

Radiation Quiz



QUESTION

What are the three principal actions that minimize exposure to radiation'

ANSWER

Reduction of radiation exposure by:

1. Time

- Limit or minimize exposure time reduces the dose from the radiation source.

1. Distance

- The dose of radiation decreases dramatically as one increases the distance from radiation source.

1. Shielding

- Inserting the proper shield between you and a radiation source will greatly reduce/eliminate the dose one receives.

WHY IS IT RIGHT

WHAT IS RADIATION'

Radiation or Electromagnetic Radiation (EMR), is energy in a wave form. An Electromagnetic Field (EMF) is made up of an electric field and a magnetic field. EMFs occur naturally and also come from sources created by human activity. Natural EMFs

comes from sources such as the earth's own magnetic field, electrical storms, the sun and even the body's own essential electric activity. Manufactured EMFs, come from overhead power lines, electric wiring in buildings, radio towers, and laser tools. It is these that are of more concern. EMR can be either ionizing or non-ionizing.

DANGER

Ionizing radiation is high frequency and high- energy and can penetrate the body – it has enough energy to break up atoms and molecules as it passes through the body (ie, it can cause ionization).

WHERE DOES RADIATION OCCURS

Ionizing radiation occurs as either electromagnetic rays (X-rays and gamma rays) or particles (such alpha and beta particles).

- Alpha particles can be easily stopped (energy absorbed) by a piece of paper.
- Beta particles can penetrate one or two centimeters of human tissue – but can be stopped by glass or metal.
- Gamma rays and X-rays are waves of energy similar to visible light; except they have more energy and are invisible. They travel at the speed of light and penetrate matter more easily. They can be screened by lead, concrete or water.

WHERE IS RADIATION FOUND

Most ionizing radiation in industry is due to X-rays.

Equipment which emits X-rays can be found in:

- Medical and dental diagnostic and therapeutic radiography;
- Industrial radiography for detection of faults in welding or metal castings;

- Testing instruments such as thickness gauges in sheet metal, plastic and paper production.

Gamma radiation is used in the sterilization of medical and surgical equipment. Radioactive isotopes are used in the mineral industry, in analytical laboratories, in diagnostic pathology and in research.

PREVENTION

- a. Time, distance, and shielding actions minimizes exposure to radiation in much the same way as they would to protect you against overexposure to the sun:

Reduce Radiation Exposure by:

Time: For people who are exposed to radiation in addition to natural background radiation, limiting or minimizing the exposure time reduces the dose from the radiation source.

Distance: Just as the heat from a fire reduces as you move further away, the dose of radiation decreases dramatically as you increase your distance from the source.

Shielding: Barriers of lead, concrete, or water provide protection from penetrating. This is why certain radioactive materials are stored under water or in concrete or lead-lined rooms, and why dentists place a lead blanket on patients receiving x-rays of their teeth. Therefore, inserting the proper shield between you and a radiation source will greatly reduce or eliminate the dose you receive.

- b. IONIZING RADIATION can prove to be deadly, if not properly controlled and monitored. This workplace hazard must be handled with the following procedures and processes.

1. HAZARD IDENTIFICATION

- Ensure your employer identifies any sources of ionizing

radiation and undertakes monitoring.

- Ensure your employer monitors all workers who may be exposed to ionizing radiation using a dosimeter, which is worn as a badge attached to clothing. At monthly intervals the dosimeter should be sent to a laboratory where the radiation exposure can be read.
- Your employer will need to employ someone with the relevant expertise to do this. The employer has a duty to employ or engage someone who is 'suitably qualified.
- Talk to members of your work group about the hazards of radiation and their control, and any effects they may be experiencing on a regular basis.
- Investigate any past incidents.

1. **RISK ASSESSMENT**

- Ensure the employer assesses results of monitoring – keep a check on results.
- Ensure your employer has an effective incident reporting procedure in place to record actual and potential exposure to radiation, unsafe conditions, and workers.

1. **RISK CONTROL**

The best way to reduce the risk of exposure to non- ionizing radiation is to eliminate the source of exposure. If that's not possible, there are other **RISK CONTROLS** to use which will be identified in your exposure control plan.

Engineering

Making physical modifications to facilities, equipment, and processes can reduce exposure.

Some questions to consider:

- Can guards or barriers be used to restrict access to high exposure areas'
- Can antennas be raised so they are above the working level of the roof'

- Can shields be erected to eliminate nearby workers from exposure'

Administrative

Changing work practices and work policies, and using awareness tools, and training, can limit the risk of non-ionizing radiation exposure. Some questions to consider:

- Can the equipment be turned off to do work around it'
- Is access to communication and data transmitting equipment secured or restricted'
- Can warning signs be posted to indicate high radiation areas'
- Can the amount of time workers spend near the antenna be limited'
- Can a notification system be set up to alert contractors when an antenna is present'
- Is a UV protection program in place'

Personal protective equipment

This is the least preferred control. It must always be used in addition to at least one other control. Some questions to consider:

- Do workers have the proper eyewear and protective clothing'
- Has personal protective equipment been verified to ensure it is working properly'
- Is sunscreen provided'

1. ADDITIONAL RISK REDUCTION CONTROLS

Ensure your employer controls the risks of radiation following the preferred order of control methods:

- Takes all measures possible to avoid exposure.
- Isolates all sources of radiation by shielding, containment or remote handling.

- Maintains all radiation generating equipment in order to minimize radiation emitted and prevent any 'leakages'.
- Develops safe practices work practices and procedures, and ensures they are followed.
- Provides suitable protective clothing and administrative controls, including job rotation and rest breaks, to limit the amount of time employees are exposed, where engineering controls are unavailable or ineffective to reduce exposure levels.
- Provides adequate information and training on any radiation hazards in the workplace. Training should include information on the sources of the radiation, the health effects, the control procedures in place and how they are monitored, safe work practices, personal protective equipment (PPE), emergency procedures and radiation monitoring programs where appropriate.
- Maintain all controls implemented.
- Develops back up option emergency procedures in the case of control measures failure.

WHY IS EVERYTHING ELSE WRONG

WORLD HEALTH ORGANIZATION

According to the World Health Organization, 'Radiation can impair the functioning of tissues and/or organs and can produce acute effects such as skin redness, hair loss, radiation burns, or acute radiation syndrome. These effects are more severe at higher doses and higher dose rates'.

When workers are exposed to extended, intense, or repeated doses of radiation beyond the regulated limit, this can cause radiation poison or sickness, which can lead to permanent disability or death.

COMPANIES/BUSINESS RESPONSIBILITY

Radiation Dosimetry Programs

Companies must implement controls to ensure that employee exposure does not exceed the exposure limit set by their country's regulators. **These controls can include monitoring activities, training, signage, and protective equipment, but let's focus on another key control: implementing a radiation dosimetry program.** Dosimetry refers to measuring, calculating, and assessing radiation absorbed by humans, and dosimeters are devices used to measure an absorbed dose of radiation.

Many organizations implement dosimetry programs where they provide employees with dosimeter badges, and employees are mandated to attach these badges onto their uniform while they work. These badges are removed periodically and sent to a lab where they analyze the amount of radiation that an employee has been exposed to. Companies can then use this data and identify whether their controls are effective or if corrective actions are required. Organizations can also use direct-reading dosimeters that do not require laboratory analysis, which is typically the case for employees who work at nuclear power plants.

EXPOSURE TO RADIATION

Exposure to radiation can affect employees' health in different ways. Exposure to radiation can affect the cells of the body and either damage or destroy them. The effects can be 'acute,' meaning that they show up soon after exposure, or they can be 'chronic,' which means they may appear years after exposure. Acute effects of exposures to radiation may include reddening of the skin, hair loss, nausea, vomiting, diarrhea, weakness, and even death if the dose is very high. Chronic effects include various kinds of cancer and damage to bone marrow or nervous system cells.

Women who are pregnant have to be especially careful when working around radiation. Prenatal doses of radiation can affect the growth of a fetus, including brain size, and could cause mental retardation or childhood cancers.

OTHER HEALTH EFFECTS

Health Effects of Exposure to IONIZING

When radiation is absorbed in the body it causes chemical reactions to occur which can alter the normal functions of the body. At high doses this can result in massive cell death, organ damage and even death. At low doses the situation is more complex.

It is well documented in the public domain that the human body is composed of brain cells, muscle cells, blood cells etc. Ionizing radiation affects the tissues of the body.

Low doses of radiation can damage the genes. The following are harmful effects:

- **RADIATION SICKNESS**

When the body is exposed to large doses of ionizing radiation over a short period, for example as a result of a radiation accident ' can lead to severe massive cell destruction and death of the person. This can occur very quickly, or over a longer period of time if the dose was smaller.

Symptoms include nausea and vomiting, loss of hair, inflammation of the mouth and throat.

- **CANCER:**

A cell damaged by ionizing radiation can lose its ability to control the rate at which it reproduces – this is cancer. Radiation at low doses can have this effect. The most common radiation induced cancers are leukemia, skin tumors and thyroid cancer, though tumors in various other organs can also occur.

- **GENETIC DEFECTS & REPRODUCTIVE TOXICITY:**

If an unborn child is exposed to ionizing radiation, then the chances that of the child then developing childhood cancer

(especially leukemia) are greater. Changes to basic cell structures (mutations) of reproductive cells (ova or sperm) can lead to miscarriages and birth defects.

- **CATARACTS:**

Clouding of the lens of the eye, eventually leading to blindness.

- **BLOOD CHANGES:**

Effects on the production of bone marrow resulting in a reduction of white blood cells and a less effective immunity system to fight infections

- **NERVOUS SYSTEM EFFECTS:**

Alteration of the electrical activity of the brain resulting in headache, fatigue, dizziness, changes in behavior.

- **CARDIO-VASCULAR EFFECTS:**

Altered blood pressure; altered electrical activity of the heart.

EMPLOYERS RESPONSIBILITY

OSHA mandates employers to protect workers who may be exposed to radiation on the job. The regulations require employers to:

- Limit employee exposures to radiation.
- Supply appropriate personal monitoring equipment to employees at risk.
- Restrict entry to radiation areas and post warning signs.
- Label containers of radioactive materials and store them properly.
- Inspect and test systems that produce radiation.
- Dispose of radioactive wastes properly.
- Have signals to warn employees of accidental releases of radiation.

- Immediately report any incidents to OSHA.

WORKER RESPONSIBILITY

Exposure to Radiation

Workers can be exposed to radiation on a daily basis, most of it in very small doses; however, if you are working in a job where exposure is a risk (dental office, x-ray clinic, airport, etc.) you should have a dosimeter and be measuring your exposure over time. Radiation poisoning can lead to very serious effects like cancer, organ failure, or death.

Here is a list of some common everyday things that emit radiation.

1. **Hand-held lasers and laser pointers**
2. **Airport full-body scanners**
3. **Tanning beds and lamps**
4. **Smart meters**
5. **Power lines and electrical appliances**
6. **Wi-Fi**
7. **Compact fluorescent lamps**
8. **Wind turbines**
9. **Cell phones and cell phone towers**
10. **Personal stereo systems**
11. **Airplanes**
12. **Microwave ovens**

Acute Radiation Syndrome (ARS) (sometimes known as radiation toxicity or radiation sickness) is an acute illness caused by irradiation of the entire body (or most of the body) by a high dose of penetrating radiation in a very short period of time (usually a matter of minutes). Examples of people who suffered from ARS are the survivors of the Hiroshima and Nagasaki atomic bombs, the firefighters that first responded after the Chernobyl Nuclear Power Plant event in 1986, and some unintentional exposures to sterilization irradiators.