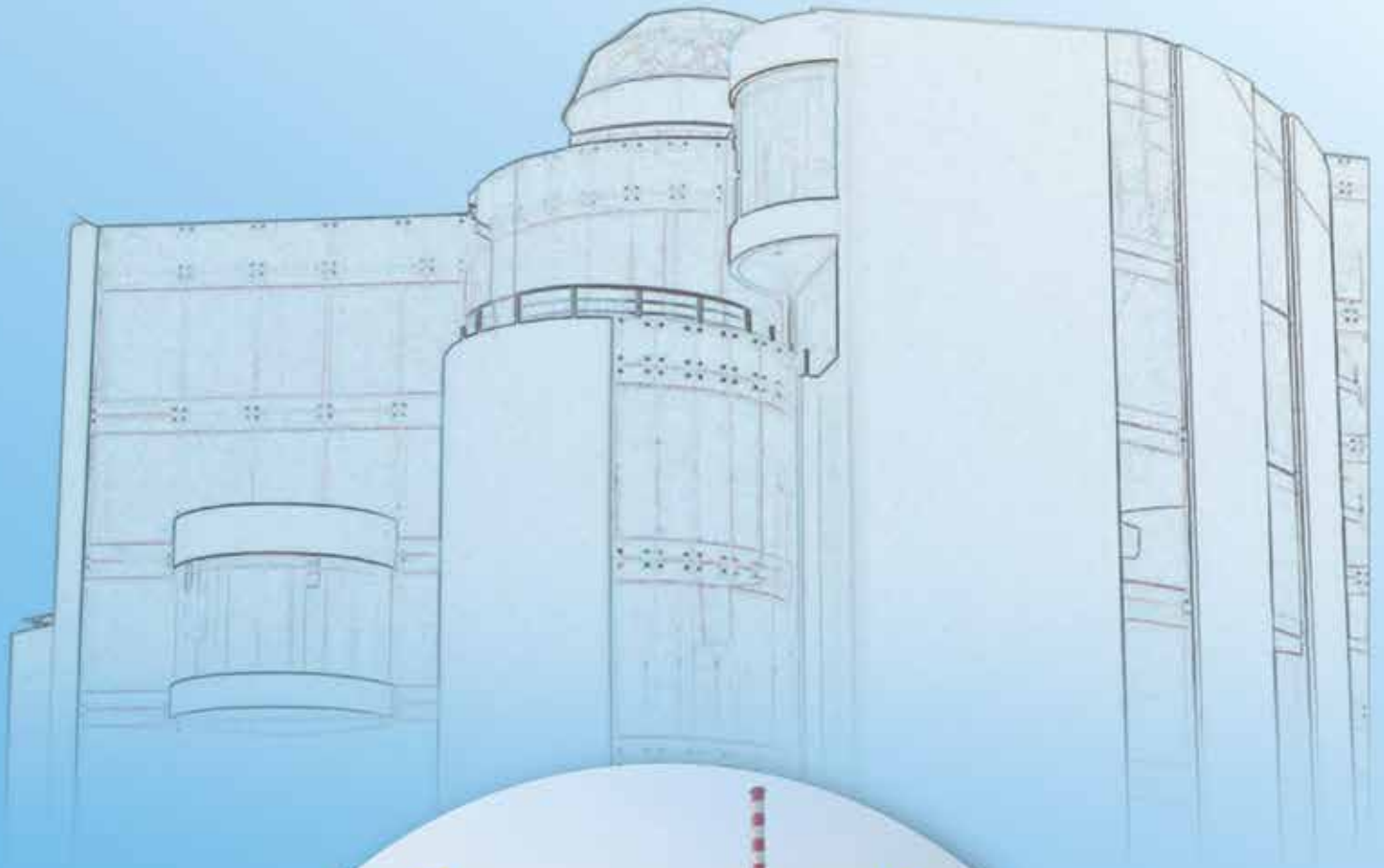
Dr. Muhammad Khurshid
Part-time Member, PNRA
(17.10.2014 – 16.10.2018)



Lt. Gen. Mazhar Jamil, HI(M)
Part-time Member, PNRA
(24.04.2015 – 25.09.2017)



Dr. Huma Qureshi
Part-time Member, PNRA
(24.01.2017 – 19.09.2017)



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