

Medical X-ray Safety

Health Worker Safety Module 7



Contents

- Introduction
- Protection from X-ray Hazards
- X-ray Safety for Health Workers
- X-ray Safety for Patients

Introduction to X-Rays

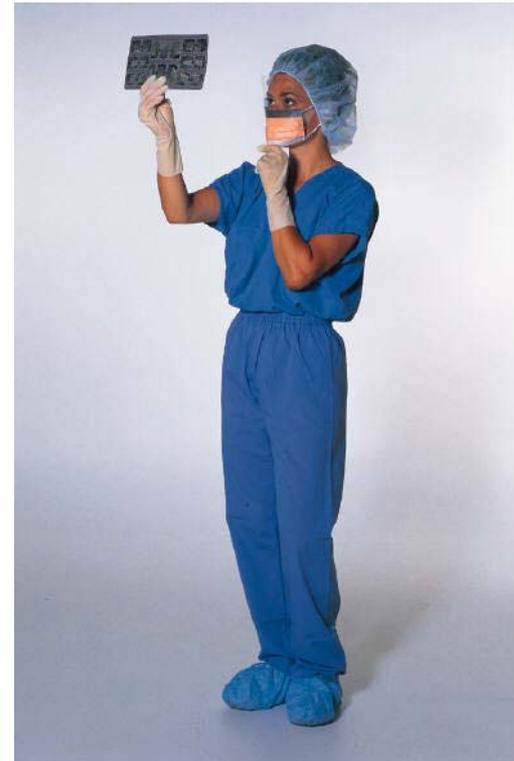
- X-rays are electromagnetic energy traveling as waves
- X-ray exposure has been linked to cancer and developmental problems, and can cause burns
- The risks from x-ray exposure are greatest for foetuses, so pregnant women should take extra precautions
- Hospital x-ray machines produce relatively high x-ray exposures and they present a hazard unless adequate safeguards are in place
- These devices should only be operated by trained personnel



Protection from X-Ray Hazards

Monitoring of exposure

- X-ray facilities are designed around the equipment and the source of radiation usually remains within a well defined area in the room
- Radiation doses to workers are monitored using personal dosimeters



Protection From X-rays

- Radiation protection for technologists and physicians relies on
 1. the **time** spent near the machine while it is producing x-rays,
 2. the **distance** between the worker and the x-ray source, and
 3. the **shielding** used by the worker and that of the tube housing
- Increasing the distance and the amount of shielding, and decreasing the time will decrease the amount of radiation exposure to a worker



Time

- When you need to use an x-ray system, work quickly and efficiently.
- Examinations should be carefully planned and rehearsed beforehand to minimize the exposure (beam-on) time and consequently reduce the total radiation exposure in the room.



Distance

- Radiation is significantly reduced by distance
 - Move away from the x-ray system when in use
 - Standing at least 2 meters from an x-ray radiation source provides a great deal of protection
- Note that many analytical x-ray systems use very narrow x-ray beams
- Because narrow x-ray beams do not “spread” as much as broad beams, even being 6 feet away from the system may still result in much of the radiation beam being absorbed by your body if the beams are narrow

Shielding

- When a new x-ray system is being installed, ensure that each tube is protected by fixed shielding.
- Shielding that is permanently in place is the most effective mechanism for protecting workers from unnecessary x-ray exposure.
- Always operate these systems with all shielding and safety components in place and never tamper with system interlocks.

Safety Precautions and Guidelines

1. Receive proper training from the person in control before operating analytic x-ray machines.
2. Wear dosimeters between your shirt collar and waist on the side of your body that is facing the radiation source.
3. Monitor radiation of newly installed machines, especially before and after modifying the machine for special experiments.
4. Check the shielding before turning the unit on. Never assume a unit was left in a safe working condition by the previous user.



X-ray Safety for Health Workers

Health Worker Safety from X-ray Exposure

- Radiation exposure to technologists, nursing staff, physicians, and to others must be kept as low as reasonably achievable.
- Only personnel who are required for the x-ray procedures or training should be present in the x-ray room during exposures.
- Health workers should use portable or fixed lead panels or use the following PPE:
 - Lead aprons
 - Lead safety glasses
 - Thyroid shield
 - Leaded gloves

Health Worker Safety from X-ray Exposure (continued)

- Keep the time of radiation exposure short, especially during fluoroscopy procedures.
- Follow proper techniques to minimize the number of repeat exposures.
- Staff should not routinely hold patients. Use mechanical holding devices when a patient or film requires added support. If that is not possible, patients should be held by a relative or friend who is wearing lead aprons and gloves.
- If pregnant, notify the head of your department.



X-ray Safety for Patients

Patient Radiation Safety Principles

- Patient exposure should be kept as low as reasonably achievable
- The radiation exposure to the patient should be minimized without compromising the diagnostic quality of the exam
- Obtaining a good quality radiograph while controlling radiation exposure of the patient is one goal of a viable quality assurance program



Patient Radiation Safety Principles (continued)

- Follow the proper technique for each examination—this reduces the need to repeat the procedure
- Obtain a good quality radiograph the first time and reduce the number of repeat examinations.
- Collimate the primary x-ray beam to the area of interest to reduce scatter radiation.
- When portable x-ray machines are used, ensure that other patients are located at least one meter from scatter radiation or utilize portable lead panels.

Patient Radiation Safety Principles (continued)

- Use gonadal shields for patients as long as they will not interfere with the medical exam.
- Identify pregnant patients and notify the referring physician before they undergo any x-ray exams.
- Use protective eye wear and aprons when appropriate.





Thank You

Bibliography

- Maxwell Adams, J. (1994, reprint 2004). *Electrical Safety 2004: A guide to the causes and prevention of electrical hazards*. London. The Institution of Electrical Engineers.
- Central Board of Health (2003). *Zambia Infection Prevention Guidelines*. JHPIEGO Corporation. Baltimore, Maryland.
- Damani, N.N. (2003). *Manual of Infection Control Procedures: 2nd Edition*. Cambridge. Cambridge University Press.
- Emory University Environmental Health and Safety Office. (2009, September). *Safety Toolbox Training: Avoiding Electrical Shocks*. http://www.ehso.emory.edu/content-guidelines/ToolboxTraining_AvoidingElectricalShocks.pdf.
- Kenyatta National Hospital (2006). *Policy Guidelines on Antiseptics, Disinfection, Sterilization and Waste Disposal*.
- Muralidhar, S., PK Singh, RK Jain, M Malhotra & M Bala (2010). "Needle stick injuries among health care workers in a tertiary care hospital in India." *Indian Journal of Medical Research*. Mar; 131: 405-10.
- Office of Safety and Health Administration. (April 2009). OSHA Academy Course 715: *Electrical Safety Basics Student Manual*. <http://www.oshatrain.org/courses/mods/715e.html>.
- Prasad, R., Z. Quezado, A. St. Andre, & N. O'Grady (2006). *Fires in the Operating Room and Intensive Care Unit*. *Anesth Analg* 2006; 102: 172-4.
- Patterson W B., Craven DE., Schwartz DA., Nardell EA., Kasmer J. & Noble J. (1985) *Occupational Hazards to Hospital Personnel*. *Annals of Internal Medicine*. May; 102: 658-68.
- Tanzania Ministry of Health and Social Welfare. (2004). *National Infection Prevention and Control Guidelines for Health Services in Tanzania*.
- Tanzania Ministry of Health and Social Welfare. (2003). *Tanzania Waste Management Guidelines*.
- Tanzania Ministry of Health and Social Welfare. (2009). *Injection Safety in the Context of Infection Prevention and Control, Participants' Manual Tanzania*.
- Tanzania Ministry of Health and Social Welfare. (2006). *Standards and Procedures for Healthcare Waste Management in Tanzania*. Pul: Ministry of Health and Social Welfare, United Republic of Tanzania, 28pp.
- Wenzel, RP, editor. (1994). *Prevention and Control of Nosocomial Infections*. Baltimore. Williams & Wilkins.