RASIMS – Thematic Safety Area 2

Occupational Radiation Protection

H. Burçin Okyar
Occupational Radiation Protection Unit
Radiation Safety & Monitoring Section, NSRW
TSA 2: Radiological Protection in Occupational Exposure

Elements of TSA 2

1. Regulatory infrastructure for occupational radiation protection
2. Individual monitoring for external radiation sources
3. Individual monitoring for intake radionuclides
4. Workplace monitoring
5. Service providers
6. Implementation of the requirements by end users
7. Occupational exposure to natural sources
An integrated and consistent set of Safety Requirements that establishes the requirements that must be met to ensure the protection of people and the environment, both now and in the future.

- GSR Part 3 (BSS) follows ICRP 103 recommendations
- Protection and Safety requirements of the BSS apply to all facilities and activities
- Planned, existing and emergency exposure situations
- Occupational, public and medical exposure categories
- 52 overarching requirements – for governments, regulatory bodies, industry, health and safety professionals, workers, public and service providers such as technical support organizations
- 12 requirements for ORP; Control, monitoring and recording
- Regulator, TSOs (authorization or approval of service providers for individual monitoring and calibration services) & Operators
**GSR Part 3 coverage for ORP**

### Planned exposure situation

#### Occupational exposure
- Req 19: Responsibilities of the regulatory body (*Regulatory Infrastructure for Occupational Radiation Protection*)
- Req 20: Requirements for monitoring and recording of occupational exposure
- Req 21: Responsibilities of employers, registrants and licensees
- Req 22: Compliance by workers (*Responsibilities of workers*)
- Req 23: Cooperation between employers, registrants and licensees
- Req 24: Radiation protection programme (*& Req 13 on Safety Assessment*)
- Req 25: Assessment of occupational exposure and workers’ health surveillance
- Req 26: Information, instruction and training
- Req 27: Conditions of service
- Req 28: Protection and safety for female workers and for persons under 18 years of age

### Emergency exposure situation

#### Exposure of Emergency Workers
- Req 45: Protection of emergency workers (arrangements for controlling the exposure)

### Existing exposure situation

#### Occupational exposure
- Req 52: Protection of workers in existing exposure situations (remedial actions, Rn in workplaces, exposure of air crew)
GSR Part 1 coverage for ORP

- **Req 7**: Safety of workers (coordination between relevant authorities)
- **Req 9**: Necessary arrangement for worker protection
- **Req 13**: Provisions of Technical Services (services for personal dosimetry, environmental monitoring and the calibration of equipment & authorization)
- **Req 25**: Graded approach for review and assessment of facilities and activities (arrangements for worker protection)
- **Req 35**: Safety related records (records of doses from occupational exposure)
LEADERSHIP FOR SAFETY
• Requirement 2: Demonstration of leadership for safety by managers
• Managers shall demonstrate leadership for safety and commitment to safety.

CULTURE FOR SAFETY
• Requirement 12: Fostering a culture for safety
• Individuals in the organization, from senior managers downwards, shall
• foster a strong safety culture.
GSR Part 4

IAEA Safety Standards
for protecting people and the environment

Safety Assessment for Facilities and Activities

General Safety Requirements Part 4
No. GSR Part 4

IAEA
International Atomic Energy Agency
Safety Guide on ORP, GSG-7

- Implementation of the Requirements on ORP in compliance with GSR Part 3
- Jointly developed by the IAEA and the ILO
- Updates of previous safety guides in the field of ORP
  - Occupational Radiation Protection, RS-G-1.1
  - Assessment of Occupational Exposure Due to Intakes of Radionuclides, RS-G-1.2
  - Assessment of Occupational Exposure Due to External Sources of Radiation, RS-G-1.3
  - Occupational Radiation Protection in the Mining and Processing of Raw Materials, RS-G-1.6
  - Management System for Technical Services in Radiation Safety, GS-G-3.2
- It is applicable to all areas concerning occupational exposure, including medicine, nuclear fuel cycle, industries involving NORM, radiation application industries and scientific as well as educational facilities.
RASIMS - TSA 2 Elements

**Planned Exposure Situations**
- Req 19: Responsibilities of the regulatory body
- Req 20: Requirements for monitoring and recording of occupational exposure
- Req 21: Responsibilities of employers, registrants and licensees
- Req 22: Compliance by workers
- Req 23: Cooperation between employers, registrants and licensees
- Req 24: Radiation protection programme
- Req 25: Assessment of occupational exposure and workers’ health surveillance
- Req 26: Information, instruction and training
- Req 27: Conditions of service
- Req 28: Protection and safety for female workers and for persons under 18 years of age

**Emergency Exposure Situations**
- Req 45: Protection of emergency workers

**Existing Exposure Situations**
- Req 52: Protection of workers in existing exposure situations

**Planned Exposure Situations**
- **ELEMENT 1**: Responsibilities of the regulatory body
- **ELEMENT 2**: Requirements for monitoring and recording of occupational exposure
- **ELEMENT 3**: Responsibilities of employers, registrants and licensees
- **ELEMENT 4**: Compliance by workers (Responsibilities of workers)
- **ELEMENT 5**: Cooperation between employers, registrants and licensees
- **ELEMENT 6**: Radiation protection programme
- **ELEMENT 7**: Assessment of occupational exposure and workers’ health surveillance
- **ELEMENT 8**: Information, instruction and training
- **ELEMENT 9**: Conditions of service
- **ELEMENT 10**: Protection and safety for female workers and for persons under 18 years of age

**Emergency Exposure Situations**
- **ELEMENT 11**: Protection of emergency workers

**Existing Exposure Situations**
- **ELEMENT 12**: Protection of workers in existing exposure situations
Regulatory Infrastructure for ORP

- **(P)** legal and regulatory framework specific for the control of occupational exposure
  - **(S)** Statutory basis for establishing requirements for occupational exposure
  - **(S)** RB with clearly specified functions and responsibilities
  - **(S)** Responsibilities of employers, registrants and licensees
  - **(S)** Establish requirements to ensure that protection and safety is optimized
  - **(S)** Empower the RB to enforce requirements to ensure optimization
  - **(S)** Dose limits for occupationally exposed workers
  - **(S)** Regulatory body to enforce compliance with the dose limits for OE
  - **(S)** Before authorizing a new or a modified practice, and in all operational states and in accident conditions, review of supporting documents from the responsible parties
    - Design criteria and design features relating to the exposure and potential exposure of workers?
    - Design criteria and design features of the appropriate systems and programmes for monitoring of workers for occupational exposure?

**Evidence needs to be added**
Requirements for monitoring and recording of Occupational Exposure

- (P) Establishment and enforcement of requirements for the monitoring and recording of OE in **PES**
  - (S) Monitoring of occupational exposures
  - (S) Recording of occupational exposures
  - (S) Control of occupational exposures
  - (S) RB reviews the monitoring programs of authorized parties to ensure the fulfilment of requirements with regard to occupational exposure?
  - (S) Authorize or approve the providers of
    - Individual monitoring
    - Calibration services
  - (I) Information on the status of approval by the RB

<table>
<thead>
<tr>
<th>Type of service</th>
<th># of providers</th>
<th># of authorized or approved providers</th>
<th>% of authorized or approved providers</th>
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<tbody>
<tr>
<td>External dosimetry</td>
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<td>Internal dosimetry</td>
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<td>Workplace monitoring</td>
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<tr>
<td>Calibration of WM &amp; measurement equipment</td>
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<td>Calibration of radiation sources</td>
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Requirements for monitoring and recording of OE

(I) As part of approval process, implementation of a QMS (IM & Calibration)

• Description of the QMS
• Documents for measurement, assessment and improvement of performance
• Working documents and job descriptions
• Results of intercomparison exercises,

• Additional technical documents and data, including:
  • Operating manuals for equipment and software,
  • Reagent safety data sheets,
  • Requirements of national authorities (laws and regulations),
  • Managerial standards
  • Technical standards,
  • External documents not within the scope of influence of the service provider,
  • Procedure for control of documents to include periodic review of valid documents?

Evidence needs to be added
TSPs

• Categories include:

**Calibration and testing/assay services**
  – Monitoring (individual, workplace and environmental)
  – Calibration and verification of monitors and radiation sources

**Consultancy and maintenance**
  – Radiation safety consultancy
  – Shielding calculations
  – Modelling for dose assessment, containment and ventilation
  – Maintenance services (in-house & contracted out)
  – Decontamination

• Organization or organizational unit designated, or otherwise recognized by a regulatory body and/or a government, to provide expertise and services to support nuclear and radiation safety and all related scientific and technical issues.
• A TSO can also support nuclear security and safeguards.
Requirements for monitoring and recording of OE

- (S) implement of monitoring programs by the employers and authorized parties
  - Requirements to implement individual monitoring services of external exposure
  - Requirements to implement individual monitoring services of internal exposure
  - Requirements to implement workplace monitoring

- (I) Availability and Criteria to initiate (in tables)
  - Gamma, beta and neutron monitoring

- (I) Operational quantities used for individual monitoring of external exposure
  - Personal dose equivalent for exposure to strongly penetrating radiation – Hp(10)
  - Personal dose equivalent for exposure to weakly penetrating radiation – Hp(0.07)
  - Personal dose equivalent for the lens of the eye – Hp(3)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Approx. total number of workers in the country per sector/monitoring frequency (in months)</th>
<th>coverage of workers in %</th>
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<tbody>
<tr>
<td>Industry</td>
<td>Photon</td>
<td>beta</td>
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<td>Medical</td>
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<td>Research</td>
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<tr>
<td>Other</td>
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</table>
## Requirements for monitoring and recording of OE

- (I) operational laboratories providing services of individual monitoring of external exposure

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<thead>
<tr>
<th>Laboratories</th>
<th>Number of qualified personnel</th>
<th>Equipment</th>
<th>Arrangements for calibration, testing and technical performance</th>
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- (I) Dosimeters approved by the regulatory body (i.e. the ‘designated or dosimeter of record’) for record keeping purposes?

  TLD, OSL, RPL (glass dosimeter), DIS (direct ion storage), Film, other...
Requirements for monitoring and recording of OE

– Provisions for workplace monitoring include
  ● Establishment of investigation levels
  ● Defined actions to be taken if investigation levels are exceeded
  ● Periodical analyses of trends in workplace monitoring results

– Criteria for initiating monitoring of internal exposure

Evidence needs to be added
Requirements for monitoring and recording of OE

- Internal dosimetry; coverage of workers covered under individual monitoring of internal exposure
  - Quantities
  - Frequency
  - Operational laboratories
- Workplace monitoring
  - Quantities
  - Frequency
- Review periodic reports on occupational exposure (including results of monitoring programs and dose assessments) submitted by employers, registrants and licensees

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Responsibilities of employers, registrants and licensees

(P) Regulatory framework to establish responsibilities of employers, registrants and licensees for the protection of workers

• Control of occupational exposure (Dose limits are not exceed)
• Optimized protection and safety
• Record keeping (decisions made) and availability of decisions to relevant parties, through their representatives, where appropriate
• Policies, procedures and organizational arrangements for protection and safety
  – Priority is given to design and technical measures for controlling occupational exposure
  – Necessary workers’ health surveillance and health services for workers
  – Appropriate monitoring equipment and personal protective equipment is provided
• Arrangements are made for the proper use, calibration, testing and maintenance of monitoring and personal protective equipment
• Necessary conditions for promoting safety culture
• Dose constraints are established and used
Responsibilities of workers

(P) Regulatory framework to establish the responsibilities of workers for fulfilling their obligations and carry out their duties for protection and safety

• **Workers**
  – Applicable local rules and procedures
  – Proper use of the monitoring equipment and PPE
  – Cooperation with the employer, registrant or licensee with regard to protection and safety, and programmes for workers’ health surveillance and programs for dose assessment
  – Information on their past and present work that is relevant for ensuring effective and comprehensive protection and safety
  – Abstain from any wilful action
  – Acceptance of information, instruction and training
Cooperation between employers, registrants and licensees

(P) Regulations to require employers and registrants and licensees to cooperate to the extent necessary for compliance by all responsible parties with the requirements for protection and safety

– Compliance by both parties with the requirements of national regulations

(P) Regulations to require employers and registrants and licensees
– Development and use of specific restrictions on exposure
– Specific assessments of the doses
– Clear allocation and documentation of the responsibilities

(P) Regulations to require employers and registrants and licensees
– Obtain from the employers, including self-employed persons, the previous occupational exposure history of workers and any other necessary information
– Provide appropriate information to the employer, including any available information relevant for compliance with the requirements of national regulations
– Provide both the worker and the employer with the relevant exposure records

Evidence needs to be added
Radiation Protection Programme & Safety Assessment

- General objective
- Scope defined for the RPP, roles and responsibilities
- Specifications on the need of designated qualified experts in relevant fields (e.g. Radiation Protection, Internal and External Dosimetry, Workplace Monitoring, Ventilation, Occupational Health and Radioactive Waste Management)?
- The system for accountability for radiation generators and radioactive sources?
- Work Planning and Work Permits?
- Monitoring and Assessment of Exposures (individual and workplace monitoring)?
- Arrangements for information exchange, instruction and training?
- Qualification and Certification System for workers?
- Audits and Reviews?
- Records?
- Specific requirements on Safety Culture?
- Specific measures for controlling exposures or preventing the spread of contamination in normal operation and anticipated operational occurrences and accident conditions?
- Emergency preparedness and response

Evidence needs to be added
Assessment of occupational exposure and workers’ health surveillance

- Assessment and recording of the occupational exposure of workers
- on the basis of **individual monitoring** where appropriate
- Arrangements are made with **authorized or approved dosimetry service** providers that operate under a **quality management system**

Evidence needs to be added
Information, instruction and training

• Information on **health risks** due to their occupational exposure in normal operation, anticipated operational occurrences and accident conditions

• Adequate instruction and training and periodic retraining in protection and safety adequate information on the significance of their actions for protection and safety

**Evidence needs to be added**
Conditions of service

• Benefits as substitutes for measures for protection and safety

• Special compensatory arrangements, or preferential consideration with respect to salary, special insurance coverage, working hours, length of vacation, additional holidays or retirement benefits, shall neither be granted nor be used as substitutes for measures for protection and safety
Protection and safety for female workers and for persons under 18 years of age

• Special arrangements for training
• Protection of the embryo or fetus and breastfed infants, in particular to provide information on:
  – the risk to the embryo or fetus due to exposure of a pregnant woman?
  – the importance for a female worker of notifying her employer as soon as possible if she suspects that she is pregnant or if she is breast-feeding?
  – the risk of health effects for a breastfed infant due to ingestion of radioactive
Protection of workers in emergency exposure situations

• A program for managing, controlling and recording the doses received by emergency workers in an emergency

• Specify the response organization(s) and employers responsible for ensuring compliance with the national requirements relevant for occupational exposures

• Establish that the relevant requirements for occupational exposure in planned exposure situations are applied for emergency workers, in accordance with a graded approach

• Guidance *(no emergency worker is subject to an exposure in an emergency in excess of 50 mSv)*
  - For the purposes of saving life or preventing serious injury
  - When undertaking actions to prevent severe deterministic effects and actions to prevent the development of catastrophic conditions that could significantly affect people and the environment; or
  - When undertaking actions to avert a large collective dose

Evidence needs to be added
Protection of workers in existing exposure situations

• **Control above specific activity concentrations**

• National regulations, are NORM scenarios (*industries involving NORM*) considered as existing exposure situations, so the requirements specific for these exposure situations are applicable
  – List of operational NORM industries
  – Criterion for the scope of regulatory control in NORM industries
  – Criterion for exemption applicable to NORM scenarios
  – Graded approach for control of occupational exposures associated with NORM industries
  – Characteristics of initial assessment (radiological characterization) of NORM scenarios for worker protection?

• **Exposure of workers undertaking remedial actions** are controlled

• **Strategy for protection against exposure due to** $^{222}$Rn in workplaces including the establishment of a reference level for $^{222}$Rn
Protection of workers in existing exposure situations

- Regulatory framework for the protection of aircrew and space crew against exposure due to cosmic radiation, including:
  - **Assessment** of exposure of aircrew
  - **Reference level of dose and a methodology for the assessment and recording of doses** received by aircrew from occupational exposure to cosmic radiation
  - Provisions for requiring employers to **assess and record doses when the doses are likely to exceed the reference level**
  - Provisions for requiring employers to make these **records of doses available to aircrew**
  - Provisions for requiring employers to **inform female aircrew of the risk to the embryo or fetus due to exposure to cosmic radiation** and of the need for early notification of pregnancy

*Evidence needs to be added*
Thank you!

H. Burçin Okyar
Occupational Radiation Protection Unit
Radiation Safety & Monitoring Section, NSRW
h.b.okyar@iaea.org