



**FORMAT AND CONTENT OF PHYSICAL PROTECTION
PROGRAM OF NUCLEAR INSTALLATIONS**

REGULATORY GUIDE

For Further Details

Directorate of Regulatory Framework

PAKISTAN NUCLEAR REGULATORY AUTHORITY

P.O. Box 1912, Islamabad

www.pnra.org

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1. INTRODUCTION

PNRA Regulations for Licensing of Nuclear Installations in Pakistan - (PAK/909) (Rev.1) requires the licensees to submit Physical Protection Program (PPP) at different stages of authorization/licensing process of nuclear installations. Subsequently, PNRA Regulations on Physical Protection of Nuclear Material and Nuclear Installations - (PAK/925) requires that the licensee shall develop and maintain a PPP according to the format and content specified by the Authority. Accordingly, this Regulatory Guide (RG) has been prepared to provide guidance to the licensee regarding the format and content of PPP of nuclear installations.

2. OBJECTIVE

The objective of this regulatory guide is to provide guidance on format and content of PPP of nuclear installations.

3. SCOPE

The RG is applicable to nuclear installations for development of their PPP, in order to fulfil the requirements of PAK/909 and PAK/925, as per the format and contents prescribed in this guide.

4. GENERAL INSTRUCTIONS

The licensee should pursue the following general instructions for the preparation of PPP:

- i. The licensee should provide clear, concise and latest/updated information.
- ii. A 'Table of Contents' should be included for each plan.
- iii. Definitions and abbreviations should be consistent throughout the program.
- iv. Duplication of information should be avoided. In case where necessary, reference of relevant section should be made.
- v. Legible drawings, diagrams, figures, maps, and tables should be added, wherever necessary with proper reference.
- vi. Concept of several layers and measures of protection including structural or other technical, personnel and organizational measures those have to be overcome or circumvented by an adversary in order to achieve his objectives.

5. FORMAT AND CONTENT OF PHYSICAL PROTECTION PROGRAM

The licensee should prepare its program in accordance with the following format and contents.

5.1 Introduction of Physical Protection Program

This section should briefly describe the introduction of PPP. The program should consist of following plans:

- i. Physical Protection Plan;
- ii. Contingency Plan;
- iii. Information Security Plan;
- iv. Transport Security Plan; and
- v. Training and Re-training Plan.

The information on physical protection system and measures at nuclear installations provided to PNRA should be up to date, based on current national threat assessment or design basis threat.

Sections 5.2 to 5.6 describe the format and content of above-mentioned plans respectively whereas Sections 5.7 to 5.11 are applicable to all the plans included in the PPP. However, Section 5.9 related to “Event Reporting” is not applicable to Training and Re-training Plan.

5.2 Physical Protection Plan

The following sections describe, in general terms, the content and level of detail that should be included in a physical protection plan:

5.2.1 Introduction

This section should briefly introduce the physical protection plan.

5.2.2 Objective

This section should include the objectives of physical protection plan.

5.2.3 Scope

This section should define the scope of the physical protection plan.

5.2.4 Facility Description

This section should describe the type of facility, working hours, number of workers and the general layout of the facility. This section should also include a map of the entire facility and with location of the major activities. The maps may illustrate terrain, transportation routes, nearby towns or hazardous material facilities, and any other areas that could affect physical protection functions. The maps may highlight main and alternative routes for law enforcement authorities or other off-site responders.

5.2.5 Physical Protection Areas

This section should include description of limited access area, protected area, vital area, isolation zone with access points, physical barriers, structures and their locations with spatial relationship in the facility. The licensee should provide scaled drawings which are properly labeled showing locations of physical protection systems, subsystems, and major components, vital areas, entry/exit control points and alarm stations.

5.2.6 Identification of Vital Areas

This section should identify and list down the vital areas (if applicable) containing equipment, systems or devices, or nuclear material, the sabotage of which could directly or indirectly lead to high radiological consequences.

5.2.7 Design Aspects of Physical Protection System

This section should provide the detailed design aspects of physical protection system to achieve the functions of detection, delay and response according to the sequence given below.

5.2.7.1 Detection

5.2.7.1.1 Intrusion Detection System

This section should describe the arrangements to detect intrusion into the boundaries of vital and protected areas along with equipment types, associated detection capabilities with technical and operational details, diagram showing their equipment locations & field of view and threshold of nuisance alarm rate of intrusion detection system.

The licensee should also provide the details of the intrusion detection systems installed anywhere else at the facility.

5.2.7.1.2 Assessment & Surveillance System

This section should describe the details of assessment systems (including equipment, personnel and procedure) at the vital and protected areas (including isolation zone) to detect intruders and to ensure the integrity of installed physical protection systems. This should include, but not limited to, the type of equipment used, performance evaluation, operational details and a diagram showing their locations and field of view. This section should also contain all means of assessment at other locations at the facility for physical protection purpose.

Details of surveillance system installed at the facility including equipment type, performance evaluation, operational detail and a diagram showing their locations and field of view should also be provided in this section. This section should include arrangements for minimum sixty (60) days backup for provision of real-time and play-back/recorded video images of detected activities before and after each alarm annunciation.

5.2.7.1.3 Illumination System

This section should describe the illumination system at the facility with sufficient details including types of lights, installation criteria and schematic layout. The licensee should describe the arrangements for sufficient illumination level for assessment purpose in the isolation zones and appropriate exterior areas within the protected area.

5.2.7.2 Delay

5.2.7.2.1 Description of Physical Barriers

This section should identify and provide analysis of site-specific conditions to determine the specific type, structure, use, locations, function, and placement of physical barriers at limited access area, protected area and vital area.

5.2.7.2.2 Security Post and Structures

This section should describe the location and purpose of all permanent security posts and structures including description of their physical construction.

5.2.7.3 Response

This section should provide the details of a 24-hour guarding service, patrolling by guard and response forces to effectively counter any malicious act.

5.2.8 Alarm Stations

This section should describe the location, layout and design of the Central Alarm Station (CAS), Secondary Alarm Station (SAS), methods used for annunciation of alarms and operator details. This section should also describe the physical protection measures for the stations and the arrangements for the following aspects during normal operation and emergency:

- i. Monitoring and assessment of alarms;
- ii. Initiation and coordination of response; and
- iii. Command and control mechanism.

5.2.9 Power Sources

This section should describe the reliable power sources (with adequate details), sequential loading diagrams, loads, backup and/or alternate power for uninterrupted operation of all physical protections systems.

5.2.10 Communication Systems

This section should describe the capability of continuous, redundant and diverse communication systems for implementation of PPP including communication among CAS, SAS, guards, response forces and facility management during normal and emergency conditions. This description should include information on:

- i. Type of communication system;
- ii. Availability of communication system on a 24-hour basis; and
- iii. Reliable, secure and tamper protected communication system.

5.2.11 Access Control and Search Systems

5.2.11.1 Access Control Locations

This section should describe the locations of the access control points for the personnel, packages and vehicles entering and exiting physical protection areas (limited area, protected area and vital areas).

5.2.11.2 Access Authorization

This section should describe the criteria used for authorizing escorted and unescorted access of plant personnel, contractors and visitors. The criteria for access authorization of vehicles should also be described.

5.2.11.3 Identification System

This section should describe the measures for establishing the identity (picture card, biometric system, finger print recognition system, etc.) of personnel at each Entry/Exit Control Point (EECP). The measures for vehicles recognition should also be described.

5.2.11.4 Search Program

This section should describe the process and methods for searching personnel, vehicles and packages before entry/exit to the facility areas during normal and emergency condition. The licensee should also describe criteria and list of contraband items.

5.2.11.5 Keys, Locks and Combinations

This section should describe the measures for controlling the keys, locks combinations and related equipment used to control access to protected, vital and any other area where access is required to be controlled.

5.2.11.6 Access Control During Emergency Conditions

This section should describe the locations of all emergency exits and access control measures. This section should also describe the licensee's mechanism for control of rapid entry or exit of authorized individuals, vehicles and equipment during emergency conditions.

5.2.12 Sustainability Program

This section should describe the sustainability program of physical protection system installed at nuclear installation. The sustainability program should encompass:

- i. Operating procedures;
- ii. Human resource management and training;
- iii. Performance testing and operational monitoring;
- iv. Configuration management (the process of identifying and documenting the characteristics of a facility's physical protection system including computer systems and software and of ensuring that changes to these characteristics are properly developed, assessed, approved, issued, implemented, verified, recorded and incorporated into the facility documentation); and
- v. Resource allocation and operational cost analysis.

5.2.13 Maintenance and Testing Program

This section should contain testing frequency and extent, maintenance programs (Preventive and corrective such as ageing management, equipment reliability, condition monitoring, and obsolescence management of physical protection resources/equipment), calibration intervals and criteria, repair and replacement arrangements, inspection techniques for intrusion detection system, communication and assessment systems, access control system, and support systems. The licensee should also describe the process for the outsourcing repair, maintenance and calibration capabilities of the facility, if in-house capability is not available.

5.2.14 Management System for Physical Protection Program

This section should describe the licensee's Management System for PPP. This section should also describe the hierarchy of security unit and its line of reporting with management of the facility. Security responsibilities and the chain of command for decision-making on security matters should be included. The Management System should also describe the quality assurance arrangements for the physical protection systems and measures. This information should be in-line with the overall Management System of the facility.

5.2.15 Evaluation

This section should describe the methodologies for evaluation of PPP by drills and exercises, simulations etc.) to determine the degree of effectiveness of security measures, procedures, personnel, and equipment. This section should also provide the frequency of evaluation of PPP and describe the scenarios for drills/exercises.

5.2.16 Measures against Insider Threat

This section should describe the set of preventive and protective measures against insider threat at the facility.

5.2.17 Compensatory Measures

This section should provide the process and mechanism for identifying compensatory measures. The licensee should also provide elements of compensatory measures to be taken in the event of degraded or inoperable equipment, component of physical protection system.

5.2.18 Security Culture

This section should address the processes and methodologies for establishing, assessing and maintaining a dynamic and effective security culture in facility.

5.2.19 Safety and Security Interface

This section should address physical protection interface with safety in a manner to ensure that they do not adversely affect each other and that, to the degree possible, they are mutually supportive. The licensee should provide the details for management and implementation of safety and physical protection interface. The licensee should also provide the details of interface areas and their corresponding handling measures.

5.2.20 Protection of Computers and Networks

This section should describe licensee's measures to protect computers and networks important to safety and physical protection (e.g. cyber-attacks, manipulation or falsification). This section should include arrangements and mechanism for cyber security and associated handling measures. The licensee should describe the physical, logical and administrative controls that are implemented for the protection of computers, communication systems and networks important to safety and physical protection. The licensee should address the measures taken for the access control of data connections (such as network connections, connections for external memory and access to portable media such as memory sticks, flash cards and data disks etc.).

This section should also describe the cyber security aspects for physical protection (e.g. cyber-attacks, manipulation and falsification) and associated measures to handle the unwanted situations.

5.2.21 Records

This section should describe the arrangements to ensure that retrievable and up-to-date records and retention time necessary for physical protection plan are maintained. The records to be maintained should include, but not limited to the following:

- i. Personnel access authorization/termination records;
- ii. Training and re-training records;
- iii. Vehicle access records;
- iv. Patrolling records;
- v. Tests, and maintenance records;
- vi. Control room related records;
- vii. Records of audits and reviews;
- viii. Records of security related event(s); and
- ix. Quality Assurance records (Implementation records, non-conformance record etc.).

5.3 Contingency Plan

The contingency plan should describe the types of contingencies, licensee's response arrangements, and coordination with offsite authorities and its interfaces with other emergency plans of the facility. This should also identify the responders; specify their responsibilities and response actions. The following sections describe the content and level of detail that should be included within a contingency plan.

5.3.1 Introduction

This section should briefly describe the contingency plan.

5.3.2 Objective

This section should describe specific objectives that licensee intends to achieve through the implementation of the contingency plan.

5.3.3 Scope

This section should define scope i.e., depth or level of details to be addressed in the contingency plan.

5.3.4 Response Arrangements

This section should describe the licensee's arrangement to interdict and neutralize the adversary during all the events described in Section 5.3.5 by properly trained, qualified, and adequately equipped personnel available at all times. This section should also describe chain of command and roles & responsibilities of the security personnel during the event.

This section should also include the licensee's arrangements to cooperate and coordinate with all organizations having responsibilities to cater security contingencies at national level.

5.3.5 Anticipated Events

This section should identify all possible events along with different scenarios requiring a coordinated response covering at least but not limited to the following contingencies:

- i. Bomb threats;
- ii. Sabotage or unauthorized removal of nuclear material or any such attempts;
- iii. Attack threats, fire, explosion or other catastrophe;

- iv. Cyber-attack(s);
- v. Civil disturbance;
- vi. Communications failure;
- vii. Perimeter and protected area intrusion;
- viii. Internal disturbance; and
- ix. Vital area intrusion.

For each of the above events identified, the objectives to be accomplished by performing the potential response activities should be specified.

5.3.6 Interface with Radiological Emergency Plan

This section should describe the arrangements to ensure the effective integration and interface of contingency plan with emergency plan.

5.3.7 Graded Approach for Protection against Sabotage in Terms of Unacceptable Radiological Consequences and High Radiological Consequences

This section should provide the thresholds limits, levels and quantitative measures for Unacceptable Radiological Consequences (URC) and High Radiological Consequences (HRC) as per guidance given in Annexure-I.

5.4 Information Security Plan

This plan contains measures for the protection of information both in hard and soft forms related to the physical protection program. The format and content of information security plan are as follows:

5.4.1 Introduction

This section should briefly describe the information security plan.

5.4.2 Objective

This section should describe the objective of information security plan.

5.4.3 Scope

This section should describe the scope of information security plan.

5.4.4 Identification and Classification of Information

This section should describe the basis for identification of sensitive information

and also describe the criteria for classification of this information.

5.4.5 Access to Information

This section should describe the criteria for access to information along with their implementing details.

5.4.6 Information Protection Measures

This section should describe the measures for protection of sensitive information both in hard and soft forms. This should further include handling measures during information generation, communication (internal and external), storage and disposal etc. to ensure its integrity, confidentiality and availability.

5.5 Transport Security Plan

The licensee should submit transport security plan that contains detailed security measures to prevent unauthorized removal of nuclear material or sabotage during transport. The details of format and content of transport security plan are as follows:

5.5.1 Introduction

This section should briefly introduce the transport security plan.

5.5.2 Objective

This section should describe the objective of transport security plan.

5.5.3 Scope

This section should describe the scope of transport security plan.

5.5.4 Roles and Responsibilities

This section should identify and describe the roles and responsibilities of individuals involved in the transportation. The licensee should also describe the changeover protocols for individual responsible during transport.

5.5.5 Description of Vehicles and Packages

This section should describe the mode of shipment, detailed description of vehicle vessel or air craft such as type, identification, installed security system etc.

This section should also include description of material (radionuclide, category, physical form, enrichment percentage, isotopic composition, radiation levels

etc.) and identification of transport package (Transport/ Criticality Index, etc.) with physical protection measures.

5.5.6 Threat Information

This section should include arrangements for identification and assessment of threats related to transport of nuclear material.

5.5.7 Security Measures during Transport

This section should provide a detailed description of all of the proposed security measures adequate to provide security during the transport of nuclear material.

5.5.8 Assistance from Offsite Authorities

This section should describe the licensee's arrangements to cooperate and get cooperation with all organizations having responsibilities related to transport.

5.5.9 Communication Arrangements

This section should provide details of equipment and procedures for two-way communications between the transport In-charge and response center to rapidly and accurately transmit assessed information and coordinate for assistance. This section should also include limitations of communication during transport.

5.5.10 Search Prior to Transportation

This section should describe the arrangements to ensure that the integrity of shipment containers and associated locks or seals is checked prior to transportation.

5.5.11 Testing and Evaluating the Transport Security Plan

This section should describe details of limited and full-scope drills and exercises designed to identify weaknesses (if any) in the system on a pre-determined frequency.

5.6 Training and Re-training Plan

This section should provide a plan for training and re-training of personnel performing physical protection systems/measures including CAS/SAS operators, security force including Quick Response Force (QRF) and other persons having direct responsibility for the implementation of physical protection program.

5.6.1 Qualification Criteria

This section should provide individual qualification criteria to perform

assigned tasks for implementation of the physical protection program. The licensee should describe qualification criteria for CAS/SAS operators and physical protection equipment maintenance personnel.

5.6.2 Training and Re-training

This section should provide individual training frequency and schedule to perform assigned tasks for implementation of the physical protection program.

5.7 Implementing Procedures

The licensee should prepare operating procedures for implementation of this program. The licensee is not required to submit these procedures but should provide list of relevant procedures at the end of each plan. The list may include the following procedures:

- i. Operation of physical protection system;
- ii. Access control and authorization;
- iii. Search procedure of individuals and vehicles;
- iv. Security alert procedure;
- v. Security briefing procedure;
- vi. Development, modification and review of physical protection program;
- vii. Use and operation of personal equipment for normal and contingency operations;
- viii. Engagement and operation of response force;
- ix. Escort and patrol procedure;
- x. Coordination with local law enforcement agencies;
- xi. Event reporting;
- xii. Equipment testing and maintenance; and
- xiii. Classification and handling of sensitive information.

5.8 Review, Evaluation and Audit

This section should describe the process of review, evaluation and audit of plans submitted under PPP to determine their effectiveness. This should also include the periodicity of review, evaluation and audit.

5.9 Event Reporting

This section should describe event reporting mechanism for reportable physical protection events as given in Regulation 21 of PAK/925. The licensee should report to PNRA as per timelines defined in Regulation 22 of PAK/925. The licensee should

make the required notifications to PNRA National Radiation Emergency Coordination Center (NRECC) through available means (such as telephone, cell phone, fax service, email etc.). The licensee should notify NRECC as per Notification Form attached at Annexure-II. The licensee should ensure confidentiality and protection of information while making event notifications.

5.10 References, Tables and Annexes

This section should include all applicable references, codes and standards, tables and annexures necessary for plans submitted under PPP.

5.11 Glossary

This section may include the alphabetical list of terms or abbreviations and corresponding definitions used in describing the operational and technical aspects of plans submitted under PPP.

6. REFERENCES

- [1]. Regulations on Licensing of Nuclear Installations in Pakistan - (PAK/909) (Rev.1).
- [2]. Regulations on Management of Nuclear or Radiological Emergency - (PAK/914) (Rev. 1).
- [3]. Regulations on Physical Protection of Nuclear Material and Nuclear Installations - (PAK/925).
- [4]. IAEA Nuclear Security Series (NSS-13) Recommendations on Physical Protection of Nuclear Material and Nuclear Facilities (INFCIRC/225/ Rev. 5).
- [5]. USNRC 10CFR Part 73.55: Requirements for Physical Protection of Licensed Activities in Nuclear Power Reactors against Radiological Sabotage.
- [6]. USNRC, NUREG 0800 - Standard Review Plan (13.6.1): Physical Security - Combined License and Operating Reactors.

GRADED APPROACH FOR PROTECTION AGAINST SABOTAGE IN TERMS OF URC and HRC

a. *Unacceptable Radiological Consequences (URC)*

URC is the level of radiological consequences, established by the State, above which implementation of physical protection measures is warranted. The licensee's definition of URC should, in turn, include the identification of targets whose sabotage could lead to such consequences and should therefore be protected. URC is defined by one or more quantitative measures of dose or radioactive material release that have been established as thresholds (limits).

b. *High Radiological Consequences (HRC)*

HRC are the potential radiological consequences of sabotage which could potentially result in a substantial radiological release significantly affecting the population and environment beyond the boundaries of nuclear facility. For threshold above or equal to HRC, vital areas need to be identified and protected.

c. *Vital Area*

Regulation 29(1) of PAK/925 requires that "All equipment, systems or devices, or nuclear material, the sabotage of which could directly or indirectly lead to high radiological consequences should be located inside one or more vital areas."

d. *Relationship between URC and HRC*

The relationship between URC and HRC and graded levels of protection are represented in below Figure-1.

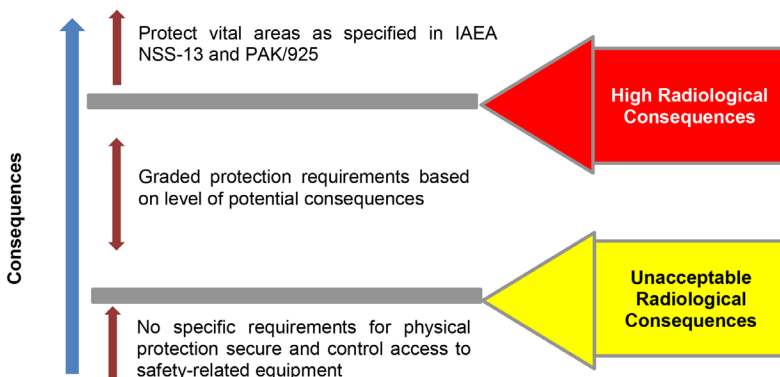


Figure-1: Relationship between URC and HRC

The physical protection requirements against potential radiological consequences are as follows:

- i. If potential radiological consequences exceed threshold of high radiological consequences, then vital areas should be identified and protected.
- ii. If potential radiological consequences fall between the thresholds of unacceptable radiological consequences and high radiological consequences, the State will specify graded protection requirements based on the level of potential consequences.
- iii. If radiological consequences fall below the thresholds of unacceptable radiological consequences, then there may be no specific requirements for physical protection, however, the operator should still secure and control access to safety related equipment and devices.

e. Criteria for Graded Protection against Sabotage

In order to apply the graded approach to physical protection against sabotage, Table-1 provides classification of facilities and sabotage targets in terms of potential radiological consequences resulted from sabotage.

Table-1: Criteria for Classification of Facilities

No.	Description	Class A	Class B	Class C
1.	Classification	Facilities, whose sabotage could result in severe deterministic effects off-site. [Emergency Preparedness Category I as given in Schedule 1 of PAK/914(Rev.1)]	Facilities, whose sabotage could give rise to doses to people off-site. [Emergency Preparedness Category II as given in Schedule 1 of PAK/914 (Rev.1)]	Facilities, whose sabotage could result in doses on-site. [Emergency Preparedness Category III as given in Schedule 1 of PAK/914 (Rev.1)]
2.	Types of Facilities	Nuclear Power Plants Freshly discharge nuclear fuel	Research Reactors (with power levels >2 MW but ≤100 MW) Spent Fuel requiring active cooling. Facilities having Irradiated, depleted or natural uranium, thorium or low enriched fuel (less than 10% fissile content)	Research Reactors (with power levels ≤ 2 MW) Facilities with inventories of radioactive material sufficient to result in doses warranting urgent protective action on-site Dry or spent fuel in wet storage with no active cooling
3.	Physical Protection Level	Class A facilities should be protected at least in accordance with the requirements of vital area*.	Class B facilities should be protected at least in accordance with the requirements of protected area*.	Class C facilities should be protected at least in accordance with the requirements of limited access area*.

* Vital, protected and limited areas, as defined in PAK/925

EVENT REPORTING FORM

1. Contact Information	
Name of the Facility:	
Reporting Officer:	
Contact Details:	
Event Date and Time:	
2. Event Description	
3. Potential/ Actual Impact	
4. Who else has been notified?	
Please provide detail:	
5. What Steps Have Been Taken So Far? (Check one or more that apply to this incident)	
<input type="checkbox"/> Corrective action has been taken	<input type="checkbox"/> Facility has been secured
<input type="checkbox"/> Timely response made to the incident	<input type="checkbox"/> No action taken
<input type="checkbox"/> Physical protection system rectified/restored	<input type="checkbox"/> Other (please describe below)

Provide a brief description:

6. Additional Information

Please provide any additional information that is important but has not been provided elsewhere on this form.

Signature of the Sender:-----

Please send filled form to:

National Radiation Emergency Coordination Center (NRECC)

PNRA HQs, Mauve Area, G-8/1, Islamabad.

Telephone	Fax	Email
Primary: 051-9262019 Backup: 051-2289210 Toll Free: 0800-77766 Officer In-Charge: 0300-8540319 Alternate Officer In-Charge: 0334-5131978	Primary: 051-9260201 Backup: 051-2289233	nrecc@pnra.org



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