IAEA
International Atomic Energy Agency
Atoms for Peace and Development

ASSESSMENT OF OCCUPATIONAL EXPOSURE DUE TO INTERNAL RADIATION SOURCES

UNIT 1
DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **CONTENTS OF LECTURE**
  - ✓ OCCUPATIONAL EXPOSURE: AN INTRODUCTION
  - ✓ OCCUPATIONAL EXPOSURE: MONITORING AND ASSESSMENT
  - ✓ TYPES OF MONITORING PROGRAMMES
  - ✓ ASSESSMENT OF EXTERNAL EXPOSURE
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  - ✓ RECORDS OF OCCUPATION EXPOSURE
  - ✓ DESIGNING A MONITORING PROGRAMME
  - ✓ REFERENCE LEVELS
  - ✓ INDIVIDUAL MONITORING SERVICE
  - ✓ CUSTOMER RELATED ISSUES

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- The objective of this unit is to give a general introduction on occupational exposure and to outline step-by-step the principles and issues involved in designing an occupational exposure monitoring programme.

- The module will include the basis for monitoring, elements of programme design, use of reference levels and individual monitoring services.

- At the completion of this module, the student should have an overview on occupational exposure and understand the principles of occupational monitoring programme design and how to approach establishing programme elements.

Occupational Exposure: An Introduction

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **DEFINITION OF OCCUPATIONAL EXPOSURE**

  ✓ **GSR Part 3** (Page 406) ➡ **Exposure of workers incurred in the course of their work.**

  GSG-7 (2.1): Occupational exposure is the exposure of workers incurred during the course of their work, regardless of the exposure situation. GSR Part 3 distinguishes between three different types of exposure situation: planned exposure situations, emergency exposure situations and existing exposure situations.
  GSR Part 3 (1.42): Exposures deemed to be not amenable to control are excluded from the scope of these Standards.
  (K-40 in the body or cosmic radiation at the surface of the Earth)

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- **TYPES OF OCCUPATIONAL EXPOSURE SITUATION**

A Planed Exposure Situation	An Emergency Exposure Situation	An Existing Exposure situation
• is a situation of exposure that arises from the planned operation of a source or from a planned activity that results in an exposure due to a source. Since provision for protection and safety can be made before embarking on the activity concerned, the associated exposures and their likelihood of occurrence can be restricted from the outset. The primary means of controlling exposure in planned exposure situations is by good design of facilities, equipment and operating procedures, and by training…	• is a situation of exposure that arises as a result of an accident, a malicious act or any other unexpected event, and requires prompt action in order to avoid or to reduce adverse consequences. Preventive measures and mitigatory actions have to be considered before an emergency exposure situation arises. However, once an emergency exposure situation actually arises, exposures can be reduced only by implementing protective actions.	• is a situation of exposure that already exists when a decision on the need for control needs to be taken. Existing exposure situations include situations of exposure to natural background radiation. They also include situations of exposure due to residual radioactive material that derives from past practices that were not subject to regulatory control or that remains after an emergency exposure situation.

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- **TYPES OF OCCUPATIONAL EXPOSURE SITUATION**

Planed Exposure	Emergency Exposure	Existing Exposure
• Planned operations and activities • Provisions for safety can be made in advance • Exposures can be restricted from the start • Essentially the same as "practices"	• From accidents, malicious acts or other unexpected event • Requires prompt action • Prevention and mitigation actions can be taken before • Actions to restrict exposures taken after the accident occurs	• Already present when decisions on the need for control are required • Exposure to natural background radiation • Residual radioactivity from uncontrolled past practices, or following an emergency exposure situation.
Occupational exposures can occur in any exposure situation		

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- **PROTECTION OF WOKERS IN SPECIAL CASES**
  - ✓ Female workers during and after pregnancy
  - ✓ Itinerant workers

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **NEED TO MONITOR AND RECORD OCCUPATIONAL EXPOSURE**

  ✓GSR Part 3, Requirement 20: Requirements for monitoring and recording of occupational exposures

  "The regulatory body shall establish and enforce requirements for the monitoring and recording of occupational exposures in planned exposure situations."

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **MONITORING IS BASED ON WORKPLACE CHARACTERIZATION. AREA CLASSIFICATION IS CRUCIAL**

  ✓**Controlled Area**

  "Any area in which specific measures for protection and safety are or could be required for:

  (a) Controlling exposures or preventing the spread of contamination in normal operation

  (b) Preventing or limiting the likelihood and magnitude of exposures in anticipated operational occurrences and accident conditions."

GSR Part 3, 3.88

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **MONITORING IS BASED ON WORKPLACE CHARACTERIZATION. AREA CLASSIFICATION IS CRUCIAL**

✓ **Supervised Area**

"Any area not already designated as a controlled area but for which occupational exposure conditions need to be kept under review, even though specific measures for protection and safety are not normally needed."

GSR Part 3, 3.91

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **OCCUPATIONAL MONITORING REQUIREMENTS (GSR Part 3, 3.100)**

  - ✓ For any worker who usually works in a controlled area, or who occasionally works in a controlled area and may receive a significant dose from occupational exposure, individual monitoring shall be undertaken where
    - appropriate,
    - adequate and
    - feasible

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **OCCUPATIONAL MONITORING REQUIREMENTS (GSR Part 3, 3.100)**
  - ✓ In cases when individual monitoring is
    - inappropriate,
    - inadequate or
    - not feasible,
  - ✓ The occupational exposure shall be assessed on the basis of the results of
    - workplace monitoring, and
    - information on the locations and durations of exposure of the worker

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **OCCUPATIONAL MONITORING REQUIREMENTS (GSR Part3, 3.101)**

  - ✓ For any worker who regularly works in a supervised area or who enters a controlled area only occasionally, the occupational exposure shall be assessed on
    - The basis of the results of workplace monitoring or individual monitoring, as appropriate.

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- **OPERATIONAL MONITORING**
  - ✓ The range of activities involved in dose assessment, including individual and workplace monitoring
  - ✓ Assessment of occupational exposure is a key element in achieving effective optimization and dose limitation
  - ✓ The general objective of operational monitoring programmes is to provide the assessment of workplace conditions and individual exposures

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **OPERATIONAL MONITORING**
  - ✓ **Assessment of internal radiation exposure**
  - ✓ **Assessment of external exposure**
  - ✓ **Individual dose assessment**

Occupational Exposure: Monitoring and Assessment

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- **ASSESSMENT OF OCCUPATIONAL EXPOSURE AND WORKERS' HEALTH SURVEILLANCE**

  ✓GSR Part 3, Requirement 25 : Assessment of occupational exposure and workers' health surveillance

  "Employers, registrants and licensees shall be responsible for making arrangements for assessment and recording of occupational exposures and for workers' health surveillance."

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **ASSESSMENT OF EXPOSURE INCLUDES,**
  - ✓ Individual monitoring
  - ✓ Workplace monitoring
  - ✓ Interpretation of results and dose assessment
  - ✓ Accuracy requirements
  - ✓ Dosimeter type testing
  - ✓ Quality Assurance and Quality Control
  - ✓ Performance testing
  - ✓ Record keeping and reporting

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- **ASSESSMENT OF OCCUPATIONAL EXPOSURE**

  - ✓ Assessment of occupational exposure involves assessment of both the **external and internal exposure** components.

  - ✓ *Effective Dose, E,* at any time, is the sum of the external and internal exposure components.

- **ASSESSMENT OF OCCUPATIONAL EXPOSURE**

✓ The following equation is used for assessment of occupational exposure and demonstration of compliance with dose limits (Dose of Record):

$$E \cong H_p(d) + \sum_j e(g)_{j,ing} I_{j,ing} + \sum_j e(g)_{j,inh} I_{j,inh}$$

Where, E is the total Effective Dose, Sv (internal + external exposures)

$H_p(d)$ is the personal dose equivalent in soft tissue at an appropriate depth d below a specified point on the body during a given time period, Sv (external exposures)

$e(g)_{j,\,ing}$ is the committed effective dose per unit intake by ingestion for radionuclide j by the group of age g during the same time period, Sv Bq^{-1} (internal exposures)

$e(g)_{j,inh}$ is the committed effective dose per unit intake by inhalation for radionuclide j by the group of age g during the same time period, Sv Bq^{-1} (internal exposures)

I_j, is the intake via ingestion of radionuclide j during the same time period, Bq (internal exposures)

$I_{j,inh}$ is the intake via inhalation of radionuclide j during the same time period, Bq (internal exposures)

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **DOSE RECEIVED BY WORKERS SHOULD BE ASSESSED BY MONITORING**
  - ✓ Measurements related to the assessment or control of exposure to radiation and radioactive material
  - ✓ Interpretation of the measurement results including those for the individual and those made in the workplace
  - ✓ Assessment of measurement results and interpretation

Types of Monitoring Programmes

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **MONITORING PROGRAMME CAN BE DEFINED FOUR TYPES RELATED TO OBJECTIVES**
  - ✓ Routine
  - ✓ Special
  - ✓ Confirmatory
  - ✓ Task-related

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **THE FOUR TYPES OF MONITORING PROGRAMME CAN BE SUBDIVIDED INTO TWO TYPES ON THE BASIS OF THE LOCATION OF THE MONITORING**

  - ✓ Individual monitoring
  - ✓ Workplace monitoring

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- **ROUTINE MONITORING**

  - ✓ Associated with continuing operations
  - ✓ Intended to meet regulatory requirements and to demonstrate that the working conditions, including the levels of individual dose, remain satisfactory

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- **SPECIAL MONITORING**
  - ✓ Investigative in nature.
  - ✓ Typically for a situation in the workplace where insufficient information is available to demonstrate adequate control.
  - ✓ Intended to provide detailed information in order to elucidate problems and to define future procedures.

  - ✓ Should normally be undertaken,
    - at the commissioning stage of new facilities,
    - following major modifications to facilities or procedures, or
    - when operations are being carried out under abnormal circumstances, such as an accident.

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- **CONFIRMATORY MONITORING**

  - ✓ Performed where there is a need to check assumptions made about exposure conditions (e.g. to confirm the effectiveness of protective measures)..

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- **TASK-RELATED MONITORING**
  - ✓ Applies to a specific operation.
  - ✓ Provides data to support the immediate decisions on the management of the operation.
  - ✓ May also support the optimization of protection.

  - ✓ If radiation fields remain constant throughout the operations, preliminary surveys are usually sufficient,
    - but repeated surveys before each series of operations are recommended.
    - Continued measurements are needed throughout the operation,
    - if the operations influence the dose equivalent rates or if the radiation fields may be variable.

Assessment of External Exposure

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **MONITORING PROGRAMME**
  - ✓ **Individual monitoring**
  - ✓ **Workplace monitoring**

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **GENERAL REQUIREMENTS FOR INDIVIDUAL MONITORING**

  - ✓ Assessment of the occupational exposure of workers on the basis of individual monitoring.
    - Any worker normally employed in a controlled area, or occasionally works in a controlled area and may receive significant exposure.
    - The need for individual monitoring is likely to be greater in the early stages of an operation.
    - As experience in the workplace is accumulated, the need for routine individual monitoring can be kept under review to decide on the need for continuation of individual monitoring.
    - In determining the necessity for individual monitoring, consideration should also be given to the potential for accidental exposures.

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **OBJECTIVES FOR INDIVIDUAL MONITORING**

1. Demonstration of good working practices which indicate the adequacy of supervision, training and engineering standards.
2. Estimation of the actual radiation exposure of workers, to demonstrate compliance with legal requirements.
3. Evaluation and development of operating procedures.
4. Provision of information which can be used to motivate workers to reduce their exposure.
5. Provision of information for the evaluation of dose in the event of accidental exposure.
6. Risk benefit analysis.
7. Medical records and epidemiological studies.

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- **WORKPLACE MONITORING**

  - ✓ Based on dose rate, activity concentration in air and surface contamination, and their expected fluctuations, and on the likelihood and magnitude of exposures in anticipated operational occurrences and accident conditions.
  - ✓ Should be sufficient for
    - evaluation of the radiological conditions in all workplaces;
    - assessment of exposures in controlled areas and supervised areas;
    - review of the classification of controlled areas and supervised areas.

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **WORKERS HAVE RESPONSIBILITIES**
  - ✓ To follow any applicable rules and procedures for protection and safety
  - ✓ To use properly the monitoring devices and the protective equipment and clothing provided
  - ✓ To provide the employer such information on their past and current work as is relevant to ensure effective and comprehensive protection and safety
  - ✓ To accept such information, instructions and training concerning protection and safety

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- **CHOICE OF MONITORING SYSTEMS**
  - ✓ Personal dosimeters
  - ✓ Workplace monitoring systems and instruments

- **SPECIFIACTION FOR MONITORING EQUIPMENT**
  - ✓ Personal dosimeters
  - ✓ Workplace monitoring systems and instruments

- **ESTIMATION OF UNCERTAINTIES**

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- **TESTING OF PERSONAL DOSIMETRY SYSTEMS**
  - ✓ Type testing
  - ✓ Performance testing
  - ✓ Routine testing

- **TESTING OF WORKPLACE MONITORING SYSTEMS**
  - ✓ Type testing
  - ✓ Pre-use testing
  - ✓ Periodic testing

- **CALIBRATION OF INSTRUMENTS**

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- **APPROVAL OF DOSIMETRY SERVICES**

- **INTERPRETATION OF MEASUREMENTS AND DOSE ASSESSMENT**
  - ✓ **Personal dosimetry**
  - ✓ **Workplace monitoring**

- **BACKGROUND SUBTRACTION**

Assessment of Internal Exposure

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **MONITORING PROGRAMME**
  - ✓ **Routine monitoring**
  - ✓ **Task related monitoring**
  - ✓ **Special Monitoring**

- **METHODS OF MEASUREMENT**
  - ✓ **Direct and indirect measurement**
  - ✓ **Detection limits and decision thresholds**

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- **CALIBRATION**
  - ✓ **Direct methods**
  - ✓ **Indirect methods**

- **PERFORMANCE CRITERIES**

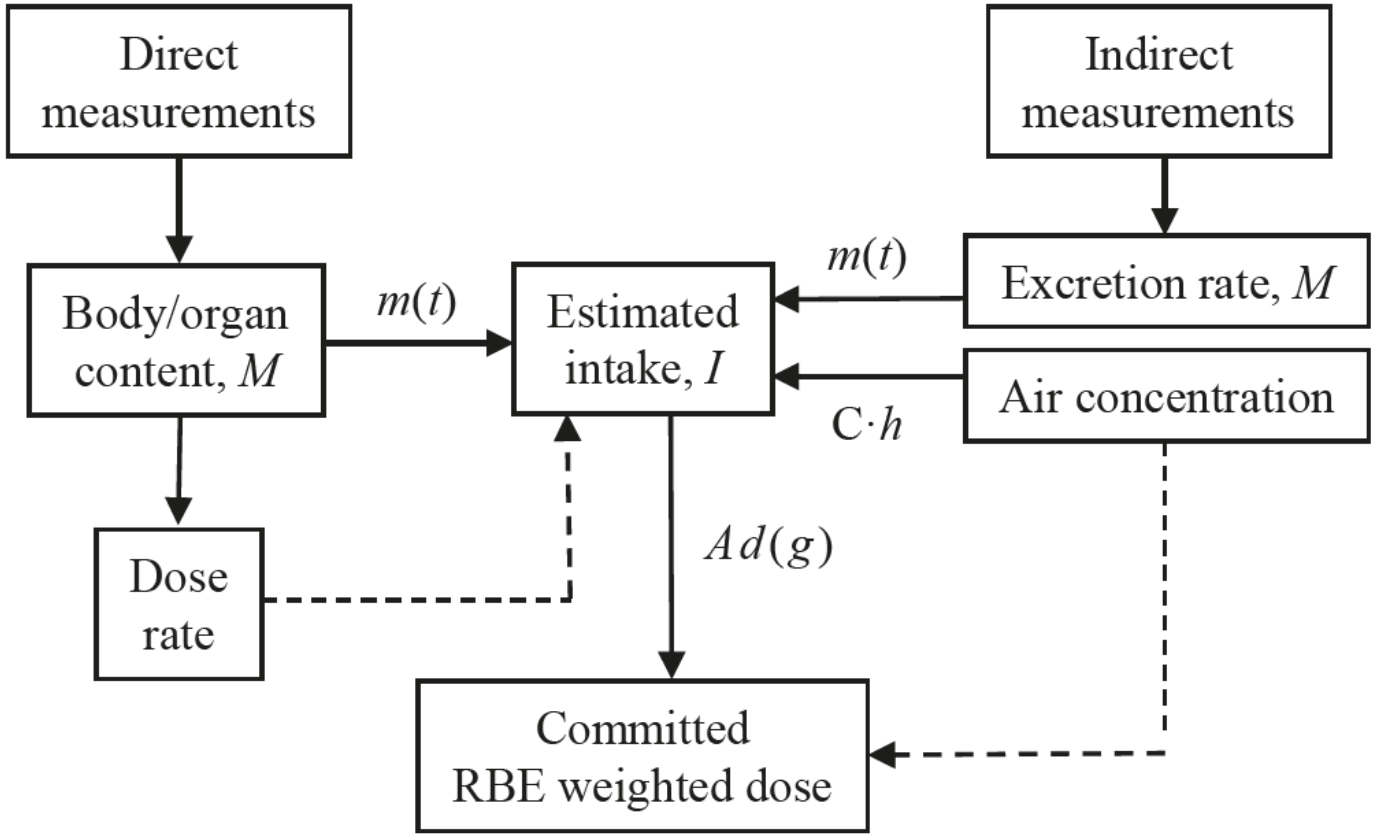
- **UNCERTAINTIES IN MONITORING ASSESSMENT**
  - ✓ **Use of workplace specific, material specific and individual specific data**

- **UNCERTAINTIES IN DOSE ASSESSMENT**

Assessment of Exposure in Emergency

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **EXTERNAL EXPOSURE**
- **INTERNAL EXPOSURE**
  - ✓ **General schema for assessment for internal dose from monitoring measurement in emergency**



Assessment of Skin Contamination

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **GENERAL CONSIDERATION**
  - ✓ **Strongly penetrating radiation**
  - ✓ **Weakly penetrating radiation**

- **MONITORING SKIN CONTAMINATION**

Record of Occupational Exposure

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- RECORD KEEPING FOR INDIVIDUAL MONITORING
- RECORD KEEPING FOR WORKPLACE MONITORING
- RECORD RETENTION PERIOD
- MONITORING SKIN CONTAMINATION

Designing A Monitoring Programme

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **DESIGNING A MONITORING PROGRAMME**

1. Determine programme requirements:
   - Regulation
   - License requirements
   - Legal protection
2. Evaluate the radiation environment:
   - Workplace hazard
   - Intensity of sealed sources
   - Type of radionuclides (Energy, T½, Activity)
   - Particle sizes
   - General metabolism
   - Dosimetric properties of the radionuclides

- **DESIGNING A MONITORING PROGRAMME (Cont.)**

3. Evaluate available monitoring capabilities:
   - Equipment available
   - Detection limits
   - Alternative resources
4. Assess the need of different software and hardware:
   - Interface with equipment
   - Databases
   - Dose calculation algorithms

- **DESIGNING A MONITORING PROGRAMME (Cont.)**

5. Define the specific objective of the programme or task:
   - Criteria for worker selection for monitoring

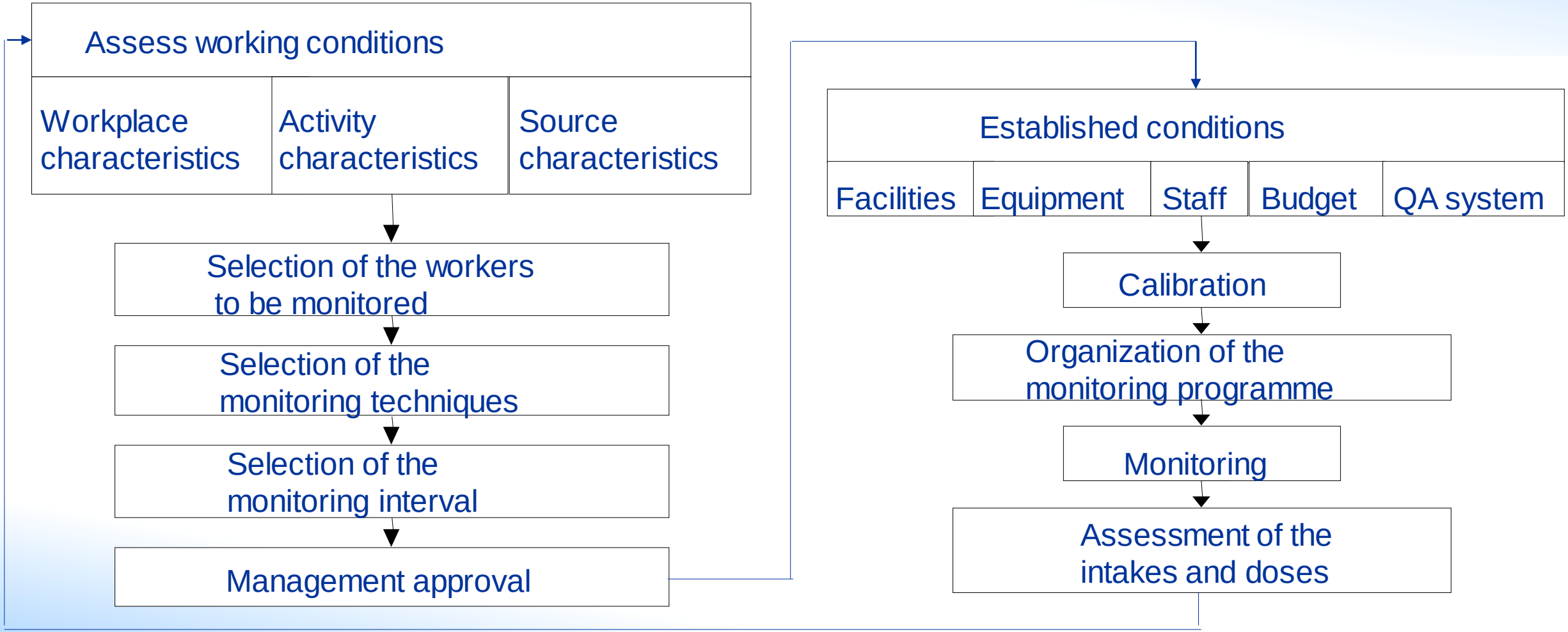
6. Define the programmatic elements for each radionuclide of interest:
   - Monitoring interval
   - Reference levels
   - Dose assessment methodology
   - Follow-up actions in case of overexposure

- **DESIGNING A MONITORING PROGRAMME (Cont.)**

7. Methods to be applied in case of radiological emergency
8. Determine QA requirements
9. Write standard operating procedures
10. Training employees in performing the standard operating procedures before they are implemented
11. Implement the standard operating procedures
12. Perform periodic programme re-assessment and adjustment

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **DESIGNING A MONITORING PROGRAMME**



Reference Levels

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **REFERENCE LEVELS**
  - ✓ **Reference level** - predetermined value for:
    - any of the quantities,
    - which requires a certain course of action if,
    - the value of the level for a quantity is exceeded

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **REFERENCE LEVELS**

  - ✓ Reference levels **often refer to *Effective Dose***, but may apply to other quantities:
    - These are called ***derived reference levels***
  - ✓ A reference level is not a limit in itself.
  - ✓ The action associated to a reference level may range from just recording the value to intervention.

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- **REFERENCE LEVELS**
  - ✓ **Recording level (RL)**
  - ✓ **Investigation level (IL)**
  - ✓ **Action level (AL)**

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- **RECORDING LEVEL**

  - ✓ Value of effective dose, equivalent dose, personal dose equivalent, committed effective dose, intake or detected activity above which a result should be retained
  - ✓ A result smaller than the recording level may be discarded and treated as zero
  - ✓ Discarding low doses may not help motivate the worker and the management to improve radiation protection and strive for lower exposure of the individual.
  - ✓ So, it may be useful to record all doses above the limit of detection,
    - However unrealistic attention should not be given to exposures which result in very small.
    - Therefore, it is suggested that the recording level is taken as the detection threshold of the dosimetry system

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- **RECORDING LEVEL**

ISO 20553 Radiation Protection – Monitoring of workers occupationally exposed to a risk of internal contamination with radioactive material:

- ✓ *Recording Level (RL) is the level of dose, exposure or intake (specified by the employer or the regulatory authority) at or above which values of dose, exposure or intake received by workers are to be entered in their individual exposure record.*
- ✓ *A dose assessment above the recording level has to be recorded, lower values being ignored .*
- ✓ *The recording level shall be set at a value corresponding (having regards to the length of the monitoring interval) to an annual dose no higher than 5% of the annual dose limit.*
- ✓ *Results falling below RL may be shown as "below recording level"*

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- **INVESTIGATION LEVEL**

ISO 20553 Radiation Protection – Monitoring of workers occupationally exposed to a risk of internal contamination with radioactive material:

- ✓ *Investigation level is the level of dose, exposure or intake (specified by the employer or the regulatory authority) at or above which an investigation is conducted in order to reduce the uncertainty associated with the dose assessment.*

- ✓ *The investigation level shall be set at a value corresponding to an annual dose no higher than 30% of the annual dose limit*

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- **ACTION LEVEL**

  - ✓ Level that for remedial or protective action.
  - ✓ Applies to chronic exposure or emergency exposure situations.
  - ✓ Action levels often serve to protect the public.
  - ✓ Have occupational exposure relevance in chronic exposure situations.
  - ✓ Particularly relevant to workplace radon exposure.

Individual Monitoring Service

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **INDIVIDUAL MONITORING SERVICE (IMS)**
  - ✓ Individual monitoring is carried out by an IMS.
  - ✓ IMS may be:
    - Component of licensee organization,
    - Commercial dosimetry service,
    - Service provided by regulatory authority, or
    - Service shared jointly by multiple licensees

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- **INDIVIDUAL MONITORING SERVICE (IMS)**
  - ✓ Several factors effect IMS selection:
    - Scope of radiation protection programme,
    - Number of workers to be monitored,
    - Financial resources,
    - Available IMS outside resources
  - ✓ Example of a small practice using commercial service is a dentist office

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **OBJECTIVES OF INDIVIDUAL MONITORING SERVICE (IMS)**
  - ✓ Supply customers with appropriate dose determination techniques :
    - with a high degree of reliability
    - with adequate accuracy; and
    - at an acceptable cost
  - ✓ Provide results within a reasonable timescale
  - ✓ Store the results in a secure dose record keeping system

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- **ELEMENTS OF AN INDIVIDUAL MONITORING SERVICE (IMS)**

  - ✓ System for unique sample identification
  - ✓ Facilities for assessment of intakes
  - ✓ An administrative system which includes a database containing details of customers
  - ✓ A secure dose record keeping system suitable for preserving and updating records for individual users
  - ✓ Means for ensuring calibration traceability

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- **IMS - BASIC ORGANISATIONAL STRUCTURE OF IMS**
  - ✓ Routine dosimetry.
  - ✓ Administration and finances.
  - ✓ Calibration section.
  - ✓ Record keeping.
  - ✓ Quality Management System

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- **IMS - BASIC ORGANISATIONAL STRUCTURE**
  - ✓ Desirable to have a capability for investigation, development and research
  - ✓ Mailing center
  - ✓ Workshop
  - ✓ Customer relations section

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- **IMS – MANAGEMENT, ORGANISATION, AND ADMINISTRATION**

  - ✓ Related to national legislation and are obviously dependent on local circumstances
  - ✓ Number of measurements to be carried out
  - ✓ Number of customers served

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- **SEQUENCE OF AN IMS SERVICE ORDER**
  - ✓ Receipt of an order from a customer
  - ✓ Preparation of an invoice for the service and the offer of a contract giving details of the service and the terms and conditions involved
  - ✓ Receipt of payment from the customer (if applicable)
  - ✓ Registration of the customer and employees into the system and the record keeping system
  - ✓ Preparation of the sample containers to be supplied for each issue period
  - ✓ Sample container dispatch to the customer

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- **SEQUENCE OF AN IMS SERVICE ORDER (cont.)**
  - ✓ Sample return to the IMS by the customer at the end of the wear period
  - ✓ Sample evaluation within the time scale prescribed by regulators
  - ✓ Entry of the sample analysis results in the data base
  - ✓ Report of the results to the customer and, if required, to the regulators or their appointees, within the timescale laid down by the regulators.
  - ✓ Issue of a Termination Report.
  - ✓ Storage of personnel dosimetry records in a form approved by and for the time required by the regulators.

Customer Related Issues

- **Customer Related Issues**

  - ✓ Several operational issues need to be resolved and agreed with the “customer”
  - ✓ Customers are organizational elements that require dosimetry services
    - Individuals within the dosimetry service
    - Other sections within the dosimetry service organization
    - Other organizations under the same employer
    - Outside companies or employers

DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

- **Customer Related Issues**
  - ✓ Radionuclides to be assayed
  - ✓ Monitoring interval
  - ✓ Measurement or analytical method(s) to be used
  - ✓ System of identification for those to be monitored
  - ✓ Dose record keeping
  - ✓ Reporting of results
  - ✓ Accessibility, privacy

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- **Customer Related Issues**
  - ✓ Interpretation of results
    - quantities
    - dose limits
    - natural background
    - net dose
    - lower- and upper limits of detection
  - ✓ Information needed from the customer

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- **Customer Related Issues**
  - ✓ Fee for service
  - ✓ Immediate reporting in case of unusually high doses (Telephone, Email, …)
  - ✓ Emergency processing
  - ✓ Technical, scientific, legal advice and/or assistance (when and how to deal with authorities)

REFERENCES – UNIT 1 - DESIGNING A PROGRAMME FOR MONITORING OCCUPATIONAL EXPOSURE

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