CENTRE FOR ENERGY RESEARCH AND TRAINING
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Lecture on
Radiation Protection Basic Principles

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To

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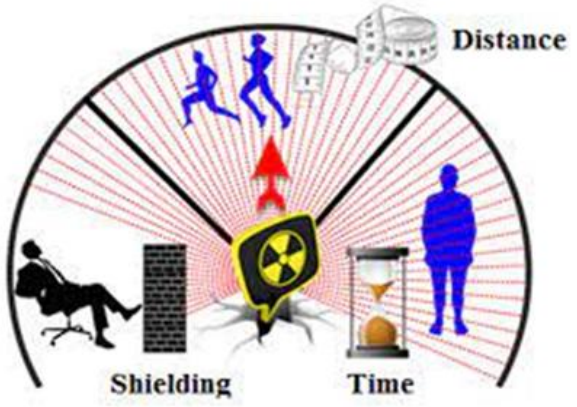
Introduction

Radiation Protection Basic principles

- Different from Safety measures, basic safety principles or basics method of radiation protection.
- Are Fundamental Principles



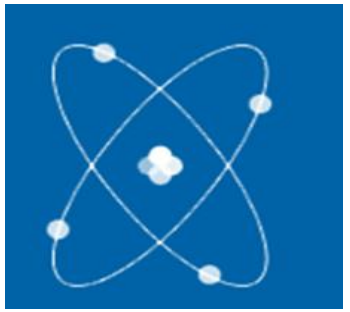
What is Radiation protection

- Is referred to Radiological Protection.
- To prevent the occurrence of deterministic effects and limit the Stochastic effects to level deemed acceptable
- The protection of people from harmful effects of exposure to ionizing radiation, and the means for achieving this.
- House Safety and security of radiation sources meaning they are interrelated.

Sponsored Organizations

- Radiation Protection Principles and Safety of Radiation Sources are contained in the International Basic Safety Standards.
- Jointly sponsored by EC, FAO, IAEA, ILO, OECD/NEA,PAHO, UNEP and WHO.
- 12th September 2021, safety standards referred to as standard of the IAEA.
- Apply international agreed standards.
- Provide a practical guide to radiation workers.

Sponsored Organizations (Cont.)



- Are use in activities assisted or supported by IAEA
- The aim of the standards is to
  - Control radiation exposure of workers, medical patients, the public and the environment
  - Prevent the occurrence of short term effects from high radiation doses and
  - Minimize the risk of long term effects
- Provides every nation with the basic requirements for radiation protection.

Basic Requirement and Objective for Radiation Protection

- Are governed by the
  - Objectives,
  - Concepts and
  - Principles of the Fundamental Safety Standard.

- The Objective of radiation protection
  - is to protect people and the environment from harmful effects of ionizing radiation and that this objective must be achieved without unduly limiting the operation of facilities or the conduct of activities that give rise to radiation risks.

The Aim of Radiation Protection

- To provide an appropriate standard of protection for man and the environment with out unduly limiting the beneficial practices giving rise to exposure.

- Beneficial Practices? Any human activity that.
  - Introduce additional source of exposure.
  - Extend exposure to additional people.
  - Modifies the network of exposure pathways from the existing sources.

Exposures Situations of Concern

Three types exist.

- Planned Exposure Situations
  - Involving planned introduction and operation of sources (including decommissioning, disposal and rehabilitation)
- Emergency Exposure situations
  - Unexpected situations form planned situation or
  - malicious act requiring urgent attention
- Existing exposure situations
  - Already exited of which a decision on control has to be taken e.g Natural background radiation and residues from past practices operated outside the system

The Categories of Exposure

- Occupation exposure.
  - Exposure incurred as a result of work.
- Public exposure.
  - Individual exposure other than occupational exposure and medical exposure.
- Medical exposure.
  - Exposure of patient as part of medical diagnosis or treatment.
  - Persons affected include volunteers helping to support or comfort patient and biomedical research volunteers.

The Fundamental Safety Standards

- Draw upon information derived from the experience of States in applying the requirements of the BSS of 1996,
- From experience in the use of radiation and nuclear techniques.
- Also form results of extensive research and development work by national and international scientific and engineering organizations on the health effects of radiation exposure and on measures and techniques for the safe design and use of radiation sources.

The Fundamental Safety Standards (Cont.)

- Take account of the findings of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and the recommendations of the International Commission on Radiological Protection (ICRP).
- And address the use of value judgements relating to the management of risks.
- Consists the Safety Fundamentals principles, the Safety Requirements and the Safety Guides.

The Fundamental Safety Principles

- Ten (10) principles on which the IAEA Standards are based on for radiation protection.
- Principle 1: Responsibility for safety
  - The prime responsibility for safety must rest with the person or Organization responsible for facilities and activities that give rise to radiation risks.
- Principle 2: Role of government
  - An effective legal and governmental framework for safety, including an independent regulatory body.
  - Must be established and sustained.

The Fundamental Safety Principles (Cont.)

- Principle 3: Leadership and management for safety
  - Effective leadership and management for safety must be established and sustained in organizations concerned with, and facilities and activities that give rise to radiation risks.
- Principle 4: Justification of facilities and activities
  - Facilities and activities that give rise to radiation risks must yield an overall benefit.
- Principle 5: Optimization of protection
  - Protection must be optimized to provide the highest level of safety that can reasonably be achieved.

The Fundamental Safety Principles (Cont.)

- Principle 6: Limitation of risks to individuals.
  - Measures for controlling radiation risks must ensure that no individual bears an unacceptable risk of harm.
- Principle 7: Protection of present and future generations.
  - People and the environment, present and future, must be protected against radiation risks.
- Principle 8: Prevention of accidents.
  - All practical efforts must be made to prevent and mitigate nuclear or radiation accidents.

The Fundamental Safety Principles (Cont.)

- Principle 9: Emergency preparedness and response.
  - Arrangements must be made for emergency preparedness and response for nuclear or radiation incidents.
- Principle 10: Protective actions to reduce existing or unregulated radiation risks
  - Protective actions to reduce existing or unregulated radiation risks must be justified and optimized.

The Fundamental Safety Principles (Cont.)

- The three general principles, which is the basic principles of radiation protection from the hazard of Ionizing radiation are summarized as,
- **Justification,**
- **Optimization of protection and**
- **Application of dose limits,**
- which are expressed in Safety Principles 4, 5, 6 and also 10.

Justification

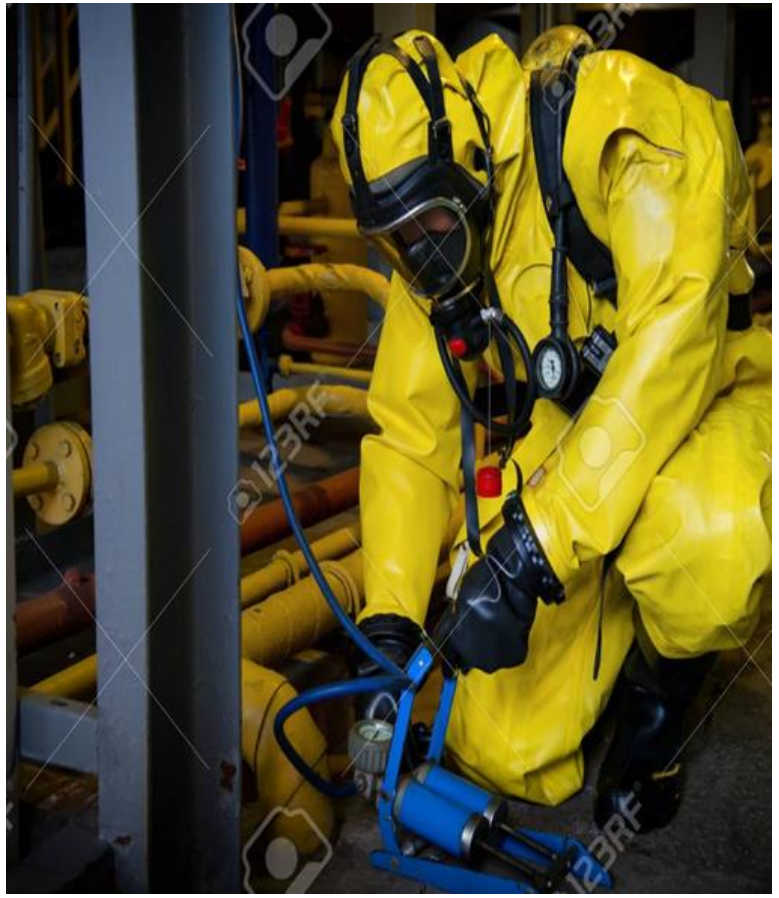
- Employers, registrants and Licensees should ensure that the practice or use of radiation must be justified.
- The advantages of usage should be greater than the disadvantage.
- The decision for radiation exposure should do more good than harm
- It applies to all the three exposure scenarios/ situations

Optimization

- Employers, registrants and licensees
  - Shall involve workers, through their representatives where appropriate, in optimization of protection and safety;
  - Shall establish and use, as appropriate, constraints as part of optimization of protection and safety.
- The process of optimization should take account of:
  - The resources available for protection, safety and security;
  - The distributions of individual exposure and collective exposure in different groups of workers;

Optimization

- The probability and magnitude of potential exposure;
- The potential impact of actions for the purposes of radiation protection on the level of other (non-radiological) risks to workers or to members of the public;
- Good practices in relevant sectors;
- Societal and economic aspects.



Dose limits

For occupational exposure of workers over the age of 18 years, the dose limits are:

- An effective dose of 20 mSv per year averaged over five consecutive years (100 mSv in 5 years) and of 50 mSv in any single year;
- An equivalent dose to the lens of the eye of 20 mSv per year averaged over five consecutive years (100 mSv in 5 years) and of 50 mSv in any single year;
- An equivalent dose to the extremities (hands and feet) or to the skin of 500 mSv in a year

Dose limits (Cont.)

For occupational exposure of apprentices of 16 to 18 years of age who are being trained for employment involving radiation and

for exposure of students of age 16 to 18 who use sources in the course of their studies, the dose limits are:

- An effective dose of 6 mSv in a year;
- An equivalent dose to the lens of the eye of 20 mSv in a year;
- An equivalent dose to the extremities (hands and feet) or to the skin of 150 mSv in a year

Dose limits (Cont.)

- The general approach to the application of the dose limits can be summarized
- the exposure of an individual worker should be controlled so that the effective dose does not exceed 20 mSv in a year.
- This includes the external dose as well as the internal dose received by the worker during the period.
- Where the exposure of an individual worker results in an effective dose exceeding 20 mSv in a year but within the dose limit of 50 mSv, the management should do the following, as appropriate:

Dose limits (Cont.)

- Carry out a review of exposure to determine whether exposures were as low as reasonably achievable and, where appropriate, to take the necessary corrective action
- Consider ways to restrict further exposures of the individual worker to ensure that the effective dose over the chosen five years averaging period is less than 100 mSv;
- Notify the regulatory body of the magnitude of the dose and the circumstances leading to the exposure

The Regulatory Responsibilities

The Regulatory body have the following responsibilities

- Shall establish requirements for the application of principles of radiation protection for the exposure situation
- Shall establish or adopt regulations and guides for protection, safety and security

The Regulatory Responsibilities (Cont.)

- Shall adapt a graded approach to the implementation of the system of protection, safety and security such that the application of regulatory requirements is inline with the radiation risks associated with the exposure

- Shall ensure the application of the requirements for education and training of all persons engaged in activities relevant to protection

The Regulatory Responsibilities of Regulatory (Cont.)

- Shall establish regulatory system to include
  - Notification and authorization
  - Review and assessment of facilities and activities
  - Inspection of facilities and activities
  - Enforcement of regulatory requirements
  - The regulatory functions relevant to emergency exposure scenario
  - Provision for information to and consultation with parties affected by its decisions and as appropriate the public and other interested parties


Thank You!