National Regulatory Requirements and Practices for Radioactive Waste Management, Decommissioning and Environmental Protection- Ensuring Safety and Enabling Sustainability

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1. Introduction

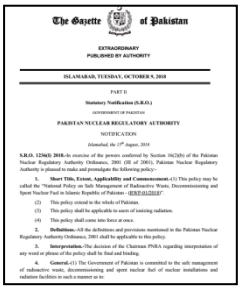
Pakistan Nuclear Regulatory Authority (PNRA) was established as a national regulatory body by Government of Pakistan on January 22, 2001 to regulate nuclear installations and radiation facilities for ensuring protection of the workers, the public and the environment from the harmful effects of ionizing radiation.

In this poster,national policy and national regulations pertaining to radioactive waste management, decommissioning, spent nuclear fuel management and environmental protection are presented that promotes sustainability in context of social, economic and environmental factors.

2. Enablers of Sustainability in National Policy and Regulatory Framework

2.1 National Policy

PNRA in collaboration with other relevant national stakeholders formulated "National Policy on Safe Management of Radioactive Waste, Decommissioning and Spent Nuclear Fuel in 2018. This policy outlines number of sustainability aspects which are presented in figure below. For example, national policy gives preference to immediate dismantling over other strategies so as to pose fewer burdens on future generation. Similarly, focus on waste minimization is also critical for optimization of cost of future waste disposal projects and protection of human health and environment.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PART II

Statutory Notification (S.R.O.)

GOVERNMENT OF PAKISTAN

PAKISTAN NUCLEAR REGULATORY AUTHORITY

NOTIFICATION

Islamabad, the 1st August, 2018

S.R.O. 1236(I)/2018.-In exercise of the powers conferred by Section 16(2)(b) of the Pakistan Nuclear Regulatory Authority Ordinance, 2001 (III of 2001), Pakistan Nuclear Regulatory Authority is pleased to make and promulgate the following policy:-

1. **Short Title, Extent, Applicability and Commencement.**-(1) This policy may be called the "National Policy on Safe Management of Radioactive Waste, Decommissioning and Spent Nuclear Fuel in Islamic Republic of Pakistan - (RNP-012018)".

(2) This policy extend to the whole of Pakistan.

(3) This policy shall be applicable to users of ionizing radiation.

(4) This policy shall come into force at once.

2. **Definitions.**-All the definitions and provisions mentioned in the Pakistan Nuclear Regulatory Authority Ordinance, 2001 shall be applicable to this policy.

3. **Interpretation.**-The decision of the Chairman PNRA regarding interpretation of any word or phrase of the policy shall be final and binding.

4. **General.**-(1) The Government of Pakistan is committed to the safe management of radioactive waste, decommissioning and spent nuclear fuel of nuclear installations and radiation facilities in such a manner as to

2.2 Regulatory Requirements for Radioactive Waste and Spent Fuel Management

Regulations on Radioactive Waste Managment (PAK/915)

- Use of best avaialbe technologies
- Adequate Financial Resources
- Management System and Safety Culture
- Waste Minimization and Resue/Recyling
- Waste Proecessing and Characterization
- Protection of Present and Future Generations

Regulations on Safe Managment of Spent Nuclear Fuel (PAK/918)

- Desgin Certification and Revalidation
- Aging Management
- Adequate Financial Resources
- Preservation of Records/Reports
- Surviellance and Testing
- Emergency Preparadness
- Physical Protection

2.3 Regulatory Requirements for Decommissioning

Decommissioning Strategy	-no undue burden on future generations -site strategy to cater interdependences among facilities
Decommissioning Planning	- prepare and maintain a decommissioning plan - retention of records and reports - institutional knowledge and staff
Decommissioning Funding	- mechanism to ensure adequate financial resources - cost estimate and consistency with financial assurance
Conduct of Decommissioning	- radiological surveys - environmental impact assessment - waste management path - surveillance program
Completion of Decommissioning	- end state criteria - full or part release of site from regulatory control

2.4 Regulatory Requirements for Environmental Protection

Regulations on Radioactive Waste Managment (PAK/915)
Regulations on Radiation Protection (PAK/904)

Preoperational study on public exposure by discharged radionuclides	Dose Assessment due to planned discharges	Determination of dose constraint and Discharge limits	Environmental impact assessment	Emergecny plan for protection of people and environment

3. Integration of Sustainability in Regulatory Functions of PNRA

- Use of Cradle to Grave Aproach , started from siting upto remoavl from regulatory control
- Detailed review of design
- Application of graded approach during inspections

- Utilization of Review & Assessment during licensing stages
- Application of graded approach during inspections
- calculetedand precise storage of radioactive waste

- Consideration of environmental impact at the site registration stage of NIs
- Collection of pre-operational data for NIs
- Environmental Monitoring around NIs and Cross verification of environmental monitoring results
- Radiation level mapping accross the country

- Detailed review of design with respet to radiation protection
- Application of ALARA principle

PNRA conducts inspections to ensure safety of radioactive waste, spent nuclear fuel managment, decommissioning and environmental monitoring. Key elements of regulatory inspection include risk based and operating experince based equipment and area selection, human performance and safety culture. Independent assessment and verification for environmental monitoring is also performed through sampling analysis.

4. Integration of Sustainability in Regulatory Processes and Practices

PNRA has established regulatory framework for waste, spent nuclear fuel, decommissioning and remediation. It also performs licensing and certification of spent fuel cask, radioactive waste pre-disposal & disposal facilities, independent spent nuclear fuel storage facilities and decommissioning facilities after reguatory review and assessment of licensees' submissions. Regualotry inspections are also perfromed in licesned facilites for verification of complinace with regulatory requirements. To achive sustainable regualtory effectiveness, PNRA has oulined following factors in its regulatory management system.

Factors Contributing to Sustainability

- Stakeholders Engagement
- Civil liability and financial assurance
- Human resouce and re-training
- Strong safety and security culture
- Independent environmental assessment and monitoring
- Cradle to grave approach
- Resource Optimization/Graded Approach

5. Conclusions

- National policy and regulatory framework of PNRA in radioactive waste management, decommissioning and environmental protection addresses number of sustainability considerations such as financial aspects, future burden, waste minimization, among others.
- PNRA's regulatory processes ensure sustainable effectiveness by inculcating strong safety culture, capacity building and resource optimization.
- Nuclear facilities are only are equitable and viable for present and future generation's social, environmental and economic needs if operated safely throughout their lifetime in accordance with regulatory requirements.

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