

**Physical hazards :**

Physical hazards that employees in the workplace face include excessive levels of ionizing and nonionizing electromagnetic radiation, noise, vibration, illumination, and temperature.

***INTRODUCTION TO LIGHTING AND NON-IONISING RADIATION***

Electromagnetic waves are produced by the motion of electrically charged particles. These waves are also called "electromagnetic radiation" because they radiate from the electrically charged particles. They travel through empty space as well as through air and can penetrate some other substances. Radio waves, microwaves, visible light, and X-rays are all examples of electromagnetic waves.

As with sound energy, Electromagnetic Radiation can be described in terms of its frequency (or wavelength) and its intensity. The frequency (Hz) is inversely proportional to the wavelength (nm), so higher frequencies have shorter wavelengths:

The intensity (mW/cm<sup>2</sup>) is expressed in terms of the amount of energy incident upon a unit area. This intensity varies inversely as the square of the distance from the source. The electromagnetic spectrum covers a wide range of frequencies.

Visible light, infrared and microwaves are types of non-ionising radiation. X-rays and Gamma rays are examples of ionising radiation.

**Types of Non-Ionising Radiation****1- Ultraviolet (UV) Radiation**

UV is invisible radiation produced naturally by the sun (solar radiation) and artificially in industry via arcs (e.g. welding) operating at high temperatures.

UV radiation is readily absorbed by human tissue and therefore the eyes and skin are particularly vulnerable. The most common exposure is from the sun, which can produce sunburn, and in severe circumstances, blistering of the skin. Prolonged skin exposure can result in premature ageing and thickening (keratosis) of the skin. Most serious of all is skin cancer, which is now the most commonly diagnosed type of cancer. Melanoma, caused by damage to melanin cells in the skin, is the most serious form. By World Health Organisation estimates, 132,000 cases of malignant melanoma (66,000 deaths) and more than 2 million cases of other skin cancers occur annually. It is the most common cancer in the young population (20 – 39 age group) and it is estimated that approximately 85% of cases are caused by too much exposure to sunlight. This has implications for occupational exposure of outdoor workers, including gardeners and construction workers. Furthermore, exposure to some substances used at work, such as coal tar or cresols found in road tars, can make the skin exceptionally sensitive to the sun.

Excessive exposure of the eyes produces conjunctivitis, a delayed, painful irritation similar to having sand in the eye. Welders experience it as "arc eye" and a similar condition occurs in "snow-blindness". In the long term ocular damage can lead to cataract formation.

Ultraviolet radiation is subdivided into three bands of decreasing wavelength; UVA being the longest wavelength, UVC being the shortest and UVB being in the middle. The longer the wavelength the less energy is associated with the radiation and the less damage that it does to the body. e.g. UVA is the type of light used in "black lights" and is not responsible for skin cancer.

## 2. Infrared (IR) Radiation

IR radiation is emitted by hot bodies, e.g. furnaces and gas torches. Its primary effect is heating of surface tissues. Excessive exposure to radiant heat will produce immediate discomfort and therefore a suitable warning of impending damage is provided, usually before burning can occur. However, the eyes do not possess such an early warning mechanism and excessive exposure can result in lens damage and cataract formation; retinal damage can also occur.

## 3. Laser Radiation

The name laser is an acronym for 'Light Amplification by Stimulated Emission of Radiation'. Laser machines emit a concentrated beam of non-ionising radiation - of a single wavelength or a narrow wavelength band - in the visible and infrared region of the electromagnetic spectrum and are potentially hazardous, particularly to the eye, because they are of high intensity and the parallel rays may be focused to a point image by the eye. Damage ranges from repairable burns to permanent blindness. Cataract formation may also occur. Lasers have widespread use, e.g. in communications, construction, medical applications, research, surveying. Lasers have been classified by wavelength and maximum output power into four classes and a few subclasses

### Laser Classes

Class 1	Safe.
Class 1M	Safe provided optical instruments are not used.
Class 2	Visible lasers. Safe for accidental exposure.
Class 2M	Visible lasers. Safe for accidental exposure providing optical instruments are not used.
Class 3R	Not safe. Low risk.
Class 3B	Hazardous. Viewing of diffuse reflection is safe.
Class 4	Hazardous. Viewing of diffuse reflection is also hazardous. Fire risk.

#### 4. Microwave Radiation

Microwaves are produced by molecular vibration in solid bodies and are usually described by the wave frequency generated. Examples of microwave energy sources are transmitter antennae and medical applications. The primary effect on the body is thermal and indeed microwaves of certain frequencies have found employment as a means of rapidly cooking food. Microwaves are widely used in applications like wireless computing and mobile phone networks.

#### **IONISING RADIATION**

Ionising radiation refers to particles or electromagnetic radiation which have sufficient energy to affect atoms directly i.e. 'ionise' them, namely to create charged particles, or "ions", when they interact with matter. There are five different types of ionising radiation, namely alpha ( $\alpha$ ), beta ( $\beta$ ), neutrons (n), gamma ( $\gamma$ ), X-ray ( $\chi$ )

**Ionizing radiation** Electromagnetic or particulate radiation capable of producing ions, directly or indirectly, by interaction with matter.

#### **TYPES OF IONIZING RADIATION**

Radiation is a form of energy. Familiar forms of radiation energy include light (a form of radiation we can see) and infrared (a form of radiation we can feel as heat). Radio and television waves are forms of radiation that we can neither see nor feel.

The most commonly encountered types of ionizing radiation are alpha-, beta-, and neutron particles and x- or gamma-electromagnetic radiation.

#### **Effect of radiation :**

There are two points of view for consideration of the injurious effects of ionizing radiation: the somatic effects (injury to individuals) and the genetic effects, which are passed on to future generations. The degree of injury inflicted on an individual by radiation exposure depends on such factors as the total dose, the rate at which the dose is received, the kind of radiation, and the body part receiving it. Tissues such as the bone marrow, where blood cells are produced, the lining of the digestive tract, and some cells of the skin are more sensitive to radiation than those of bone, muscle, and nerve. The time between exposure and the first signs of radiation damage is called the latent period. It was found that the incidence of cancer and certain blood diseases was higher among radiologists than would be expected for a chance distribution in the population studied.

The pool of health experience data was obtained from the following sources:

- Early radiation workers
- Medical personnel who routinely administered radiation for diagnostic and therapeutic purposes
- Patients who were treated with radiation
- A group of workers who painted dials with luminous paints containing radium
- Studies of Japanese atomic bomb survivors

With data collected from these sources, it became apparent that exposure to ionizing radiation was associated with a higher than normal incidence of certain diseases such as skin, lung, and other cancers; of bone damage; and of cataracts..