G.9: Quantitative Reasoning Assignment

Sample 2

Radiation Field Survey Project

Instrument Needed: Ionization Chamber
Operation Mode: mR/h (operation as a rate meter in mR per hour) Radiology Area: Fluoroscopy

Instructions

1. Inform the Radiologist, supervisor and technologist in advance that you will be obtaining radiation measurements during the procedure. And obtain permission.
2. Choose an exam where the technologist does not need your assistance, or where another student is available to assist with the fluoro procedure. You should be an extra person in the room where you would not be expected or needed to assist the radiologist or patient.
3. Wear a lead apron with your dosimeter outside the apron. Have a set of lead gloves available.
4. It may be necessary to obtain your readings over the course of several different fluoro studies in order to get them all. You should not ask the radiologist to alter the exam at all to accommodate your assignment.
5. Meter Operation:

Press the power switch located on the right side of the screen. Allow the meter to initialize. This process takes less than a minute. It is done when the bar meter stops reading close to zero. The meter should default to mR/h and begin to read. The numbers will fluctuate as the meter reads the radiation rate in mR/hour. To obtain your readings hold the meter upright, with the black bottom facing the radiation source. Record your readings as indicated below.

6. Hold the meter, and obtain readings at the following locations during the beam-on time of the fluoroscopic operation:

   A.  1. Approximately 2 feet at a right angle to the protective lead curtain of the fluoroscope (see diagram)

       mR/hour

   2. Approximately 4 feet at a right angle to the protective lead curtain of the fluoroscope *see diagram)

       mR/hour
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3. Approximately 6 feet at a right angle to the protective lead curtain of the fluoroscope (see diagram)

\[ \text{mR/hour} \]

4. Approximately 8 feet at a right angle to the protective lead curtain of the fluoroscope (see diagram)

\[ \text{mR/hour} \]

B. 1. Approximately 2 feet at a 45 degree angle to the protective lead curtain of the fluoroscope (see diagram)

\[ \text{mR/hour} \]

2. Approximately 4 feet at a 45 degree angle to the protective lead curtain of the fluoroscope (see diagram)

\[ \text{mR/hour} \]

3. Approximately 6 feet at a 45 degree angle to the protective lead curtain of the fluoroscope (see diagram)

\[ \text{mR/hour} \]

4. Approximately 8 feet at a 45 degree angle to the protective lead curtain of the fluoroscope (see diagram)

\[ \text{mR/hour} \]

C. Place the meter (don’t hold it) on the x-ray table in the following locations:

1. At the far foot of table:
2. At the far head of table:
3. Hold the meter and step back approximately 2 feet from the foot of the table and measure:
4. Hold the meter and step back approximately 2 feet from the head of the table and measure

D. 1. Stand behind the radiologist and see if you get a reading:

E. While wearing a lead glove, step behind the control panel (protective booth), and obtain a reading while holding the meter in the following locations:

1. Well behind the protective booth:
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2. Just outside of the protective booth with a lead gloved hand:

3. Record the KVP of tube operation:

4. Record the mA of tube operation:

5. Patient Size

(small/average/large): Questions

Each student in the group should answer the following questions individually and submit an individual paper.

Discuss your findings, and the implications for the various distances and locations measured. Relate it to the inverse square law.

As the distance increased by 2 feet, the intensity of the radiation decreased by approximately one quarter (1/4).

Compare how the scatter coming from the patient (extended source) differs from radiation being emitted from a point source such as the x-ray tube. Does scatter coming from the patient follow the inverse square law in how the intensity changes at different distances. Why or why not?

According to the classic inverse square law, if the exposure was 60 mR/hour at a distance of 2 feet, what should it be at 4 feet?

Where is the safest place to stand during a fluoroscopic study? What physical factors contribute to this being the safest?

Where is the least safest place to stand during a fluoroscopic study? What physical factors contribute to this being the least safe? (exclude the control panel area)

Thanks to Kim Utley for allowing use of this sample.