



IAEA

International Atomic Energy Agency

Occupational
Radiation
Protection

Occupational Radiation Protection

2. Exposure of Workers in Planned Exposure Situation – Part 1

GSG7 Section 3

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Application

Introduction

- Planned exposures are defined in paragraphs 3.1 to 3.4 of BSS
- Requirements for planned exposures apply to practices involving radioactive material or radiation generators
- Requirements for planned exposures apply to any occupational exposure, medical exposure or public exposure due to any practice or due to a source within a practice

Natural Sources

- Exposure to natural sources normally subject to requirements for **existing exposure situations** (Section 5)
 - Except for paragraphs 3.159 to 3.161 of IAEA GSG7
 - Material containing any radionuclide from the uranium-238 or thorium-232 decay chains with an activity concentration above 1 Bq/g; or
 - Material contains potassium-40 with an activity concentration above 10 Bq/g

Natural Sources (continued)

☐ Radon

- Normally subject to requirements for **existing exposure situations**; however radon exposure is subject to the requirements for planned exposures if:
 - the workplace uses NORM which is controlled as a Planned Exposure Situation; or
 - the average annual radon concentration remains above the reference level for workplaces following remediation

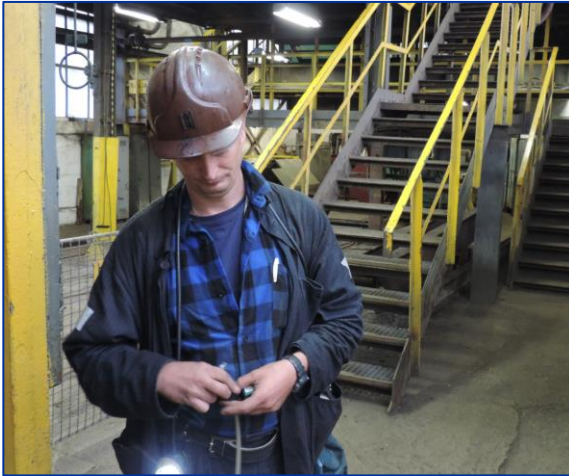


Regulation

Regulation of planned exposures

Each member state's government or regulatory body must set out a graded approach to regulation:

Exemption	Radiation risks too low to warrant regulatory control – expected annual dose < 10 μ Sv or activity or activity concentration below Schedule 1 of BSS.
Notification	Very low risk practices. Exposure unlikely to exceed a small fraction of dose limits. Likelihood and magnitude of potential exposures or detrimental consequences negligible.
Registration	Low risk practices. Facilities or equipment designed to ensure protection, simple operating procedures, minimal safety training requirements or historical safety problems.
Licensing	All other practices. Practice subject to compliance with a licence issued by the regulatory body. Licence conditions to ensure protection and safety is optimized.



OPTIMIZATION

Employer's responsibilities

- ❑ The **primary responsibility** of employers is to be responsible for protection of their workers against occupational exposure, to ensure that **protection and safety is optimized** and that dose limits for occupational exposure are not exceeded.
- ❑ Workers exposed to radiation that is not directly related to their work shall have **the same level of protection against such exposure as members of the public.**

Optimization of protection

Optimization to be considered for all stages of the life of the equipment or installation

Consider all possible actions involving the equipment/ source and all ways workers operate or work nearby

Adapt for changes in techniques of protection resources available

Commitment to optimization

- ❖ Management to demonstrate commitment to effective protection and safety policy and radiation protection programme
- ❖ Workers to demonstrate commitment to optimization with involvement in development of protection methods and feedback on their effectiveness
- ❖ Appropriate training for all relevant persons (regulators, workers, managers)

Dose constraints

- To be used at the planning stage for optimization of protection.
- Places a ceiling on individual dose in for a **single source of exposure**.
- To be set by the operator in cooperation with relevant parties.

DOSE LIMITATION

Dose limitation

- Occupational exposure must be controlled so dose limits are not exceeded.
- Special arrangements are required for protection of persons who are under 18, pregnant or breastfeeding or who have been overexposed within current year.
- Regulations should include provision for averaging over five year period where required.

Dose limits

*Optimization should ensure that most workers receive doses below 20 mSv per year. Circumstances leading to workers receiving doses above 20 mSv per year should be notified to the regulator. Regulator may decide that provision for averaging over five years is not required and set the annual dose limit at 20 mSv. Public includes unborn or breast-fed children.

	Effective dose (mSv)	Extremities and skin (mSv)	Lens of the Eye (mSv)
Workers 18+ averaged over 5 consecutive years	20	-	20
Workers 18+	50*	500	50*
Apprentice 16/17	6	150	20
Public	1	50	15

Radiation Protection Programmes

Radiation Protection Programme (RPP)

- Purpose to **demonstrate management responsibility for protection, safety and optimization** using management structures, policies, procedures and organizational arrangements.
- Employer to establish and manage RPP in close co-operation with company's Health & Safety team.
- Roles and responsibilities to be documented.

Radiation Protection Programme: scope

- ☐ Roles and responsibilities
- ☐ Qualified experts
- ☐ Integration with general health and safety
- ☐ Accountability for radiation generators and radioactive sources
- ☐ Controlled and Supervised Areas
- ☐ Local Rules and Supervision, training of personnel
- ☐ Personal Protective Equipment
- ☐ Personal and area monitoring and record keeping
- ☐ Emergency plan
- ☐ Health surveillance
- ☐ Reviewing and auditing, Quality Assurance

Hierarchy of control measure

Engineered controls



Administrative controls



Personal protective equipment



PRIOR RADIOLOGICAL EVALUATION

Prior Radiological Evaluation and Safety Assessment

RPP to be appropriate using graded approach (paras 2.20 to 2.22 IAEA DS453)

Complexity of activity, facility or process and level of risk to be identified by **Prior Radiological Evaluation**

Graded approach to determine appropriate nature of Prior Radiological Evaluation

Prior Radiological Evaluation

- To identify, for all aspects of operations:
 - Sources, nature and magnitude of reasonably foreseeable exposures during normal operations
 - Reasonably foreseeable failure situations and the sources, nature and magnitude of potential exposures
 - Protection and safety measures needed to implement the optimization process
 - Appropriate monitoring systems
 - An assessment of public exposures from radioactive effluents from the facility

Prior Radiological Evaluation: methodology

Magnitude of exposures in normal operation and potential exposures to be assessed using:

Workplace monitoring

Literature data and information from comparable facilities

Numerical simulations

Confirmatory measurements during commissioning

Safety assessments

Employer responsible for conducting appropriate safety assessments

Safety assessments to be conducted throughout lifecycle of facility

Assessments carried out at design stage should identify measures needed to ensure safety and protection

QUALIFIED EXPERTS

Qualified Experts and Radiation Protection Officers

- Employer to ensure services of Qualified Experts (QE) in relevant fields are provided
- Radiation Protection Officer (RPO) to be appointed to oversee compliance with regulatory requirements
- QE and RPO to be provided with adequate equipment, resources and staff
- Employer to consult QE as appropriate on all aspects of the RPP
- QE to report to employer representative with overall responsibility for safety



SOURCE ACCOUNTANCY

Source accountability

- ❖ Employers shall ensure the safety of **radiation generators and radioactive sources** using an accountability system...
- ❖ ...including an inventory with the location and description of each source or generator and the activity and physical/chemical form of radioactive sources and any special instructions
- ❖ Inventory to be updated and verified periodically and include details of any disposed sources
- ❖ More detailed requirements in **IAEA RS-G-1.10 Safety of Radiation Generators and Sealed Radioactive Sources**



CLASSIFICATION OF AREAS

Classification of areas

- Area classification should be considered when there is occupational exposure to radiation
- Prior radiological evaluation to identify areas in need of classification
- Two types of areas to be clearly defined in the RPP
 - **Controlled Areas and Supervised Areas**

Controlled Areas

- To be designated when specific measures for protection and safety are required for:
 - Controlling exposures or preventing the spread of contamination
 - Preventing or limiting the likelihood and magnitude of exposures in anticipated operational occurrences and accident conditions

Requirements for Controlled Areas -1

- ❖ Delineated by physical or other suitable means
- ❖ Radiation warning symbol and access instructions to be displayed at access points
- ❖ Access restriction by physical or administrative means as appropriate
- ❖ Information, instruction and training for persons working in area

Requirements for Controlled Areas -2

- ❖ Measures for protection and safety within area to be established, e.g.
 - ❖ Physical measures to control the spread of contamination
 - ❖ Local rules and procedures
- ❖ Personal Protective Equipment, changing facilities and monitoring equipment to be provided at entrance to area (where appropriate)
- ❖ Monitoring equipment, washing facilities and storage for contaminated PPE to be provided at exit from area (where appropriate)

Supervised Areas

- To be designated when it is necessary for exposure conditions to be kept under review (when not already designated as a controlled area)
- Areas where prior radiological evaluation predicts effective dose greater than 1 mSv per year should be designated as supervised areas
- Delineation and signs may be appropriate but not always (eg. if accessible to the public)

LOCAL RULES AND PROCEDURES

Local Rules and Procedures

Management required to establish Local Rules, to ensure protection and safety of workers

Local Rules to be made known to workers and be prominently displayed or otherwise made available

Local Rules to be adequately supervised and all workers to be given adequate training to enable them to comply with Local Rules and procedures

Local Rules – Essential Content

- Investigation or authorized levels and procedures to be followed if exceeded
- Procedures to be followed in Controlled Areas
- Some or all of other components of RPP, eg
 - Monitoring of exposures and contamination
 - Use of PPE
 - Emergency preparedness and response
- Other aspects listed in paragraph 3.89 of IAEA GSG7

Key messages

- Employers carrying out practices must ensure the protection and safety of workers and others are optimized
- Before starting any work activity carry out a prior radiation evaluation to identify necessary protection measures
- Implement engineered and administrative controls, and provide PPE necessary to ensure objective achieved

QUESTIONS AND DISCUSSION