

Radiation Safety for OR Staff

Radiation Safety

The North Memorial Ambulatory Surgery Center in Maple Grove (NMASCMG) has an established radiation protection program. This program consists of policies and procedures that provide radiation protection for the safety of patients and ASC personnel.

The goal of the program is to keep the risks from ionizing radiation as low as reasonably achievable (ALARA) with time, distance and shielding being employed to keep radiation exposure within safe levels (2015 AORN, 335).

This self-directed learning module contains information you are expected to know relative to radiation safety to patients, your coworkers and yourself.

Target Audience: Surgery personnel who will come in contact with radiation.

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North Memorial

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Instructions:

This module is intended as an introduction to important radiation safety policies and procedures for NMASCMG personnel. This module is required to be completed upon employment and annually. After completing this module, submit your completed posttest to your manager or the Radiation Safety Officer.

- Read this module
- If you have any questions about the material ask your manager or the Radiation Safety Officer
- Complete the posttest

Learning Objectives:

When you finish this module, you will be able to:

- Define the ALARA program
- List 3 basic principles of radiation protection
- Discuss the general guidelines for personnel monitoring (badge) use
- List the annual radiation limits for occupational radiation workers
- Discuss the fetal dose monitoring program
- Describe posting requirements

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Radiation Protection Program and ALARA Program

The NMASCMG has an established radiation protection program. This program consists of policies and procedures that provide radiation protection for the safety of patients and ASC personnel. The radiation protection program is reviewed annually by the Radiation Safety Officer, the OR Manager and the contracted Consulting Radiologist. Copies of the NMASCMG radiation protection regulations, policies and procedures are available for review. They are kept in the OR Manager's office.

The **As Low As Reasonably Achievable (ALARA)** program is an important component of the radiation protection program. NMASCMG staff and personnel are committed to the radiation protection program and to maintaining individual and collective occupational radiation doses as low as reasonably achievable (ALARA). The ALARA program is also reviewed as part of the annual radiation protection program review.

Radiation exposure can be minimized by utilizing three basic principles:

1. **Time:** Shorter exposure time results in a lower dose (use low dose or pulse mode).
2. **Distance:** Increasing the distance from a source of radiation.
3. **Shielding:** Appropriate shielding (lead apron or lead barrier) greatly reduces the radiation dose.

Radiation Units and Terms

Radiation is energy emitted from unstable atoms. Sources of radiation in the ASC include the big C-Arm, the two Mini C-Arms and radioactive materials implanted in patients by Nuclear Medicine. Our patients who are implanted with radioactive tracers are sources of radiation exposure to staff and medical personnel.

rem:

(rem) *r* oentgen-*e* quivalent-*m* an: the amount of any ionizing radiation that has the same biological effectiveness as 1 rad of x-rays; 1 rem = 1 rad × RBE (relative biological effectiveness).

millirem (mrem): a unit of ionizing **radiation** dose equal to one thousandth (10⁻³) of a **rem**.

Personnel Monitoring Program

Personnel monitoring devices, optically simulated luminescence (OSL) badges, are provided to individuals to measure radiation exposure from s-ray sources. The badges are provided, processed and reported through a commercial service company that meets current National

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Institute of Standards and Technology National Voluntary Laboratory Accreditation Program (NVLAP) guidelines.

Personnel monitoring devices are provided to individuals who:

1. Are likely to receive a radiation dose in one year in excess of 10 percent of:
 - 5 rems, total effective dose equivalent, to the whole body
 - 15 rems, eye dose equivalent, to lens of the eyes
 - 50 rems, shallow dose equivalent to the skin or to each extremity
2. Have declared a pregnancy
3. Meet issuance criteria as assessed by the OR Manager or Radiation Safety Officer

General Guidelines for Badge Use

Technical data published and available from Mirion Technologies indicate that optical stimulated luminescence (OSL) dosimeters issued to NMASCMG teammates provide environmental stability and are not sensitive to heat, humidity, temperature, or other external factors. **The below practices should be followed for wear and storage of the OSL dosimeters/personnel monitoring badges:**

1. It is the responsibility of each individual badge recipient to wear, use and store the badge properly.
2. The whole body badge is to be worn on the body where it will most uniformly measure radiation dose to the head and torso of the wearer. Generally, whole body badges are worn on the breast pocket or collar area. When a protective apron is worn, the badge is to be worn at the collar, outside the apron.
3. The badge assigned for whole body monitoring shall not be used to monitor the extremities (hands, forearms, feet, ankles). Separate badges are assigned for extremity monitoring if deemed necessary.
4. The control badge supplied with each shipment should be stored in a low background radiation area. The control badge shall not be used for area monitoring or assigned to an individual.
5. The individual badges should be left at NMASCMG in a low background radiation area, when not in use.
6. A thorough investigation will be completed if a high exposure or dose is reported on an individual badge reading. The Radiation Safety Officer at NMASCMG reviews all personnel monitoring reports.
7. Badges are issued for occupational radiation dose monitoring only.
8. Badges should never be stored on lead aprons when not in use.
9. Physically damaged badges should be replaced as soon as possible. A replacement badge will be ordered from Mirion Technologies and assigned to the individual for the

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appropriate monitoring period. Report all damaged or potentially damaged badges to the NMASCMG Radiation Safety Officer or OR Manager.

10. Control badges must be returned with the appropriate badge shipment to account for radiation received by the badges during transport or shipment.
11. Each monitored individual must have an assigned radiation monitoring badge.

Fetal Dose/Pregnant Teammate Monitoring

NMASCMG has an established fetal dose monitoring program to ensure an additional level of radiation protection for the fetus of declared pregnant radiation teammates. Individuals who wish to participate in this program should contact the OR Manager or the Radiation Safety Officer to formally declare their pregnancy in writing. After written declaration is received, a fetal badge is issued and a conference regarding radiation safety is held with the individual and the Radiation Safety Officer or OR Manager. The fetal badge should be worn at the waist level. Reports of the fetal badge monitoring are reviewed by the Radiation Safety Officer and the OR Manager. Ideally pregnant teammates will be assigned to cases not involving exposure to radiation.

Occupational Dose Limits

Limits for radiation doses received by occupational radiation workers are defined in the NMASCMG regulations. These limits specify the maximum allowable occupational radiation dose per year. NMASCMG incorporates the ALARA philosophy into their radiation protection program to maintain radiation doses to occupational workers as low as reasonably achievable. The annual dose limits as defined in the NMASCMG radiation protection regulations are:

Part of Body	Maximum Annual Dose
Whole body, Total Effective Dose	5 rem
Fetal Dose, Declared Pregnant Woman	0.5 rem (500 mrem)
Recommended Monthly Fetal Dose	50 mrem per month

As part of the ALARA program, action levels are established which trigger investigation into higher than normal badge reading for an individual. When a badge reading exceeds a certain dose level, the employee is notified as soon as possible of the badge reading. An investigation by the Radiation Safety Officer or OR Manager may be completed. Common action levels are 125 mrem for whole body badges and 30 mrem for fetal badges. Employees are notified of any reported badge reading that exceeds an ALARA action limit.

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Sources of Radiation Exposure

We are continuously exposed to radiation as part of our daily lives. Some sources of radiation exposure include medical x-rays, dental x-rays, nuclear medicine procedures, nuclear power production, radiation therapy procedures, and natural background radiation.

The annual dose to an individual from background radiation is approximately 300mrem per year. Sources of background radiation exposure include cosmic radiation, natural radioactive deposits from the earth, commercial products containing radioactivity, and radioactivity in building and construction materials.

The occupational dose limit for radiation workers is 5000 mrem per year. The dose limit to the public from radiation-related activities, such as diagnostic x-rays is 100 mrem per year. These dose limits exclude the dose contribution from background radiation.

Postings

Areas in the ASC where radiation or radioactive materials are being used are posted with caution signs. Each radiation warning sign must display the three-bladed trefoil symbol. The sign must have a yellow or orange background. The radiation symbol and caution wording may be magenta or black.



Radiation Safety-Fluoroscopic Procedures

1. Limit radiation exposure by minimizing the time spent in the room during radiographic or fluoroscopic procedures.
2. Increase the distance from the radiation source to decrease radiation dose.
3. Wear protective shielding devices, such as lead aprons and thyroid shields. Lead devices shall be worn during fluoroscopy including both c-arm and mini c-arm procedures.
4. Maintain shielding device integrity to prevent damage. Vertically hang lead protective devices. Lead devices will be inspected annually for cracks and defects.
5. No individuals, other than the patient, should be permitted in procedures where fluoroscopy is being used unless:
 - A lead apron is worn by the people in the room

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- Lead gloves are placed on the hands if in the primary beam as deemed necessary by the primary surgeon
 - The individuals follow safe radiation procedures as directed by the OR nurse
6. No individual should be required to routinely restrain or hold patients during fluoroscopy.

Who to contact with questions or concerns

Any questions regarding radiation safety should be directed to the OR Manager or MGH Radiation Safety Medical Director (Dr. Gambach).

Definitions (2015 AORN)

Authorized User:	A physician or someone who has received special training or is credentialed to use radioactive materials and understands radiation physics, radiobiology, radiation safety, and radiation management.
Beam:	A unidirectional flow of particle or electromagnetic radiation
Distance:	The physical space between a source of radiation and its target (or the distance away from a source of radiation). The greater the distance an individual or target is from the source of radiation, the less the amount of radiation exposure. The inverse-square law applies—at a 4 ft distance from the source, the exposure received is approximately one quarter of that received at a 2 ft distance. Likewise, at a 6 ft distance the radiation is one ninth that received at a 2 ft distance.
Dosimeter:	A device that is used to determine the external radiation dose that a person has received.
Rad:	Radiation Absorbed Dose
Scatter radiation:	Radiation is scattered when an x-ray beam strikes a patient's body, as it passes through the patient's body, and as it strikes surrounding structures (i.e. walls, furniture).
Shielding:	Radiation interacts with any type of material, and the amount of radiation is reduced during passage through materials. A thin layer of lead can absorb most scattered diagnostic x-rays. Radiation...is substantially attenuated by 1 to 2 inches of lead.
Time Factor:	The less time a person is exposed to radiation, the less radiation one absorbs.

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Posttest

Name: _____ Date: _____

Circle the correct answer

1. **Radiation workers are allowed an annual radiation dose of:**
 - a. 100 mrem
 - b. 500 mrem
 - c. 5 rem
 - d. 50 rem

2. **The fetus of a declared pregnant employee is allowed a radiation dose of:**
 - a. 500 mrem
 - b. 100mrem
 - c. 5 rem
 - d. none of the above

3. **ALARA means:**
 - a. as long as radiation allows
 - b. as long as regulations allow
 - c. as low as reasonably achievable
 - d. as low as rationally attainable

4. **The three basic principles of radiation protection are:**
 - a. time, distance, shielding
 - b. containment, protective clothing, surveys
 - c. lead aprons, surveys, distance
 - d. none of the above

5. **When a lead apron is worn, the radiation monitoring badge should be worn:**
 - a. on the collar outside the apron
 - b. under the thyroid shield
 - c. on the sleeve
 - d. in your shoe

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6. **Radiation warning signs should be posted when the C-Arm is in use:**
 - a. on the c-arm itself
 - b. on the anesthesia machine
 - c. on the rack of lead aprons
 - d. on the outside of the OR door

8. **Lead aprons and thyroid shields are:**
 - a. checked annually for cracks and defects
 - b. folded neatly when not in use to maintain integrity
 - c. only required when using the big c-arm
 - d. not necessary if the case is less than 30 minutes in length

9. **Instructions for wear and storage of the OSL dosimeters/personnel monitoring badges:**
 - a. it is the responsibility of each individual badge recipient to wear, use and store the badge properly
 - b. badges should never be stored on lead aprons or in ORs when not in use
 - c. the fetal badge should be worn at the waist level
 - d. all of the above

10. **The goal of the radiation program is to keep the risks from ionizing radiation as low as reasonably achievable (ALARA) with time distance and shielding being employed to keep radiation exposure within safe levels**
 - a. True
 - b. False

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Orientation Checklist:

By initialing each bullet point you are acknowledging that you have a working knowledge of each area of radiation safety.

- ALARA Program _____
- Time, Distance, Shielding _____
- Personnel Monitoring Program _____
- General Guidelines for Badge Use _____
- Postings (Radiation Area) _____
- Location of Radiation Safety Manual & Policies _____

- Emergency Shutdown Procedure _____
- Who to contact _____
- I have reviewed the manufacturer's instructions for each of the 3
CArms _____

I have completed the Radiation Safety Training at North Memorial ASC Maple Grove and I have been oriented to the ASC's Radiation Safety Manual and Policies.

Employee Signature _____ Date _____

Clinical Educator _____ Date _____