

Safety Rules Against Hazards of Nuclear Radiation

GRADE 11 GROUP 5

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Introduction to Nuclear safety



- The International Atomic Energy Agency (IAEA) is an intergovernmental organization that has its objective to use nuclear energy in a peaceful manner and to inhibit its use for any military purpose.

Introduction to Nuclear safety

- IAEA was created in response to growing international concern toward nuclear weapons, specifically the tension between the US and the Soviet Union.
- Nuclear safety is defined by the international atomic energy agency (IAEA) as " the achievement of proper operating conditions , prevention of accidents or mitigation of accidental consequences, resulting in protection of workers, the public and the environment from undue radiation hazards"

The reasons for nuclear accidents



- The reasons for nuclear accidents are multifaceted.
- Mechanical failures and human errors play role in nuclear accidents, deeper issues such as poor safety management and organizational structures with in nuclear industries and governmental agencies are fundamental causes.

Nuclear safety regulation



- Nuclear safety can be understood as accident prevention in nuclear installations, through its systems and its human resources, and the mitigation of risks and consequences if an accident should occur.

Nuclear safety regulation

- The main goal is that the radiological impact on people and the environment from nuclear installations remains as small as possible for both normal operation and potential accidents.

At every step, adherence to certain principles and practices which define what is known as safety culture is essential to ensure the safe operation of nuclear facilities.

Some safety cultures include:

- Boiling Water Reactors(BWRs)
- Codes and standards
- Digital Instrumentation
- Inspection Practices
- Operating Experience
- Regulations of new and advanced reactors

Minimum requirements for nuclear safety:

- Extraction, transportation, storage, processing, and disposal of fissionable materials
- Safety of nuclear power generators
- Control and safe management of nuclear weapons, nuclear material capable of use as a weapon, and other radioactive materials
- Safe handling, accountability and use in industrial, medical and research contexts
- Disposal of nuclear waste
- Limitations on exposure to radiation

Protecting yourself from radiation



What do we mean by Radiation ?

In physics, radiation is the emission or transmission of energy in the form of waves or particles through space or a material medium.

Radiation

This includes:

- electromagnetic radiation consists of photons, such as radio waves, microwaves, infrared, visible light, ultraviolet, x-rays, and gamma radiation (γ)
- particle radiation consists of particles of non-zero rest energy, such as alpha radiation beta radiation proton radiation and neutron radiation
- acoustic radiation, such as ultrasound, sound, and seismic waves, use physical transmission medium
- gravitational radiation, in the form of gravitational waves, ripples in spacetime

Applications of radiation

- **Health:** thanks to radiation, we can benefit from medical procedures, such as many cancer treatments, and diagnostic imaging methods.
- **Energy:** radiation allows us to produce electricity via, for example, solar energy and nuclear energy.
- **Environment and climate change:** radiation can be used to treat wastewater or to create new plant varieties
- **Industry and science:** nuclear techniques based on radiation, scientists can examine objects or produce materials with superior characteristics in, for instance, the car industry.

Types of radiation

1. Non-ionizing radiation

- Non-ionizing radiation is lower energy radiation that is not energetic enough to detach electrons from atoms or molecules, whether in matter or living organisms.
- However, its energy can make those molecules vibrate and so produce heat. This is, for instance, how microwave ovens work.

Types of radiation

2. Ionizing radiation

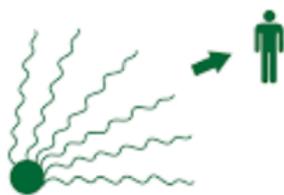
- Ionizing radiation is a type of radiation of such energy that it can detach electrons from atoms or molecules, which causes changes at the atomic level when interacting with matter including living organisms.
- Such changes usually involve the production of ions (electrically charged atoms or molecules) – hence the term “ionizing radiation”.

Radiation protection principles of time, distance and shielding

To reduce radiation exposure:



Limit Time



Increase Distance

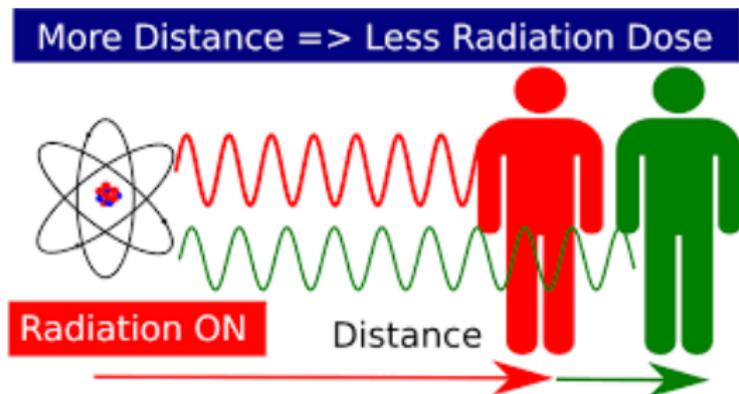


Use Shielding

1. 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.

Radiation protection principles of time, distance and shielding



2.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.

Radiation protection principles of time, distance and shielding

3. Shielding:

- Barriers of lead, concrete, or water provide protection from penetrating gamma rays and X-rays.
- 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.

Safety precautions when using radioactive sources in schools

- Radioactive sources which are used in school are usually very weak.
- They are kept in sealed container except when they are being used in an experiment.
- The container can be designed based on appropriate shields.

Safety precautions with radioactive material...



When using a radioactive source it should be:

- handled with tongs or forceps, never with bare hands. Moreover, hands must be washed after the experiment and definitely before eating.
- kept at arm's length, pointing away from the body.
- always kept as far as possible from the eyes

Precautions Should be taken when using radioactive materials

- Handling radioactive materials, always wear the relevant protective clothing, wear a lab coat, and always wear gloves when handling radioactive sources.
- Regularly examine the radiation level of these gloves. For handling the radioactive elements use proper radioactive shields.
- To avoid internal contamination, hygiene is essential when handling radioactive materials, like eating, smoking etc.

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- To use and store radioactive materials safely in the classroom, containers must be correctly labeled and sealed.
- Keep radioactive sources like technetium-99 shielded (preferably in a lead-lined box) when not in use.
- Wear protective clothing to prevent the body becoming contaminated should radioactive isotopes leak out.
- Avoid contact with bare skin and do not attempt to taste the sources.

