



IAEA

International Atomic Energy Agency
Atoms for Peace and Development

NORM IX

IAEA Workshop on the Safe Management of NORM

**Radiation Protection Programme (RPP)
(how to establish and maintain)**

Jim Hondros

Content

- **Radiation in Perspective**
- Purpose of a RPP
- Content of a RPP
- Practical Considerations
- Summary

Workplace Hazards



COLLISIONS



CHEMICALS



TYRES



MANUAL
TASKS



ISOLATION



STRATA
CONTROL



FIRES



EXPLOSIONS



SLIPS TRIPS
& FALLS



OCCUPATIONAL
HEALTH



INTERFACE



OUTBURST



GROUND
CONTROL



INRUSH



EXPLOSIVES
OPENCUT



EXPLOSIVES
UNDERGROUND

Occupational Health



- Dust (inorganic, silica)
- Diesel exhaust emissions
- Hazardous substances:
 - Gases and vapours
 - Solids and liquids
- Noise, Vibration
- Thermal / heat stress
- Asbestos and synthetic mineral fibres
- Non-ionising radiation (e.g. welding flash)
- Ionising Radiation

Occupational Health

- Dust (inorganic, silica)
- Diesel exhaust emissions
- Hazardous substances:
 - Gases and vapours
 - Solids and liquids
- Noise, Vibration
- Thermal / heat stress
- Asbestos and synthetic mineral fibres
- Non-ionising radiation (e.g. welding flash)
- Ionising Radiation

Challenge is
maintaining all
risks in
perspective





Content

- Radiation in Perspective
- **Purpose of a RPP**
- Content of a RPP
- Practical Considerations
- Summary

Purpose of an RPP

- For an operator to:
 - Describe the approach to radiation protection
 - Identify the exposure pathways
 - Describe the control mechanisms for radiation
 - Outline the radiation monitoring programmes
 - Management of radioactive wastes
 - Systems for transport of radionuclide materials
- Demonstrate a level of understanding and competence:
 - Radiation risk
 - Other risks in perspective

How We See the RPP (1)

- A licence requirement
- Based on specific regulatory requirements
- Based on national or international guidance
- A checklist

- **Focus on compliance (eg; number of samples)**



How We See the RPP (2)



- It is an operational working document
- Containing working procedures and process
- On the ground controls
- Monitoring
- Education and training
- Does not “over manage” radiation
- **Focus on practicality**

Characteristics of “Good” RPP

- Practical and able to be used operationally
- Balanced and considers the actual risks from radiation
- Existing in the broader HSE management plan
- Quality document and consistent with recognised standards
- Fit for Purpose:
 - Type of operation
 - What are the risks ?
 - Exposure groups
 - Location
 - Radiation characterisation
- “Controls commensurate with the risk”

Content

- Radiation in Perspective
- Purpose of a RPP
- **Content of a RPP**
- Practical Considerations
- Summary

Development and Implementation of a Process Based Management System

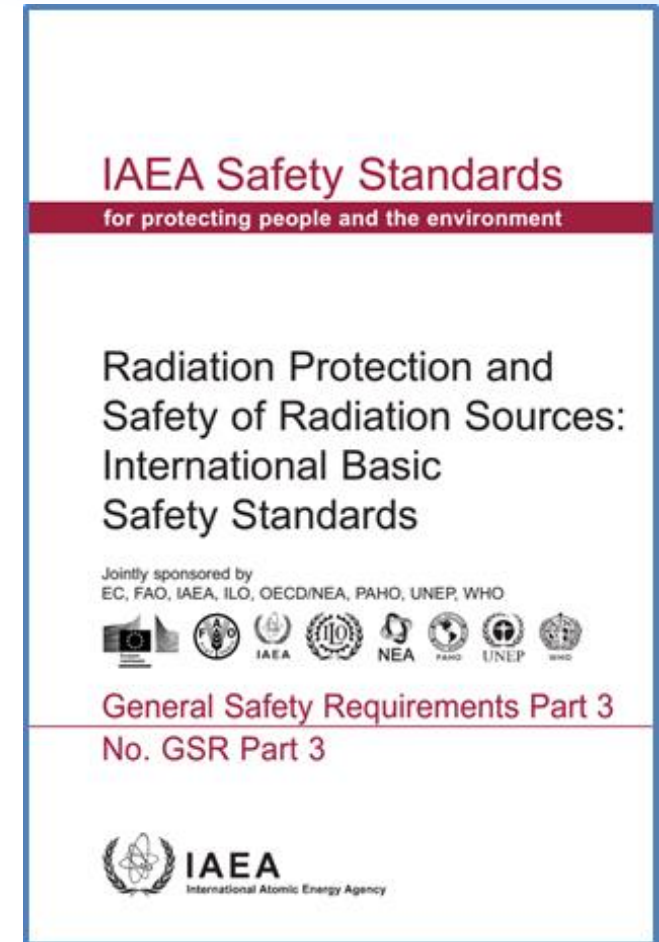
NG-T-1.3

- Integration of requirements in a coherent manner in decision making with high priority given to safety is a prerequisite for a strong safety culture;
 - Ensure that all people and the environment are protected
 - Controls are commensurate with the actual risk
 - Integration with operations management
 - Integration with other OHS and environmental risks



GRS Part 3

- **Requirement 24: Arrangements under the radiation protection programme (3.88–3.98)**
- Employers, registrants and licensees shall establish and maintain organizational, procedural and technical arrangements for the designation of controlled areas and supervised areas, for local rules and for monitoring of the workplace, in a radiation protection programme for occupational exposure.
- Appropriate licencing (Notification, Unconditional Exemption, Conditional Exemption, Licensing)



Requirements



- Classification of areas (3.88, 3.91)
- Local rules and procedures and personal protective equipment (3.93)
- Monitoring of the workplace (3.96)
- Need to review the other requirements of GSR Part 3
 - (eg; Requirement 25: Assessment of occupational exposure and workers' health surveillance)

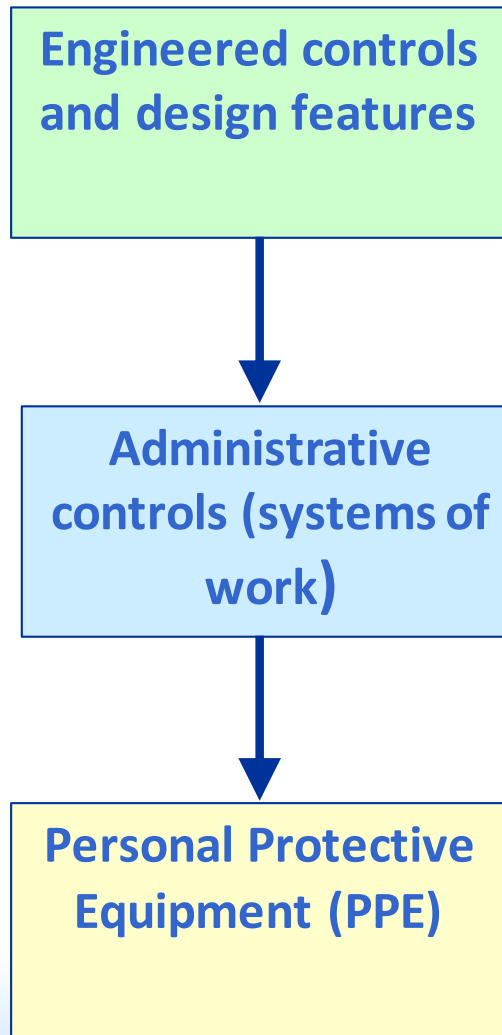
Considerations

- Training
- Education
- Procedures and site rules
- Accountabilities
- Expertise
- Resources
- Technical capability
- Identification of sources of radioactivity
- Identification of pathways
- Security
- Monitoring
- Radon controls
- Process dust
- Spillage controls
- Material on skin and clothing
- Cleaning of contaminated equipment
- Stockpile management
- Tailings/waste dams
- NORM waste
- Transport of material
- Optimisation of discharges

RPP – Main Components

- The RPP for a NORM industrial facility should contain the following components:
 - Aligned to overall management system
 - Assignment of responsibilities
 - Controlled and supervised areas
 - Local rules and supervision
 - Monitoring, recording and reporting
 - Education and training
 - Health surveillance

The Hierarchy of Control Measures



Containment, ventilation, design for ease of decontamination (and shielding)

Where use of engineered controls is not sufficient alone to restrict exposures, consider admin controls

Use when engineered controls and admin controls are not sufficient to provide adequate protection

Control of Exposure - Gamma



- Time, distance and shielding
- Control measures are usually only required for high activity NORM:
 - Facility design with respect to bulk material
 - Distance (dedicated storage areas)
 - Shielding (walls, stockpiles of low activity material)
 - Rules and working procedures
 - Exposure times
 - Warning signs, physical barriers
 - Training and awareness

Control of Exposure - Dust

- Identification of dust sources
- Containment may be impractical, especially where large quantities involved
- Suppression of dusts
- Workplace ventilation (dust may already be controlled by OHS regulation for non-radiological reasons)
- Clean up of spills
- Limiting spread of materials to other areas

Control of Exposure

Radon Decay Products

- Radon as source of radon decay products
- Ventilation
 - Mines
 - Workplaces
 - Confined spaces
 - Prevent re-circulation
- Occupancy time
 - Where there are practical limitations on the provision of adequate ventilation
- Consideration for radon and thoron (^{232}Th)
- PPE

Monitoring of controls

- Identify the key controls for radiation protection
- Monitor that the controls are working
- For example;
 - Ventilation system performance
 - Regular measurements should be made of the flow rates at the inlet and outlet of the auxiliary ventilation duct to demonstrate that leakages are under control
 - Effectiveness of interlocks and access systems
 - Checks if they are working
 - Effectiveness of cleanup procedures
 - Workplace inspections
 - Equipment checks
 - PPE is maintained and used correctly
 - Maintenance of control systems
 - Waste management

Qualified experts

- Expertise depends upon the nature of the operation and the risks involved,
 - Radiation protection officer (RPO)
 - Ventilation expert
 - Occupational medicine (for health surveillance)
 - Industrial hygiene and safety
 - Environmental practitioner
- Access to decision makers
- Ability to work across organisational layers
- Ability to communicate

Local Rules and Procedures

- Local rules and procedures should be developed and tailored to the type of NORM facility involved
- For example, in underground mines and other workplaces where exposure to airborne dust and/or radon is of significant concern, special reference may need to be made to:
 - Monitoring of dust and/or radon
 - The maintenance of adequate quality/quantity of ventilation air
 - The control of ventilation
 - The provision of alternative means of ventilation if the normal ventilation system fails

Overview of Monitoring



- Measurement of radiation in an operating NORM facility provides the information necessary for maintaining protection and safety
- Departures from normal operating conditions and the need for correction are quickly detected
- The RPP should include provisions for:
 - Monitoring the performance of control equipment such as ventilation
 - Identifying deficiencies in design or operation
 - Predicting and explaining trends as the operation proceeds
 - Enables the planning of mitigatory measures in the longer term
 - An essential part of the optimization process

Monitoring for assessment of dose

- Assessment of doses is required for :
 - Optimization of protection
 - Compliance with dose limits
 - Individual dose records
- Use individual or workplace monitoring, or a combination of both, as appropriate
- Individual monitoring of a subset of workers may be appropriate for groups of workers with similar work patterns and moderate exposure levels

Education and training

- The education and training programme should include topics specific to radiation protection in the operation
- Depending on the type of NORM facility, such topics might include:
 - The properties and health effects associated with:
 - Uranium, thorium, radium, etc.
 - U, Th series radionuclides in dust
 - Radon, thoron (where appropriate) and decay products
 - Measurement of airborne activity (dust, radon)
 - The functioning and purpose of the ventilation system, and its importance for radiation protection
 - The purpose of and methods for controlling and suppressing airborne dust

Worker Health Surveillance



- Health surveillance programmes for workers in NORM industrial facilities need be no different in principle from those for general industrial activities involving exposure to radiation
- Such programmes are:
 - Based on the general principles of occupational health
 - Designed to assess the initial and continuing fitness of workers for their intended tasks
- The working and environmental conditions in many NORM facilities, especially mines, may be different from those in normal facilities involving radiation sources
- In order to be familiar with such conditions, the occupational physician in charge of the health surveillance programme may need to periodically visit the workplaces concerned.
- May not be required for all industries

Audits and reviews

- The RPP should be regularly audited and reviewed by persons who are technically competent to enhance the effectiveness and efficiency of the RPP
- Audits and reviews should be performed using written procedures and check lists at appropriate intervals:
 - When required by the regulatory body
 - When considered necessary by management
 - Following implementation of a new RPP or addition of significant new content
 - Following significant reorganization/revision of the RPP
 - To implement previously identified corrective actions

Content

- Radiation in Perspective
- Purpose of a RPP
- Content of a RPP
- **Practical Considerations**
- Summary





IAEA





Summary and key messages



- RPPs should be established and maintained for NORM facilities
- The levels of detail should be commensurate with the risk (ie; a graded approach)
- The content of an RPP is based on components outlined in GSR Part 3
- Key aspects of a good RPP;
 - Fit for purpose
 - Requirements consistent with actual risk
 - Practical and able to be implemented
 - Auditable
 - Contribute to radiation protection
 - Integrate with existing management plans
 - Effective



IAEA

International Atomic Energy Agency

Atoms for Peace and Development

Thank you!

