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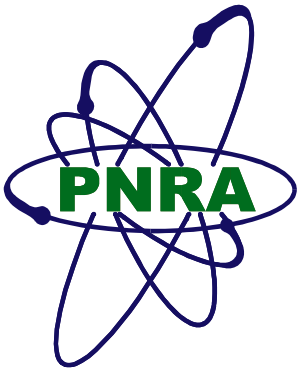

FORMAT AND CONTENT OF ENVIRONMENTAL MONITORING PROGRAM FOR NUCLEAR INSTALLATIONS

REGULATORY GUIDE

PAKISTAN NUCLEAR REGULATORY AUTHORITY

For Further Details

Directorate of Policies & Procedures
PAKISTAN NUCLEAR REGULATORY AUTHORITY
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FORMAT AND CONTENT OF ENVIRONMENTAL MONITORING PROGRAM FOR NUCLEAR INSTALLATIONS

ABSTRACT

Environmental monitoring is an important parameter to assess the impact of radioactive discharges on the public and the environment around nuclear installations. Regulations 8(6) and 8(10) of PNRA Regulations for Licensing of Nuclear Installations in Pakistan - (PAK/909) (Rev.1) require the licensee to prepare and submit Environmental Monitoring Program (EMP) of its installation to PNRA for approval. The licensee is required to conduct environmental monitoring in accordance with the approved EMP. This regulatory guide provides guidance to the licensee on standard format and content of EMP for nuclear installations.

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1. INTRODUCTION

The controlled release of radionuclides to the atmospheric and aquatic environment is a legitimate waste management practice in Nuclear Installations (NIs). An important and essential element in the control of such releases is to conduct continuous monitoring, both at the source of discharge and in the recipient environment, to ensure protection from harmful effects of ionizing radiation. Regulations 8(6) and 8(10) of PNRA Regulations for Licensing of Nuclear Installations in Pakistan - (PAK/909) (Rev.1) require submission of Environmental Monitoring Program (EMP) for approval by the Authority along with the application for obtaining permission to introduce nuclear material into the installation and for obtaining license for decommissioning/closure of the installation respectively. This Regulatory Guide (RG) provides guidance on format and content for the preparation of EMP.

2. OBJECTIVE

The objective of this RG is to facilitate the licensee of NIs in preparation of EMP in a harmonized manner and to facilitate PNRA personnel in conducting orderly review of EMP during licensing process.

3. SCOPE

This RG is applicable to NIs for the preparation of EMP for normal operation, emergency, decommissioning and closure stage in accordance with the prescribed format and content.

4. FORMAT AND CONTENT OF EMP

The licensee should develop its EMP, by adopting and implementing applicable guidance provided in this RG, commensurate with the level of radiation risk associated with its facility i.e. by applying graded approach. The licensee should prepare and submit its EMP to the Authority, for approval, in accordance with the content given in the subsequent sections.

4.1 General Instructions for Preparation of EMP

The licensee should follow the following instructions for preparation of EMP:

i. Provide clear, concise, factual and latest/updated information;
ii. A table of contents including figures, tables, annexes, etc. along with page numbers should be included;
iii. Definitions and abbreviations should be consistent throughout the document;
iv. Duplication of information should be avoided. In case where necessary, reference of relevant section should be made; and

v. Legible drawings, diagrams, layouts, maps, and tables should be added, wherever necessary, with proper reference.

4.2 Content of EMP

Following should be the general content of an EMP:

4.2.1 Introduction

In this section, the licensee should briefly introduce the EMP.

4.2.2 Objective

In this section of the program, the licensee should describe objectives to be achieved through preparation and implementation of the EMP.

4.2.3 Scope

This section should describe the scope of the EMP.

4.2.4 Description of the Facility

This section should include sufficient information about the NIs including its name, purpose, type, location along with the longitude and latitude, date of commencement of operation or decommissioning or closure (whichever is applicable), and area under administrative control of the licensee. It should also describe anticipated radioactive discharges, their types, principal radionuclides involved, discharge points and preoperational environmental monitoring study.

4.2.5 Organization Structure

This section should include licensee's organizational structure along with the responsibilities of all individuals involved in environmental monitoring. The information regarding interfaces (if any) between different divisions/groups involved in environmental monitoring should also be addressed.

4.2.6 Site Characteristics

This section should describe information of the site that is used to establish the EMP e.g. flora and fauna etc. The areas where radionuclides might accumulate due to release of activity from other facilities at the same site should also be identified.

4.2.7 Metrological Conditions

The section should include the metrological conditions of the site that is used to

establish the EMP such as wind speed, wind direction, etc.

4.2.8 Demography and Living Habitat

This section should describe population distribution, population density, largest and nearest population center, life expectancy around the facility. It should describe the habitat of public including living habits, occupancy factor, human utilization of environmental media to be affected by discharges and fraction of consumption of local food.

4.2.9 Exposure Pathways for the Site

This section should include all possible exposure pathways including inhalation, ingestion and direct radiation for all age groups on the site.

4.2.10 External Radiation Monitoring

This section should include information regarding identification of monitoring points, justification for their selection and the map of the identified locations. The result of ambient dose rate monitoring including monitoring points, selection of equipment (e.g. Thermoluminescent Dosimeter (TLDs) and online radiation monitors, etc.) for detection of particular type of radiation and energies, along with their measuring range (i.e. minimum and maximum detection level), and analysis frequency should be described as per format specified in Table 1 of Annexure I.

4.2.11 Environmental Sampling and Analysis

This section should describe sampling points, types of samples, frequency and types of analysis including basis. A map indicating locations of sampling points, distances and directions from the reactor or site centerline should be provided. It should include information about the selection of equipment/system for sampling and analysis of particular types of environmental media including minimum and maximum detection levels for radiation or activity. A summary of environmental sampling and analysis may be provided as per format specified in Table 2 of Annexure I.

4.2.12 Environmental Monitoring Program during Emergency Phase

The main purpose of the environmental monitoring during emergency phase is to locate the areas of high radiation level and to assess the accident impact in immediate vicinity of the site. Environmental monitoring during emergency is also helpful in estimating public exposure, in deciding protective and remedial actions within Emergency Planning Zone (EPZ). The licensee should describe the arrangements

including necessary equipment, vehicles and technical expertise for the environmental monitoring during emergency. The criteria for the selection of sampling points, types of samples, frequency and analysis during all emergency phases should be described. The arrangements and methodology for external radiation monitoring during emergency should also be described.

4.2.13 Assessment of Radiation Doses to Public

This section should include dose assessment methodology to the public covering all site specific exposure pathways by using environmental monitoring results. The values of site specific parameters to be used for the assessment of radiation doses should also be provided. The computer codes (if used) including their validation should also be described.

4.2.14 Content of Annual Radiological Environmental Monitoring Report

The licensee should prepare its annual radiological environmental monitoring report in accordance with the content given in Annexure II. The report should include monitoring and sampling summaries, analysis of trends of the results and interpretations; comparison with pre-operational studies; any deviations from approved EMP and an assessment of the observed impacts of the plant operation on the environment. The report should also summarize the results of both the direct external radiation monitoring and the environmental sampling analysis in a tabular format as specified in Annexure III and Annexure IV respectively.

4.2.15 Periodic Review of EMP

Periodic review of the EMP should be conducted to re-examine the adequacy and effectiveness of the program to achieve its objectives. The program review should evaluate the need to expand (or reduce) the EMP based on the results of the environmental monitoring and any change in principal radionuclides being discharged from the facility, exposure pathways, sampling media and land use census, etc. The licensee should describe its commitment and the frequency for conducting periodic review of the program in this section. The EMP should be revised, if needed, on the basis of review outcome and operating experience feedback. The revised program should be submitted to the Authority for review and approval.

4.2.16 Quality Assurance

This section should include assurances regarding relevant qualification, training and re-training of staff; quality control on samples and equipment/systems; verification and validation of results.

4.2.17 Record

This section should describe the arrangements to ensure that retrievable and up to date record necessary for environmental monitoring is maintained.

4.2.18 Program Implementing Procedures

The licensee should provide a list of procedures necessary for the implementation of the EMP, being followed at the NIs, in the form of an annexure, where appropriate.

4.2.19 Definitions and Abbreviations

In this section, the licensee should include, alphabetically, the list of terms, their definitions and abbreviations used in the EMP.

4.2.20 References, Codes, Standards, Tables and Annexes

In this section, the licensee should include all applicable references, codes, standards, tables and annexes referred in the EMP.

5. REFERENCES

1. Regulations for Licensing of Nuclear Installations in Pakistan - (PAK/909) (Rev.1), Pakistan Nuclear Regulatory Authority (PNRA), Islamabad (2012).
2. Regulations on Radioactive Waste Management - (PAK/915), Pakistan Nuclear Regulatory Authority (PNRA), Islamabad (2005).
3. Regulations on Radiation Protection - (PAK/904), Pakistan Nuclear Regulatory Authority (PNRA), Islamabad (2004).
4. Radiological Environmental Monitoring for Nuclear Power Plants, Regulatory Guide 4.1 (Rev.2), U.S. Nuclear Regulatory Commission (US-NRC), Washington, DC (2009).
5. Preparation of Environmental Reports for Nuclear Power Stations, Regulatory Guide 4.2 (Rev.2), U.S. Nuclear Regulatory Commission (US-NRC), Washington, DC (1976).
6. Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors, NUREG-1301 (Supplement No. 1), U.S. Nuclear Regulatory Commission (US-NRC), Washington, DC (1991).
7. Environmental and Source Monitoring for Purposes of Radiation Protection, Safety Guide (RS-G-1.8), International Atomic Energy Agency (IAEA), Vienna (2005).

ANNEXURE I

Table 1: Ambient Dose Rate Monitoring

Monitoring Point	Location of Monitoring Equipment (TLD, etc.)	Type of Equipment	Measuring Range	Analysis Frequency

Table 2: Environmental Sampling and Analysis

Sampling Point		Sample Type	Collection Frequency	Type of Analysis	Remarks
Station/Name	Location (Distance, Direction)				

ANNEXURE II

Content of Annual Environmental Monitoring Report

Executive Summary

Table of Contents

1. Introduction
2. Purpose and Scope of the Report
3. Characteristics of Environment
4. Summary of Environmental Monitoring Program
5. External Radiation Monitoring
   - 5.1 Monitoring Equipment
   - 5.2 Results, Trend Analysis and Interpretation
6. Environmental Sampling
   - 6.1 Sample Collection
   - 6.2 Results, Trend Analysis and Interpretation
7. Deviation from Environmental Monitoring Program
8. Dose Assessment Results and Interpretation
9. Conclusion

ANNEXURE III

Results of Direct External Radiation Monitoring around Nuclear Installation

Location	Ambient Radiation Doses (Units)				
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Average

ANNEXURE IV

Results of Environmental Sampling Analysis

Sample Type	Location	Measured Activity (Unit) as per Analysis					Gamma Emitting Radionuclides along with Activities (Unit)			Remarks
		Gross α	Gross β	Sr-90	H-3	Any other	Radionuclide-1	Radionuclide-2	Radionuclide-3, etc.	

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