**Viva assignment Radiation Protection**

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**Q1 :**

# **Ans : Role of the Radiation Protection Officer**

A Radiation Protection Officer (RPO) is a specialist in radiation safety and compliance matters and is an appointed position within University Health and Safety Services.
The role of the RPO is to support the University’s work with ionising radiations by ensuring arrangements are in place to manage radiation risks, so that work is carried out safely and in compliance with Regulations and so that University employees and the public are protected from harmful effects.

The role involves:

1. Acting as the point of contact within the University for the external Radiation Protection Adviser (RPA).

2. Acting as the point of contact within the University for Regulators relevant to ionising radiations compliance i.e. the Environment Agency (EA) and the Health and Safety Executive.

3. Preparing periodic status reports on radiation safety and management for purposes of University governance.

4. Managing Environment Agency Permits including:
• Make application for new or variation to existing EA Permits.
• Manage the collation of waste records and make Pollution Inventory returns to EA on behalf of the University.
• Advise on the use of Exemptions under the Environmental Permitting Regulations 2011.
• Advise on routes of radioactive waste disposal.

5. Monitoring site activity against Environment Agency Permit conditions; including
• Expert inspection and auditing of storage and disposal facilities.
• Auditing holdings and usage records.
• Auditing waste accumulation in stores.
• Performing waste sampling when required by the Regulator.
• Performing measurements to check radiation doses, dose rates and activity.

6. Arranging for disposal of radioactive waste to authorised contractors.

7. Managing the security of radioactive sources according to current national requirements and carry out periodic security audits.

8. Managing facility or site decommissioning.

9. Applying and managing maintenance of a Best Practicable Means (BPM) culture in management and operations including :.
• Advising on design standards for laboratories and designation of areas.
• Providing site specific information to the RPA (for BPM, risk assessments etc.).
• Contributing to the production of local rules and local radiation safety policy.
• Assessing that BPM is being applied.
• Advising Radiation Protection Supervisors.

10. Managing a system for the provision of personal dosimetry and associated record-keeping.

11. Advising on selection of monitoring equipment and manage a system for the periodic calibration of radiation and contamination monitors and associated record-keeping.

12. Managing an inventory of equipment capable of emitting x-rays.

13. Investigating incidents and report incidents when appropriate to the relevant regulatory authority.

14. Advising on training in radiation safety.

**Q2 :**

**Ans :** The two sources of ionizing radiation to which everyone is exposed are natural environmental or background radiation and ) human-made radiation. Examples of natural environmental or **background radiation** include cosmic radiation from the sun and stars; radioactive elements in the earth, such as uranium, radium, and thorium; and radioactive substances such as radiopotassium and radiocarbon, which are found in foods, drinking water, and the air. The amount of radiation that we receive from our natural environment depends to a great extent on where we live. One area of India has a high intensity of background radioactivity that gives the population 10 times more radiation than the average background radiation dose in the United States. People who live in high-altitude areas receive more cosmic radiation than those living in low-altitude areas; for example, the population in and around mile-high Denver receives more radiation than populations in or near sea-level coastal areas. Although background radiation varies from place to place, it accounts for more than one half of the exposure that the general public receives. Radiation has existed since time began. Diseases resulting from excessive radiation are not new either. The same kinds of harmful effects that radiation causes can also be caused by other agents, such as certain chemicals.

**Human-made radiation** sources include fallout from nuclear weapons testing and effluents from nuclear power plants, radioactive materials used in industry, and medical and dental x-ray exposures. The use of medical and dental radiographs and radioactive materials to diagnose and treat disease accounts for 90% of the general public’s exposure to human-made radiation.

The possibility of radiation-induced injury was reported shortly after Roentgen’s discovery of x-rays in 1895. Since then, research, advanced technology, and the communications media have made society increasingly aware of the possible harmful effects of radiation; this awareness has lead to a belief that patient exposure to ionizing radiation must be kept to a minimum while obtaining optimal diagnostic information for the radiologist. Understanding the characteristics of x-radiation, its biologic effects, and the methods of reducing patient and operator exposure is the responsibility of the radiologic technologist.

### **Radiation Measurements**

As awareness of the possible dangers of x-ray use increased, establishing a method of measuring its use became necessary. In the early days, persons who worked with x-rays used a unit of measure called the **erythema dose.** This unit was the amount of radiation required to turn the skin red, and its name was derived from the term erythema, which means redness of the skin. However, the erythema dose lacked preciseness and accuracy. A reliable instrument that measured the amount of ionization in gases was later developed, and the accuracy of this instrument allowed for the establishment of the unit of measurement known as the **roentgen**. This unit is the amount of ionizing radiation that produces, in 1 cubic centimeter of air, ions that carry 1 electrostatic unit of quantity of electricity of either positive or negative charge. The unit was named after the discoverer of x-rays, Wilhelm Conrad Roentgen. In 1938, the roentgen was adopted as the international standard measure of ionization in air. In 1956, another unit, called the **radiation absorbed dose**(rad), was established to measure the amount of radiation absorbed by a medium.

For introductory purposes, the long history of measurement standards and regulation, a brief overview of the National Council on Radiation Protection and Measurements, and the names and functions of other consumer protection agencies are presented.

Units of measurement are known as the roentgen (written as R in calculations), the rad, the **roentgen-equivalent-man**(rem), and the **curie** (Ci); the quantities associated with these units are exposure, absorbed dose, dose equivalent, and activity, respectively. The roentgen is a unit of exposure for x-rays and gamma rays. The rad is a unit of absorbed dose of any type of radiation. The rem is a unit that measures the biologic effect of x, alpha, beta, and gamma radiation on humans. The International System of Units (SI) uses coulomb\*/kilogram (C/kg) in place of roentgen, gray (Gy) instead of rad, and sievert (Sv) rather than rem. For radiation protection from x and gamma radiation, 1 roentgen (C/kg) approximately equals 1 rad (Gy) or 1 rem (Sv). The Ci measures the

**Q3 :**

**Ans :** Exposure to very high levels of radiation, such as being close to an atomic blast, can cause acute health effects such as skin burns and acute radiation syndrome (“radiation sickness"). It can also result in long-term health effects such as cancer and cardiovascular disease .

Ultraviolet (UV) radiation is a known cause of skin cancer, skin ageing,

eye damage, and may affect the immune system.

People who work outdoors are the most likely of all workers to suffer

health damage from exposure to UV radiation. Other people may be

exposed to UV radiation at work from non-solar sources such as arc

welding, the curing of paints, inks etc and the disinfection of equipment in

hospitals and laboratories amongst others

In relation to non-solar sources of UV radiation, well designed engineering

and administrative controls and in the case of arc welders, personal

protective equipment can keep the risks to a minimum.

However with outdoor workers who are regularly exposed to the sun for

long periods of time, a more comprehensive strategy is required to

minimize risks. This is because the sun (exposure source) cannot be

controlled like other workplace exposure hazards.

Factors that affect UV radiation include the following;

• Sun elevation: The higher the sun in the sky, the more intense the UV

radiation. Therefore the UV radiation levels are highest around solar

noon and in summer

• Latitude: The closer to equatorial regions, the higher the UV radiation

levels.

• Cloud cover: Solar UVR can penetrate through light cloud cover, and

on lightly overcast days the UV radiation intensity can be similar to

that of a cloud-free day. Heavy cloud can reduce the intensity of UV

radiation. Scattered cloud has a variable effect on UV radiation levels,

which rise and fall as clouds pass in front of the sun.

• Altitude: At higher altitudes, the atmosphere is thinner and absorbs

less UV radiation.

• Ozone: Ozone absorbs some of the UV radiation that would otherwise

reach the Earth's surface.

• Ground reflection: Grass, soil and water reflect less than 10% of UV

radiation; fresh snow reflects as much as 80%; dry beach sand about

15% and sea foam about 25%.

As UV radiation can neither be seen nor felt, it is important therefore that

workers who have the potential to be exposed to intense levels of UV

radiation are aware of the risks and are regularly reminded to take

prompt, appropriate protective action.

**Q4 :**

**Ans :** In determining whether the guidance from the North Atlantic Treaty Organization embodied in the Allied Command Europe (ACE) Directive adequately follows generally accepted practices of radiation protection, the committee first reviewed standard practice. The international basis of radiation protection practice has been developed explicitly by the International Commission on Radiological Protection (ICRP). This has been considered and adapted for use in the United States by the National Council on Radiation Protection and Measurements. On the basis of their own needs and the recommendations of these organizations, various federal agencies, such as the U.S. Nuclear Regulatory Commission and the Environmental Protection Agency, have developed and continue to develop specific implementing regulations.

In this section, the committee summarizes current radiation protection philosophy and procedure in the United States. Later, in [Chapter 5](https://www.ncbi.nlm.nih.gov/books/n/nap9454/ddd00074/?report=reader), this will be a yardstick against which the ACE Directive is compared.

 The philosophy of radiation protection and the practices that ensure radiation safety must include social as well as scientific judgments to provide an appropriate standard of protection without unduly limiting military operations. The overall goal of radiation protection, regardless of the specifics of the situation that leads to exposure, is to prevent the occurrence of acute effects (e.g., cataracts, radiation burns, and acute radiation sickness) and to ensure that all reasonable steps are taken to reduce the potential long-term effects, such as cancea), to a level that is acceptable to society. The methods applied to achieve that aim will vary, depending upon the radiation exposure scenario. The two types of exposure scenarios addressed here are ractices (routine and potential) and interventions.

The first of these, a *practice,*is an intentional activity in which the practitioner is routinely at risk of exposure. Workers who are exposed to radiation during the course of their duties include, for example, x-ray technicians in hospitals, nuclear power plant workers, and researchers who use radioactive materials. The practices in which they engage include taking x rays of patients, maintaining a nuclear reactor (or nuclear electric generating station), or taking measurements using radioactive sources. These occupationally exposed individuals are trained to appreciate the hazards of radiation, to acknowledge those risks as a condition of employment, and to follow safety precautions to minimize their exposure.

Any practice may involve exposures that do not routinely occur (e.g., accidents). If these have not yet happened, they are called *potential exposures.*Both the probability that such events will happen and the magnitude of the expected radiation doses can be calculated in the planning of responses. These also should be considered in the introduction and management of new practices. If an accident actually happens, *interventions*are taken to reduce exposure.

An *intervention*is an action that one takes to reduce radiation exposure (often to other individuals or groups) from specific radiation sources .

1.

reducing or removing the existing sources,

2.

improving the reliability of the existing sources,

3.

modifying pathways, or

4.

reducing the number of exposed individuals.

An example of an intervention is the response of the firefighters who fought to control the fire during the Chernobyl nuclear reactor accident. Often, an intervention is associated with an emergency action.

To distinguish practice from intervention, it is helpful to consider that, prior to the accident, the Chernobyl workers were engaged in a practice—production of electric power. The workers in the plant were operating under a radiation protection program required for a practice, which included management's option of discontinuing or changing the practice to eliminate or reduce the level of radiation exposure. The firefighters who responded after the accident were operating under different rules and exposure criteria: those intended for an intervention situation.

 **THE END**