Name: _____   Date: _____   Team: _____

# Lab Experiment # 8

## Direct Square Law

*Computed Radiography (CR)*

### Purpose

This digital (CR) system experiment is designed to demonstrate how to maintain exposure index and SNR when changing SID.

### Learning Objectives

After completing this lab, you should be able to:

1. Use the laboratory equipment properly.
2. Set up the control console and ceiling tube mount correctly.
3. Function effectively in group work.
4. Perform the experiment independently.
5. Calculate the appropriate mAs to compensate for a change in SID to maintain exposure index and SNR.
6. Explain the Direct Square law.
7. Summarize the mAs and SID relationship when exposure index and SNR.
8. Predict the effect of the change in mAs and SID on exposure index and SNR.

### Materials Needed

- 10 x 12 IP
- Hand phantom
- Set of lead numbers

# Pre-Lab Discussion

## *Direct Square Law – Density/Exposure Maintenance Law*

*The direct square law is used to <u>maintain</u>  Exposure index and SNR.*

*The change in mAs is <u>directly</u> proportional to the <u>square</u> of the change in SID*

According to the Inverse Square Law, the amount of radiation received at a given point is inversely proportional to the square of the distance between the point and the radiation source.

**<span style="color:red">To compensate</span>** for a change in distance you must make the exposure at the new distance equal what the exposure was at the old distance.

Therefore:

As distance **INCREASES**, mAs must be **INCREASED** *significantly*

As distance **DECREASES**, mAs must be **DECREASED** *significantly*

Symbolically:

$$\uparrow \left\| \quad \frac{\text{mAs}_{new}}{\text{mAs}_{old}} = \frac{(\text{Distance}_{new})^2}{(\text{Distance}_{old})^2} \quad \right\| \uparrow^2$$

Distance **=** SID **or** SSD

### *Radiographically:*

- ✓ An INCREASE in mAs will compensate for an INCREASE in SID and MAINTAIN exposure index and SNR.
- ✓ A DECREASE in mAs will compensate for a DECREASE in SID and MAINTAIN exposure index and SNR .

# Dosimeter Worksheet

| Exposure 1 65 kVp 0.5 mAs | Exposure 2 65 kVp 2.0 mAs | Exposure 3 65 kVp 8.0 mAs |
| --- | --- | --- |
| 18-inch Distance (46 cm) | 36-inch Distance (92 cm) | 72-inch Distance (183 cm) |
| Actual dosimeter reading | Actual dosimeter reading | Actual dosimeter reading |
| **Record the dosimeter reading in the row above. Then, calculate the expected dosimeter readings and record them in the boxes to the right.** | Expected dosimeter reading | Expected dosimeter reading |

# Procedure
## Computed Radiography

### Hand Radiograph

*Instructions for Exposures 1 through 3.*

1. When adding images to your new exam use system diagnostic menu.

2. Use the Computed Radiography IR.

3. Direct the central ray **perpendicular** to the third MP joint.

4. Tape the appropriate ID markers onto the image receptor within the collimated light field so they do not obscure any areas of interest.
   (The room, side and exposure number must be labeled on **all** radiographs.)

5. Set the x-ray tube, mode of operation and focal spot size as indicated on **Worksheet** .

6. Make all the exposures using the settings indicated on **Worksheet** .

7. In the worksheet write LGM numbers. Indicate overall image brightness and noise level of each image.



**Lab 8**
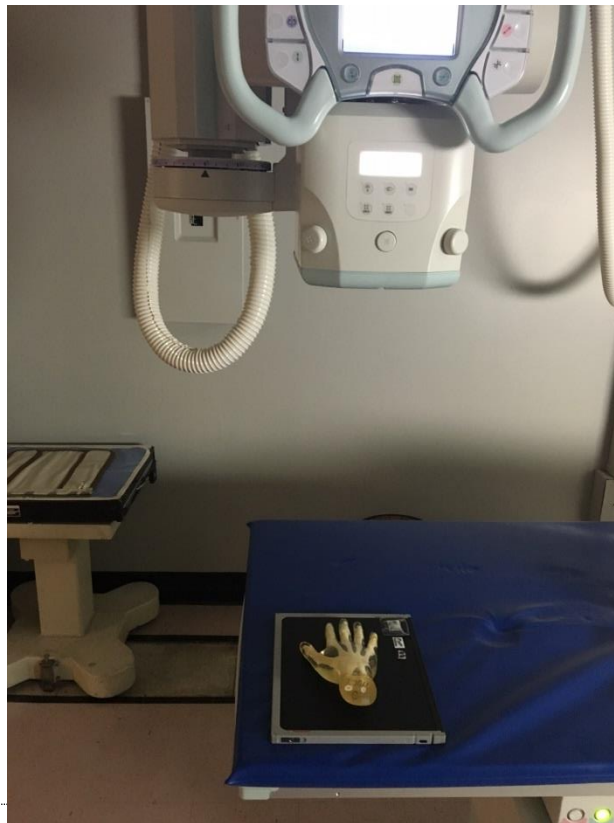
# Worksheet

## CR

| | kVp | Focal Spot | SID | mAs | mode | bucky | LGM |
|---|---|---|---|---|---|---|---|
| **1** | **65** | | 18" (46 cm) | **0.5** | manual | no | |
| **2** | **65** | | 36" (92 cm) | **2.0** | manual | no | |
| **3** | **65** | | 72" (183 cm) | **8.0** | manual | no | |

# Worksheet

| | LGM | Briefly describe the overall brightness, contrast and noise level of each image. |
|---|---|---|
| **1** | | |
| **2** | | |
| **3** | | |