Name: _____ Date: _____ Team: _____

Lab Experiment # 7B

Automatic Exposure Control Systems

Comprehensive review

Direct Radiography

Purpose

This experiment is designed to demonstrate the proper use of automatic exposure control (AEC) systems as well as the most common configurations and limitations.

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. Set up the control console or an automatic exposure control system.
6. Explain the common limitations of AEC.
7. Summarize the appropriate relationship between kVp, SID, mA, density selectors and AEC.
8. Predict the effect of the change in radiation detectors, kVp, SID and mA on exposure index.

Materials Needed

- 35cm x 43 cm FPD image receptor
- Abdomen Phantom
- Set of radiopaque markers

Pre-Lab Discussion

AEC Systems

The primary limitation when manually setting the exposure factors for an examination is that the radiographer only determines the radiation in the primary beam/signal. An unknown amount of absorption and scattering takes place as the radiation passes through the object; so, ***the intensity of the image-forming radiation in the exit beam is different for each examination***.

An AEC system works on a very simple assumption to overcome this problem. When the correct amount of radiation reaches a specific area of the image receptor an optimum exposure will be produced for the entire image receptor.

Automatic exposure control systems contain special, highly sophisticated radiation detectors that measure the quantity of radiation reaching the image receptor **as the exposure is taking place**; once a pre-set amount that corresponds to optimal density is reached, the systems shut off the x-ray timer, thereby terminating the radiation.

This is analogous to baking a turkey in the oven after inserting a pop-up timer into the breast of the chicken. When the temperature of that specific area of the breast is correct, the timer pops up to indicate the entire chicken is done. The assumption is that when that area has reached the correct temperature, the entire chicken has reached the correct temperature.

Consequently, when the **dominant area** of an image receptor has received the pre-set amount of radiation that corresponds to optimum exposure, the entire image receptor has received the correct amount of radiation; so, the ***exposure*** will generate optimum diagnostic quality image.

A **dominant area** is not the most dense or least dense; it ***is any area of the object that, when properly exposed, will ensure that the entire object will be properly exposed***.

Precise alignment of the dominant area of the anatomic part and the active radiation detector(s) is critical when using AEC systems. They can only guarantee an optimum exposure for structures positioned **in front of** the active detector(s).

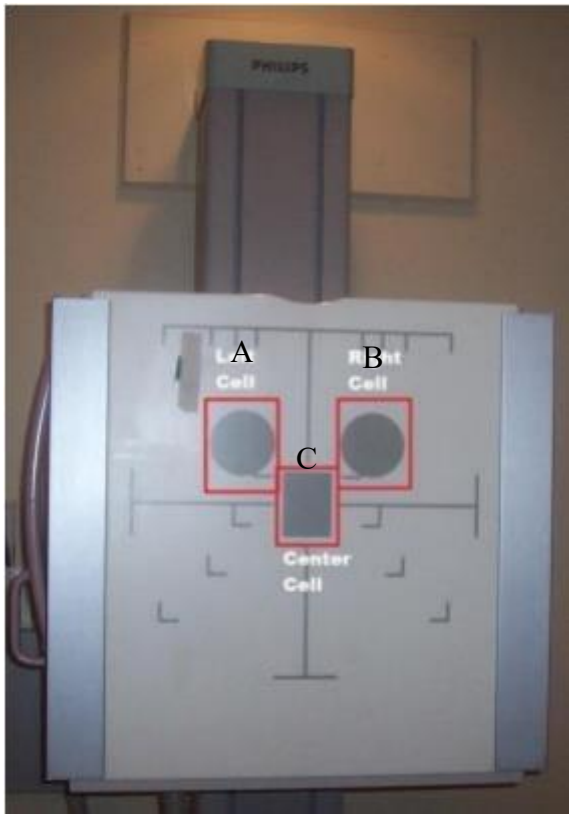
The radiographer does not control exposure time. The AEC system controls the exposure time, and as a result, the mAs used for each examination. All other factors may be set manually.

With many of the newer digital imaging systems, when the radiographer sets the body part and position, ***the AEC automatically selects the radiation detectors for the dominant area(s), optimum kilovoltage for penetration, mA station, and default back-up time for the exam***.

Experimental Setup

Instructions for Exposure 1

1. Place a direct radiography FPD image receptor in the **bucky lengthwise** and set the SID to 40 inches.
2. Place the **Whole Body Phantom** on the tabletop positioned for the KUB exam.
3. Direct the central ray **perpendicular** at the level of iliac crest and the midsagittal plane.
4. Tape the appropriate ID markers onto the tabletop 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 control console to the **AEC** mode.
6. Make exposer **1-18** using the settings indicated on the worksheet.
7. Record the mAs and time for each exposure. It will be displayed on the control console **immediately after each exposure has been completed**.
8. Record the TEI, EI, and DI for each exposure.



Lab 7

Technique Worksheet

Direct Radiography

The wireless digital (FPD) image receptor can only be handled by an instructor!

	Speed MHL	kV	FSS	Backup		Density	Grid	SID	mAs time	EI
1	?	84	Large	?	A,B,C	0	bucky	40”	?	?
2		84	Large		A&B	0	bucky	40”		
3		84	Large		B only	0	bucky	40”		
4		84	Large		C Only	0	bucky	40”		

**** Determine optimal technical factors for KUB study # 1 (speed of IR, backup time, and density settings) DI<0.5***

	Speed	kV	FSS				Grid	SID	mAs time	EI
5		**64**	Large		A,B, C	0	bucky	40”		
6		**74**	Large		A,B, C	0	bucky	40”		
7		**84**	Large		A,B, C	0	bucky	40”		
8		**94**	Large		A,B, C	0	bucky	40”		
9		**104**	Large		A,B, C	0	bucky	40”		

	Speed	kV	FSS				Grid	SID	mAs time	EI
10		84	Large		A,B, C	0	bucky	**55”**		
11		84	Large		A,B, C	0	bucky	**45”**		
12		84	Large		A,B, C	**0**	bucky	**35”**		

	Speed	kV	mA				Grid	SID	mAs time	EI
13		84	**100**		A,B, C	0	bucky	40”		
14		84	**200**		A,B, C	0	bucky	40”		
15		84	**400**		A,B, C	0	bucky	40”		

	Speed	kV	FSS				Grid	SID	mAs time	EI
16	**M**	84	Large		A,B, C	0	bucky	40”		
17	**L**	84	Large		A,B, C	0	bucky	40”		
18	**H**	84	Large		A,B, C	0	bucky	40”		

Worksheet

	TEI, EI, DI	Describe the effect of the technical change (yellow background) on mAs, exposure time, and exposure index (EI).
1–4		
5–9		
10 – 12		
13-15		
16-18		