# Baptist Memorial Health Care
# Radiation Safety Training
# Allied Health Students (NMT, RAD, RTT only)

## Joint Commission Sentinel Event Alert:

- In August of 2011 the Joint Commission published a Sentinel Event Alert (Issue 47) related to the radiation risks of diagnostic imaging.
- Sentinel Event Alerts identify specific types of sentinel events, describes their underlying causes and suggests steps to prevent occurrences in the future.
- The Sentinel Event Alert # 47 recommended 21 steps to eliminate avoidable radiation exposure.
- In response to the sentinel event alert, Baptist Memorial Health Care developed a team to perform an assessment and implement steps to address the potential radiation risks of diagnostic imaging.
- The team developed a plan to ensure that a radiation safety program is in place to appropriately address the recommendations of The Joint Commission including the right test, right dose, effective processes, safe technology and promotion of a radiation safety culture.

## Radiation Dose and Effect:

Nuclear Medicine

- Nuclear Medicine exposes the patient to radiation by using radiopharmaceuticals introduced into the body. The radiopharmaceuticals help produce images which provide physiological information to the radiologist for a diagnosis.
- Radioactive materials can be inhaled, ingested, injected or absorbed through the skin.
- The higher the dose of radiation delivered at any one time, the greater the risk for long-term damage.
- Patients most prone to harm from diagnostic radiation are children and young adults; pregnant women; individuals with medical conditions sensitive to radiation, such as diabetes mellitus and hyperthyroidism; and individuals receiving multiple doses over time.

- Medical radiation is cumulative over a person's lifetime. The more radiation a person receives, the greater the danger of cancer.

Radiation Safety Compliance:

- The technologist / student technologist must document the radiopharmaceutical name and dose used for the procedure in the patient's medical record.

- The following misadministrations of radiopharmaceuticals must be reported to the Radiation Safety Officer (RSO).
  - patient total dose that exceeds plus or minus 20% of the prescribed dose range
  - wrong patient dosed
  - wrong radiopharmaceutical administered
  - incorrect administration route

- Access to hot labs must be restricted to authorized hospital personnel.

<u>Computed Tomography</u>

- CT involves larger radiation doses than the more common, conventional x-ray imaging procedures.

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- Patients most prone to harm from diagnostic radiation are children and young adults; pregnant women; individuals with medical conditions sensitive to radiation, such as diabetes mellitus and hyperthyroidism; and individuals receiving multiple doses over time.

- To measure CT radiation dose, most physicists use the System International (SI), a uniform system of weights and measures that evolved from the metric system to measure radiation dose.

- The biological risk of exposure to radiation is measured using the SI unit Sievert (Sv).

- The radiation dose absorbed by a person is measured using SI unit Gray (Gy). One Gray = 100 Rad.

- CT Dose Index (CTDI) is the current standard for CT dosimetry and performance.

- The CTDIvol is a weighted average measurement in a reference phantom.

- CTDIvol provides an estimate of patient dose based on measurements in a phantom and is expressed in milliGrays (mGy). A milliGray is 1/1000 of one Gray.

- The Dose Length Product (DPL) is the product of the CTDIvol and the scan length for a group of scans and is expressed in miliGray centimeters.

- Informed consent should be obtained by the Licensed Independent Practitioner before performing CT scan of the chest, abdomen, or pelvic area on a patient with a known pregnancy.

- If a CT scan of the chest, abdomen, or pelvic area is performed on a patient with an unknown pregnancy, the Radiation Safety Officer (RSO) should be notified. The technologist/ student technologist should provide the RSO with the information needed to calculate the dose to the fetus.

<u>Diagnostic/Fluoroscopy</u>

- The higher the dose of radiation delivered at any one time, the greater the risk for long-term damage.

- Medical radiation is cumulative over a person's lifetime. The more radiation a person receives, the greater the danger of cancer.

- Patients most prone to harm from diagnostic radiation are children and young adults; pregnant women; individuals with medical conditions sensitive to radiation, such as diabetes mellitus and hyperthyroidism; and individuals receiving multiple doses over time.

- Informed consent should be obtained by the Licensed Independent Practitioner before performing an x-ray of where the fetus will be in the direct x-ray beam (abdomen, pelvis, lumbar spine) abdomen, or pelvic on a patient with a known pregnancy.

- If an x-ray exam is performed where the fetus was in the direct x-ray beam on a patient with an unknown pregnancy, the Radiation Safety Officer (RSO) should be notified. The technologist should provide the RSO with the information needed to calculate the dose to the fetus.

- Fluoroscopy provides live x-ray images of a patient's internal anatomy on a TV like monitor.

- Prolonged fluoroscopy can lead to severe radiation skin burns.

- The technologist / student technologist must document the amount of fluoro time used during all fluoroscopy procedures in the patient's medical record.

- If fluoroscopy time to a single field exceeds 150 minutes under fluoroscopy (and 75 minutes for C-arm cases) during a procedure, the technologist / student technologist must report the incident to the Radiation Safety Officer (RSO) for investigation. The RSO will calculate the patient dose and determine if any further action is needed.
    - Patient doses that exceed 1500 rad to a single field must be reported to the Joint Commission as a sentinel event.

## Eliminating Avoidable Radiation for Patients:

- Radiation exposures must be supported by a documented order from a Licensed Independent Practitioner and verified by the technologist / student technologist (with the exception of screening mammography).

- Radiation exposures must be clinically indicated. The medical benefit should outweigh the radiation exposure risks (dialogue between radiologist and ordering physician as appropriate).

- Physicians, Radiologic Technologists, and Student Technologists are trained to eliminate avoidable radiation by using the lowest possible dose during the exam to get an accurate and clear diagnostic image. This is known as the "ALARA" principle (As Low As Reasonably Achievable).


    - All radiation producing equipment is tested initially and annually by a State approved registered inspector.

    - Preventive maintenance and quality control testing are performed on radiation producing equipment in accordance with the manufacturer's guidelines.

    - Technologists/ student technologists receive annual education and competencies to assure safe radiation practices including pediatric specific radiation safety.

    - Baptist Memorial Health Care pledges to endorse and promote the goals of "Image Wisely" (for Adults) and "Image Gently" (for Pediatrics). These

campaigns are designed to raise awareness of opportunities to lower radiation dose used in medical imaging by making information available to the medical community and the public.

## Eliminating Avoidable Radiation for Patients in Nuclear Medicine

- Nuclear Medicine dosing protocols are developed and utilized in accordance with the ALARA principle and approved at least annually by the Nuclear Medicine physicians.

- Nuclear Medicine Technologists and Student Technologists may inject radiopharmaceuticals under the supervision of the Nuclear Medicine physicians who are listed on the hospital's radioactive materials license.

- Written take home instructions and restrictions are provided to patients who have been treated with Iodine-131 in order to protect the public and other family members from unnecessary radiation.

## Eliminating Avoidable Radiation for Patients in CT

- CT Imaging protocols are developed and utilized in accordance with the ALARA principle and approved at least annually by a radiologist, medical physicist and the appropriate hospital committees; including pediatric specific protocols to insure child size radiation doses.

- Protocol editing is restricted to specific personnel to insure that unauthorized changes are not allowed.

- Shielding radiosensitive tissues such as eyes, thyroid, and breasts drastically lowers the effective dose received by the patient. Lead shielding absorbs 90% to 95% of the x-rays that interact with it.

- Appropriate CT shielding may include eye shields, thyroid shields and breast shields.



## Eliminating Avoidable Radiation for Patients in Diagnostic/Fluoroscopy

- Fluoroscopy procedures must be performed under the supervision of a Licensed Independent Practitioner.

- The physician should use continuous fluoroscopy only as needed to observe rapid anatomical or physiologic changes.

- Pulsed fluoroscopy (as few as 3 pulses per second) may be adequate for most patients, while *significantly* reducing the patient dose (especially in pediatric patients).

- During fluoroscopy procedures the x-ray tube should be positioned as far away from the patient's body as possible. The patient should be as close to the image intensifier as possible.

- Proper collimation and patient shielding should be used appropriately based on the exam being performed and patient condition. The tissues most sensitive to radiation are eyes, thyroid, and reproductive organs. Care should be taken to protect these tissues/organs from the direct s-ray beam.

## Radiation Safety for Students

- Personnel dosimetry badges are issued to the student technologist to measure their radiation exposure.

- Dosimetry badges must be stored away from x-ray equipment/radiation when not being worn.

- Dosimetry badges are exchanged every two months for processing.

- Students that declare pregnancy are issued a second dosimetry badge (fetal badge) to be worn under beneath the lead apron at waist level and measure radiation dose to the fetus. The fetal badge is processed monthly.

- Personnel domimetry badges measure biological risk of exposure to radiation using the conventional unit **REM** (roentgen equivalent man).

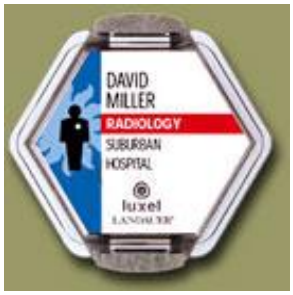
- Dosimetry badge reports are expressed in millirems (mREM) which is 1/1000 of a REM.
    - Healthcare workers are allowed the following radiation exposures annually:

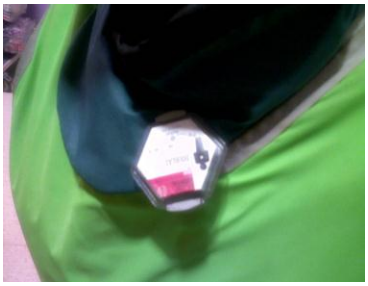
- 5,000 mREM /year – whole body
- 15,000 mREM /year – lens of the eye
- 50,000 mREM /year – skin or extremity
- 500 mREM fetal dose during entire pregnancy for a declared pregnant worker (50mREM/month)

- Healthcare workers are notified in writing if their dosimetry badge reaches or exceeds investigational ALARA levels I or II.
  - ALARA level I is 10% of the annual exposure limit.
  - ALARA level II is 30% of the annual exposure limit.

## Radiation Safety for Students in Medical Radiography

- Collar dosimetry badges are worn by Medical Radiography students. The collar badge is worn at the collar level outside of the lead apron. The badge should be worn with the label facing outward.



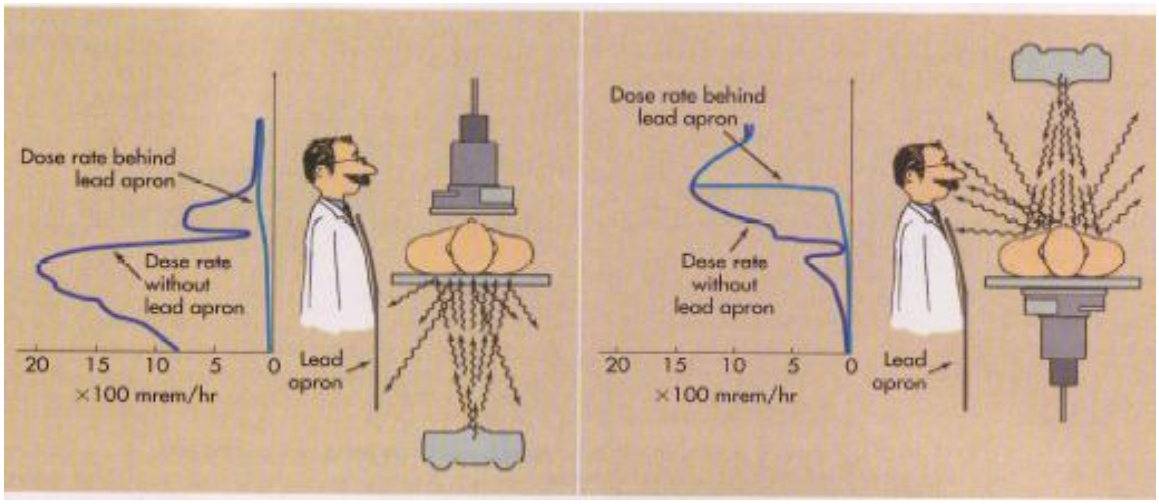



- Physicians and staff whose hands will be in or near the x-ray beam should wear ring badges.

- When wearing lead/surgical gloves, ring badges must be worn underneath the gloves. The label should face towards the x-ray tube.

- The staff receives their highest radiation dose from scattered radiation during an x-ray exam.

- X-rays are emitted only while the exposure button is pushed. After the exposure, there is no radiation present in the room.
- Most scattered radiation is directed toward the x-ray tube. Placing the C-arm x-ray tube under the patient significantly reduces the dose of scattered radiation to the operator's eyes. (see diagram)
- When the C-arm is positioned horizontally staff should stand on the opposite side from the x-ray tube to avoid scattered radiation.




Bushong, SC, Radiologic Science for Technologists, 8th Ed, 2004

## Radiation Safety for Students in Nuclear Medicine

- There are two (2) types of dosimetry badges worn in Nuclear Medicine.
  - The Whole Body badge should be worn with the label facing outward and positioned on your torso so that it is closest to the source of radiation.
  - The Ring badge used is a Thermoluminescent Dosimeter (TLD). The ring badge should be worn on the dominant hand with the TLD chip facing forward the palm of the hand. When wearing gloves, the ring should be worn underneath the glove.

- In Nuclear Medicine, personnel bioassays are used to detect the internal presence of radioactivity in the body and are required to be performed by the technologist between 6 and 72 hours following dosing a patient with Iodine-131.

## Basic Principles of Radiation Protection:

- **Time–** Reducing the time of exposure can directly reduce radiation exposure.

- **Distance**– Increasing the distance between you and the radiation source reduces your exposure by the square root of the distance.

**Shielding** – Shielding (lead aprons, thyroid shields, etc.) can effectively reduce radiation dose in most situations.

- Leaded aprons and thyroid shields are required to be worn by all persons who remain in the exam room during the CT procedure.

- DO NOT eat, drink, or apply cosmetics/contacts in any nuclear medicine area where radioactive materials are used or stored.