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The Role of Quality Assurance in radiation protection

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1. Background-Aim

Aim: To examine the importance of Quality Assurance (QA) in radiation protection and its role in minimizing risks.

Background: Radiation is widely used in various fields, with ionizing radiation presenting specific risks. Quality assurance plays a crucial role in maintaining safety and effectiveness in radiation protection by regulatory and optimizing procedures.



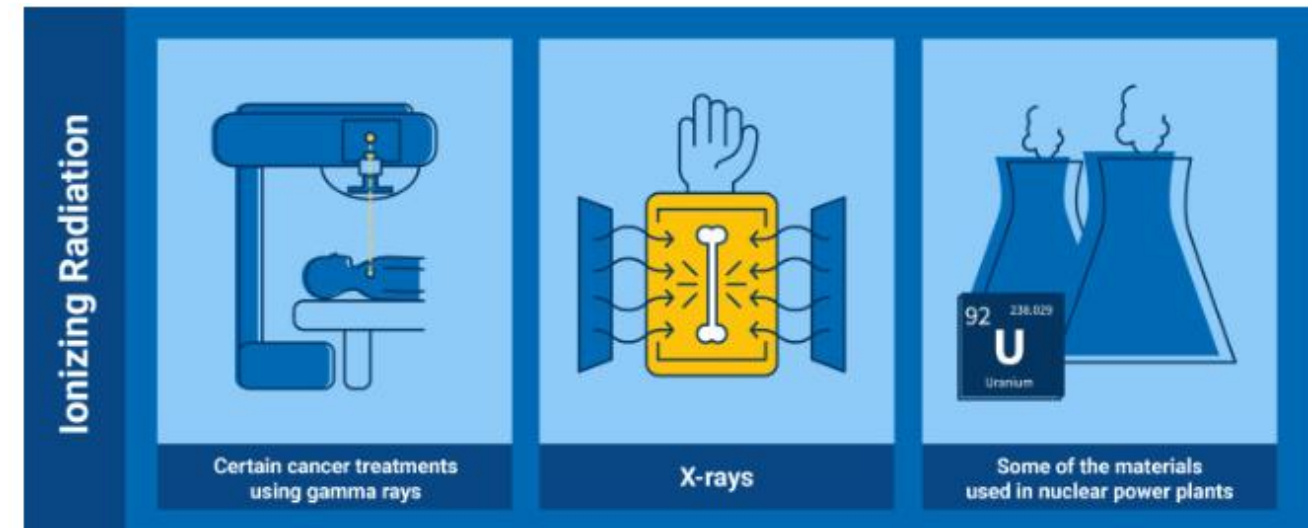
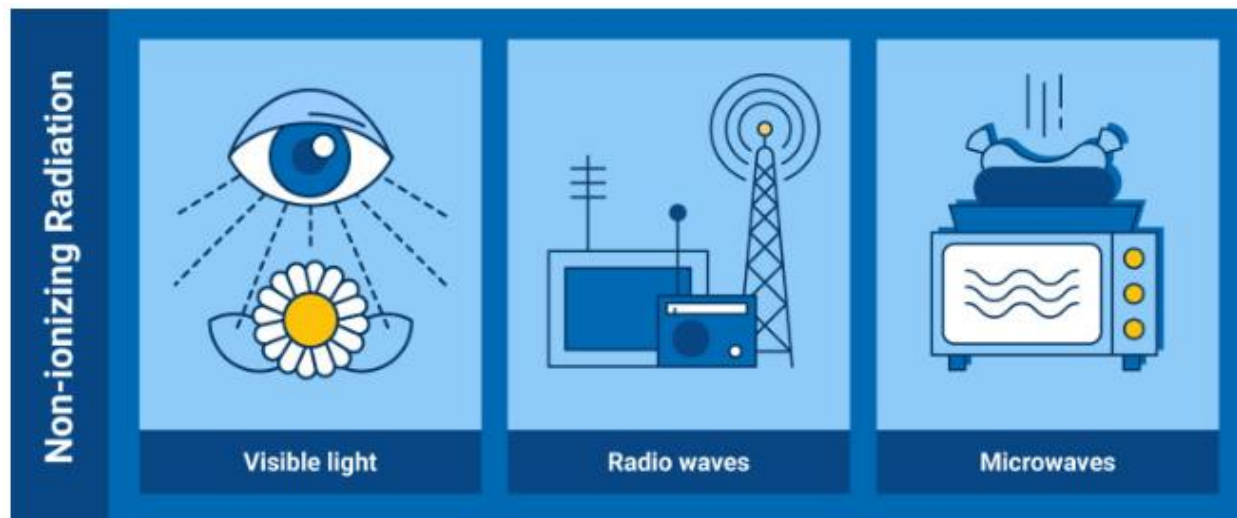
2. Materials & Methods

Introduction to Radiation

Radiation: is the emission of energy from one place to another as electromagnetic waves or moving subatomic particles

Non-ionizing Radiation: is low-energy radiation that cannot remove electrons from atoms or molecules but can cause molecular vibration, generating heat.

Ionizing Radiation: has enough energy to dislodge electrons from atoms, potentially causing cellular damage at high doses but offering beneficial applications at controlled levels.



2. Materials & Methods

The Role of Quality Assurance in Radiation Protection

Radiation protection aims to reduce unnecessary radiation exposure with a goal to minimize the harmful effects of ionizing radiation.

→Critical across industries: Medical, Nuclear Power, Industrial, Aerospace and Environmental Monitoring

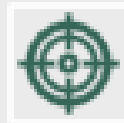
Quality Assurance (QA) in radiation protection is a systematic approach ensuring the safety and effectiveness of radiation-related activities. It involves actions that instill confidence in the satisfactory and safe performance of facilities, structures, systems, components, or procedures.

→Critical across: Diagnostic Radiology, Industrial Radiography, Radiation Therapy

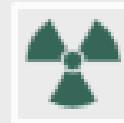
2. Materials & Methods

Importance of QA in Different Fields

- Diagnostic Radiology: Routine tests ensure optimal image quality and reduce patient exposure during diagnostic procedures.
- Industrial Radiography: Audits ensure compliance, tests check equipment, and drills prepare staff for emergencies.
- Radiation Therapy: Ensures patient safety and effective treatment through regular equipment checks and planning verification, enhancing overall care and outcomes.



Ensure the accuracy of the diagnosis.



Minimize radiation dose delivered to the patient



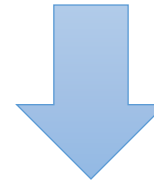
Performance evaluation of diagnostic x-ray equipment



The QA tests should be carried out thereafter at regular intervals (periodicity- once in two years) and also after repairs of the equipment or when equipment malfunction is suspected.

Challenges in QA for Radiation Protection and Overcoming

- **Funding & Equipment:** Requires significant resources.
- **Personnel:** Insufficient staff and complex systems.
- **Data Management:** Ensuring safe storage of large volumes of QA data.



- **Standardization:** Use consistent equipment and software.
 - **Funding:** Secure grants and institutional support.
 - **Training:** Ongoing education for personnel.
- **Automation:** Use AI for consistency and efficiency in QA processes.

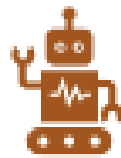
3. Results

Future Directions

Effective radiation protection requires proper measurement tools, techniques, and assessment methods. New technologies and regulatory changes demand a proactive, comprehensive QA approach to maintain safety, compliance, and quality in radiation therapy and protection.



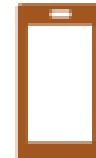
AI and Machine
Learning



Robotics and
Automation



Real-time
Dosimetry



Wearable
Devices



Electronic
Health Records



Telemedicine

4. Conclusions

Continuous Improvement: QA practices in radiation protection are vital for minimizing harm while optimizing treatment and safety measures. The integration of emerging technologies will shape the future of radiation safety.

Ionizing radiation is crucial to modern medicine, enabling technologies like X-rays, CT scans, and radiation therapy that have saved lives and improved countless patients' quality of life. Despite these benefits, it also presents risks, such as potential injuries and long-term illnesses, including cancer, for patients, medical staff, and the public and that is why is crucial the role of Quality Assurance.

5. References

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