VITALIZING IONIZING RADIATION SAFETY

University of the Incarnate Word Nuclear Medicine Science Program

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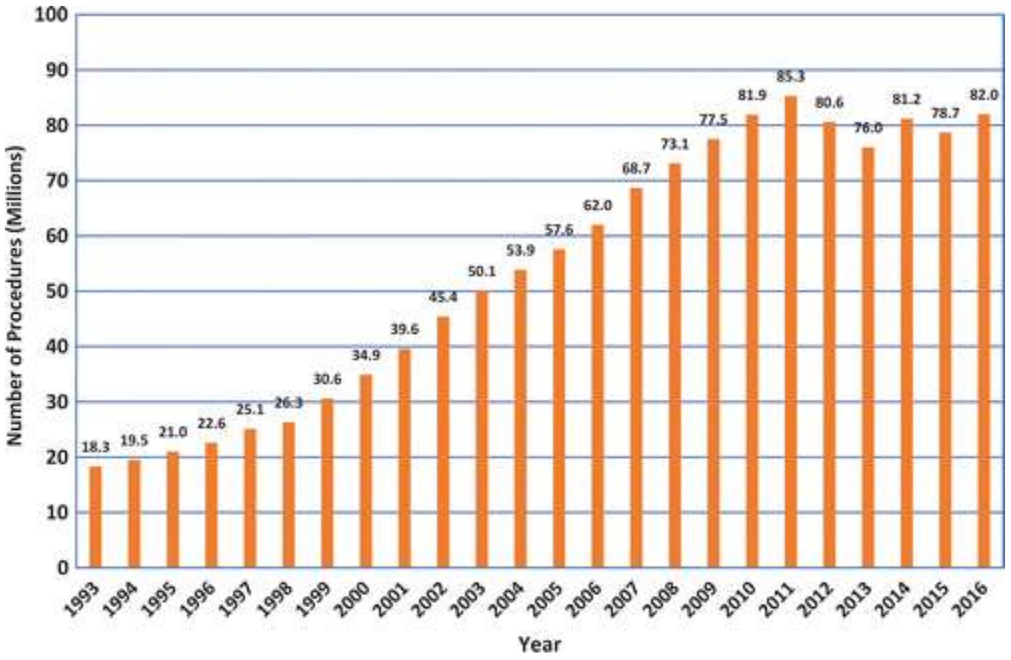
Trend of Radiation Use

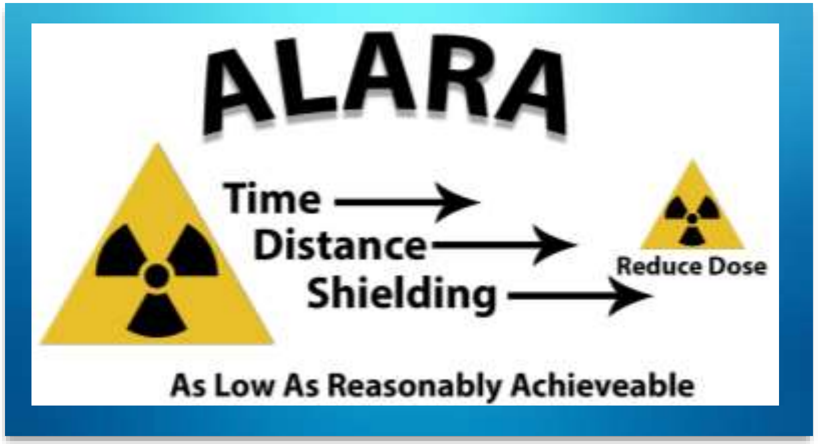
- In 1966, the Public Health Service estimated that more than half of the US population was subjected each year to some form of radiological study[1]
- In 1989, about 100 million procedures using radioactive materials were performed[8]
- In 1991, an estimated 150 million procedures involving the administration of radiopharmaceuticals (National Council on Radiation Protection and Measurement, 1996).
- In 2004, approximately 2 billion diagnostic x-ray examinations, 32 million nuclear medicine examinations, and 5.5 million patients treated with radiation therapy worldwide (Mettler, 2004).

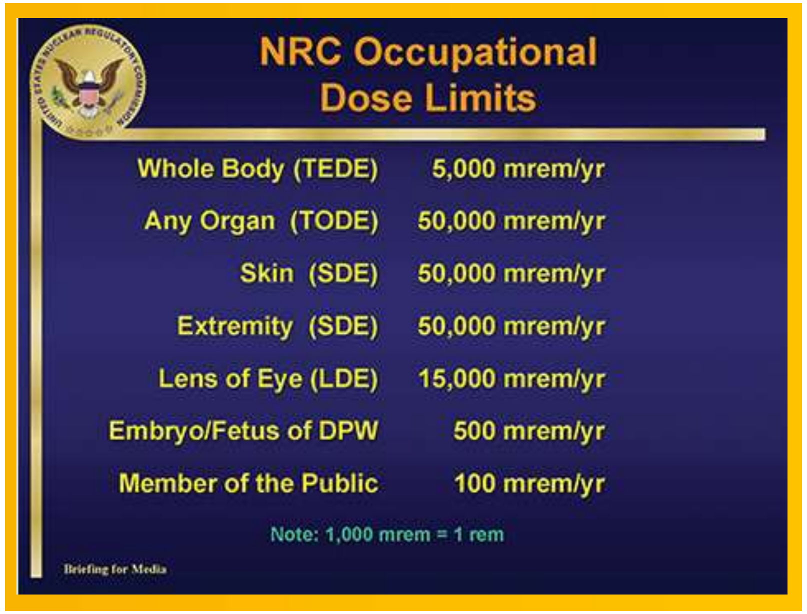


Bar graph shows total CT procedure volume trend data reported by IMV Medical Information Division in the United States from 1993 to 2016

Basic Principles of Radiological Protection

- ALARA, "As Low As Reasonably Achievable."
- The fundamental principles central to the system of radiation safety and protection are Justification, Optimization, and Limitation
- 6 feet away from near natural background radiation levels (OSHA, 1996).
- Most important principles: **time, distance,** and **shielding**




NRC Occupational Dose Limits

Whole Body (TEDE)	5,000 mrem/yr
Any Organ (TODE)	50,000 mrem/yr
Skin (SDE)	50,000 mrem/yr
Extremity (SDE)	50,000 mrem/yr
Lens of Eye (LDE)	15,000 mrem/yr
Embryo/Fetus of DPW	500 mrem/yr
Member of the Public	100 mrem/yr

Note: 1,000 mrem = 1 rem

Briefing for Media

Basic Principles of Radiological Protection

Justification

- The objective: **avoid** unnecessary (unjustified) examinations
- risk: benefit ratio must be carefully considered
- radiation exposure situation should produce more good than harm[6]

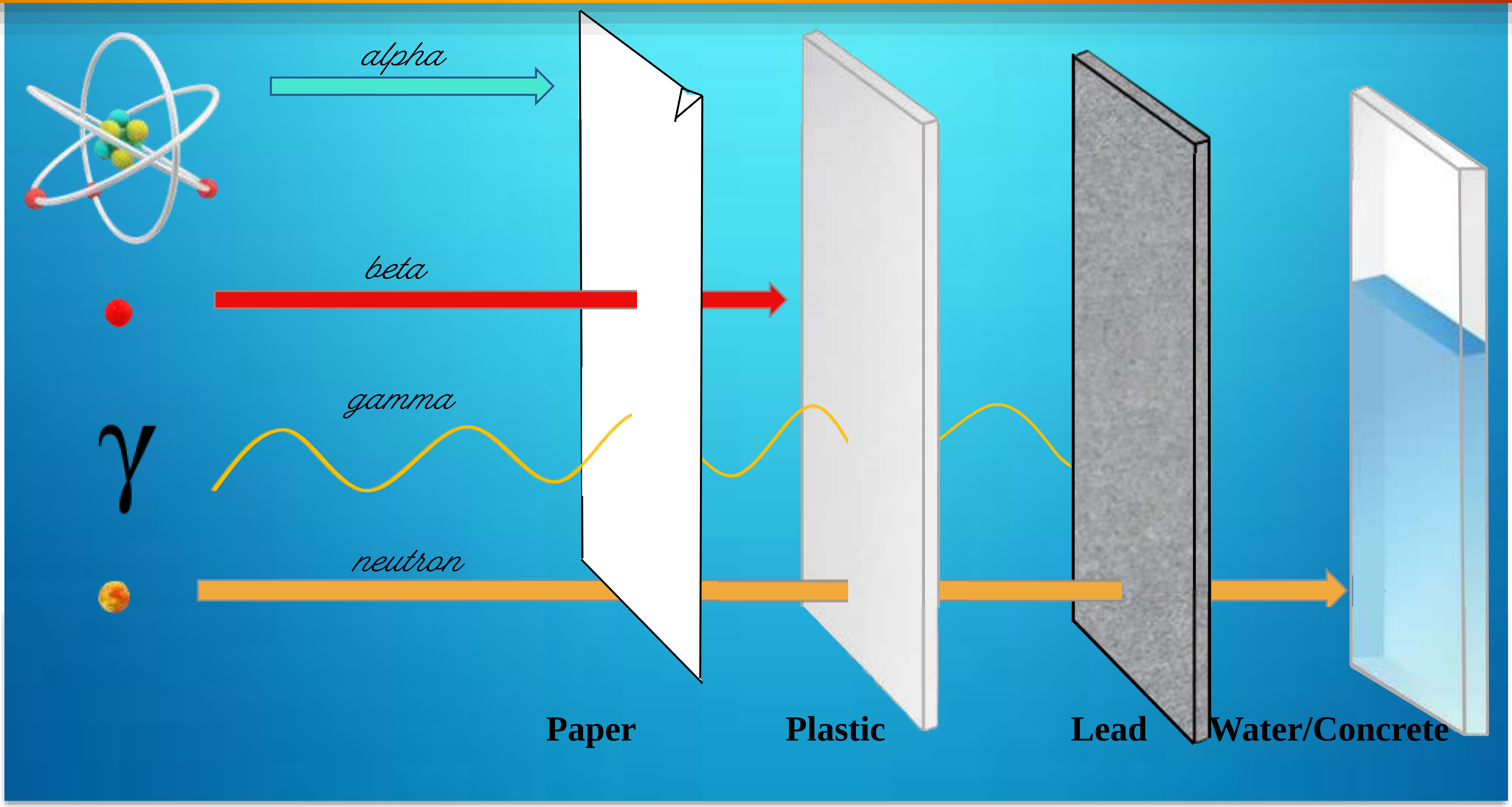
Optimization

- The principle focused on ensuring all exposures should be kept ALARA[6]
- **Greatest impact** on dose reduction, regardless of the exposure situation[6]
- Optimization for procedures and diagnostics reduces excessive doses.1[0]

Limitation

- The application of dose limits.[6]
- This includes **both** occupational and general public dose limits
- Includes routine surveys in the form of scintillation detectors/GM counter

Basic Principles of Radiological Protection



Protection of our healthcare workers

- Nursing staff and other healthcare professionals are considered "category 13" by the ICRP[5]

- All staff who are occupationally exposed should wear a personal radiation monitoring device.

- Personal monitoring dosimeters should be worn

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Protection of our healthcare workers

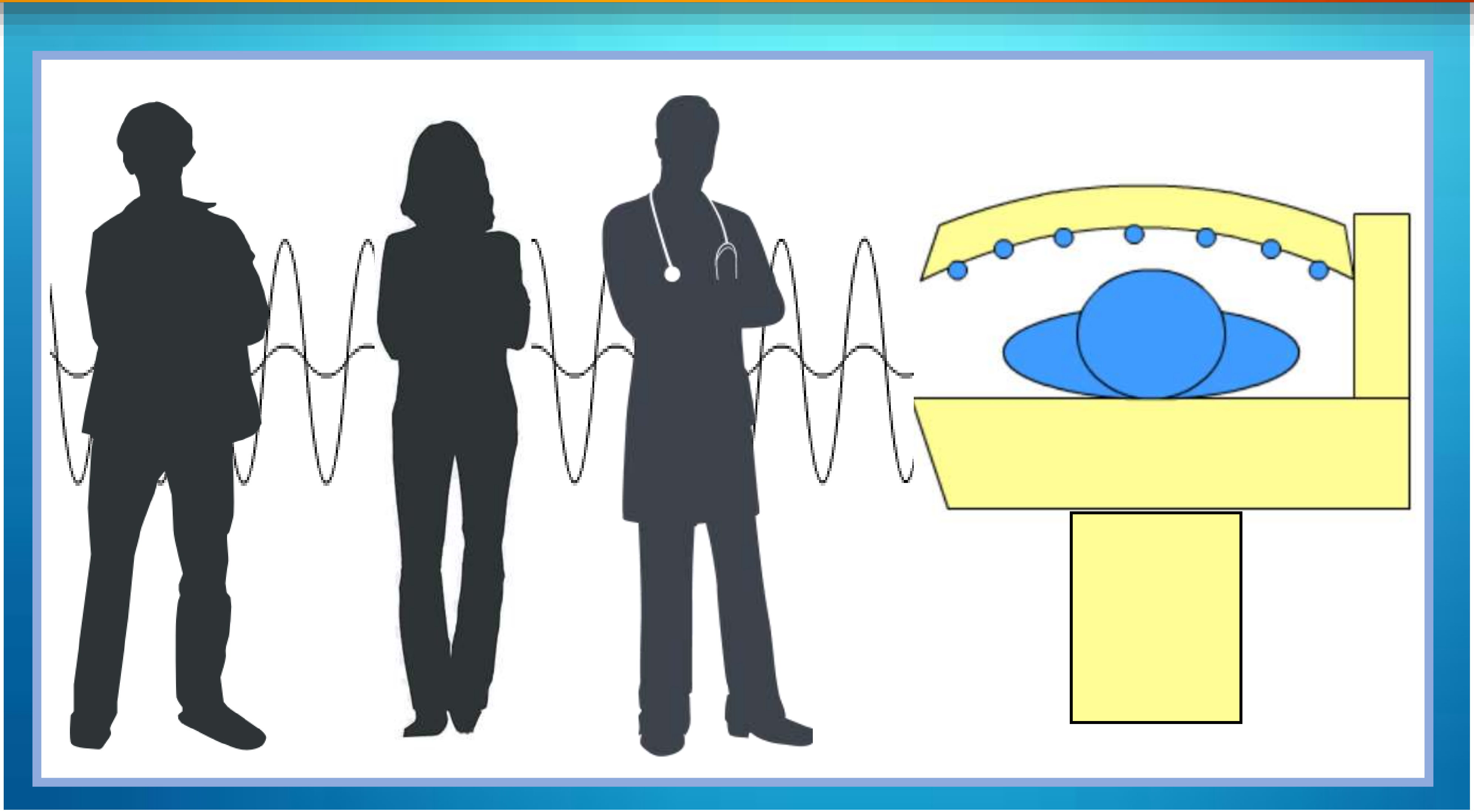
- Ditkofsky et al., (2016) found that 44.6% of health care providers surveyed were unable to identify the most common modalities that used radiation.[2]

- Nurses and other healthcare providers who assist in procedures using ionizing radiation must have knowledge regarding the risks and precautions to minimize the exposure of themselves and others.[5]

Protection of our healthcare workers

- one in five nurses reported exposure to ionizing radiation during pregnancy.
- Studies have found increases in the incidence of cancer for children exposed to low-levels of ionizing radiation *in utero*.
- If a nurse is required to assist with holding a patient during a portable x-ray, he/she should avoid placing a hand(s) in the direct beam.

Exposure



Safety of the Patient

- Recognizing the effects of radiation exposure by the type of organ/tissue
- Understanding "absorbed dose"
- Rethinking how we use radiation during exams/procedures
- managed to a low multiple of normal background exposure.

Radiation Safety Policy

- fundamental contributor to procedural justification, exam optimization and dose-limiting practices in medical imaging.
- Has come more as a personal choice than a requirement.
- The International Atomic Energy Agency (IAEA) estimates that when radiation safety protocols are followed, the radiation dose to the staff assigned to patients receiving radiopharmaceuticals can be managed to a low multiple of normal background exposure.

The Nuclear regulatory commission (NRC) regulates the manufacture and use of radioactive materials

Policy enforcement

- Hayre et al. (2018) recommend conducting ongoing discussions with radiation protection supervisors and advisors[3]
- The International Commission on Radiological Protection (ICRP) recently expanded recommendations regarding necessary radiological protection education and training[5]
- Policy must be understood by anyone encountering radioactive material or equipment

Conclusion

- Relevant stakeholders must work together, making use of supportive, data-driven, and nonpunitive approaches to facilitate a culture of safety.
- All imaging procedures should be evaluated regularly to ensure that the application of the **ALARA principle** is maximized, and where necessary, adjustments are made to the radiation protection measures.
- active participation should include every member of the healthcare team to include the patient, who are all armed with the basics of radiation protection knowledge.

Sources

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