# Radiation (Ionizing)

## WHAT'S AT STAKE?

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.

## WHAT'S THE 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).

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 do you find ionizing radiation?**

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.

**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 closes 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 closes 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.

# HOW TO PROTECT YOURSELF

If not properly controlled and monitored Ionizing radiation can prove to be deadly. This workplace hazard should be handled in the following manner.

**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.
- Note it is likely that 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.

**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.

**RISK ELIMINATION / REDUCTION**

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’.
- Implements engineering controls to reduce radiation levels.
- 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.

# FINAL WORD

Prevent damages and possible disaster with the three steps prevention protocol. Hazard Identification, Risk Assessment and Risk Elimination / Reduction.