

- ❑ Conducting the Fluoroscopic Examination
- ❑ Basic Operational Procedures
 - ❑ Pediatric Fluoroscopy
 - ❑ Mobile Fluoroscopy Equipment

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Conducting the Fluoroscopic Exam

- Technical factors **directly** influencing dose rate
 - mA
 - kVp
 - Collimation
 - Filtration
 - Exposure time
 - Target to panel distance

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mA

- Measure of tube current
- Measure of the quantity of x-ray
- X-ray output is directly proportional to mA
- Number of photons affect dose rate
 - An increase in photons equates to an increase in patient dose

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kVp

- Measure of tube potential
- Determines the penetrating ability of x-rays
- Refers to the quality of the beam
- Maximize differential absorption

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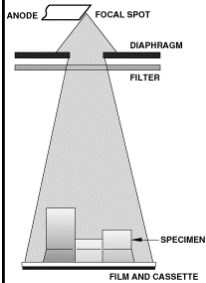
Collimation



- Most effective method to reduce patient and operator exposure
- At 14 inches above table a border must be seen on the monitor (if using manual collimation)

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Filtration



- A material placed in the useful beam to absorb less penetrating radiation
- May not be less than 2.5 mm of aluminum filtration
- Inherent 0.5 mm
- Added 2.0 mm
- 2.5 mm total at 80 kVp

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Half Value Layer



- Material which reduces radiation intensity by 50%
- A diagnostic tool
- Standard thickness of 3 mm used at normal operating voltages (80 - 120 kVp)

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Exposure Time

- The X-ray beam “on” time
- Reducing beam “on” time decreases patient exposure
- Cumulative manual reset time
- Predetermined time limit may not exceed 5 minutes
- Designed to protect patient

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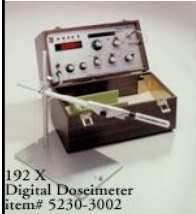
Allowable Exposure Rates



- Dose Rate at 80 kVp not to exceed 2.2 R/ mA per min or 5 R total
- Exposure rate not greater than 10 R/min with boost
- Devices that indicate current must be provided

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Allowable Exposure Rates



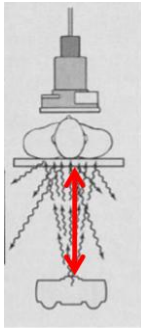
192 X Digital Doseimeter Item# 5230-3002

- Monitoring of the exposure (tube current) **must** take place weekly
- Logs **MUST** be kept
- Evaluation of rates by a physicist once each 3 years, or with replacement or modification (w/o AEC)
- Cine (& units w/ AEC), once a year and any time modification is done

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Target to Panel Distance (TPD)

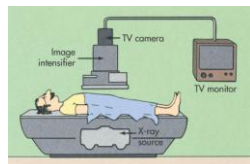
- AKA source-to-tabletop distance (STTD), source-to-skin distance (SSD)
- Patient receives less dose with an increased distance from the x-ray tube
- Should be at least 18", shall be no less than 12"



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Courtesy Stephen Barber, Colfax

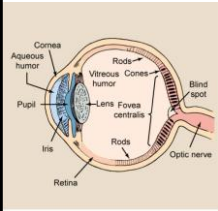
Conducting the Fluoroscopy Exam



- **Indirectly** influenced exposure factors
 - Lighting
 - Poor image receptor quality
 - Low absorption table tops

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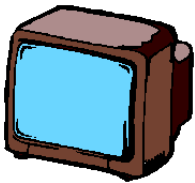
Lighting



- Visual acuity: the ability to see fine detail
- Rods
 - Black and white (Scotopic)
- Cones
 - Color, daylight (Photopic)
- Cones at central retina
- Rods at periphery

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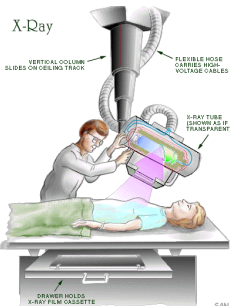
Lighting



- Dim room to enhance visualization of B & W TV images
- Normal viewing distance 12-15 inches
- Image Integration time of at least 0.2 seconds

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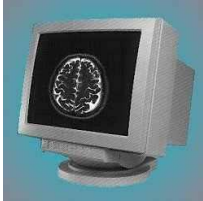
Low Absorption Table Tops



- May not be more than 1 mm Al/eq at 100kvp
- Increased thickness increases patient dose

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Image Receptor Quality



- Poor conversion due to age (input or output phosphors)
- Maladjusted image intensifier
- Feedback loop system (ABS circuit adjusting kVp and mA)

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Conducting the Exam

- Patient and operator shielding are important exposure reducing considerations
 - Gonadal shielding (*shall* be no less than 0.5 mm Pb)
 - Bucky slot cover (must be covered with at least 0.25 mm Pb)
 - Three-phase or high frequency generators make x-ray generation more efficient

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High Voltage Generation

“From the standpoint of patient dose and radiographic quality (when radiographic technique is adjusted to same density and contrast), there is no appreciable improvement with the three-phase generator or high-frequency generator in standard imaging techniques.”

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Basic Operational Procedures

- Minimization of beam “on” time
- Manual reset timer
- Maintenance of:
 - Low mA
 - Optimal kVp
 - Collimation
 - Proper dose rate
 - Minimal magnification
 - Limited high-level fluoroscopy (boost)

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Basic Operational Procedures

- Image recording
 - Video tape, photospot / digital photospot recording, conventional spot filming,
- QC of image intensifiers
- TV camera/monitor
- Minimal patient-to-intensifier distance

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Basic Operational Procedures

- Position to the area of interest prior to fluoroscopy
- Reduce patient motion
- Provide gonadal shielding
- Reduce extraneous room light
- Ensure bucky tray is moved from to one end of the table

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Pediatric Fluoroscopy



- Motion will present the biggest challenge
- Personnel need to wear lead gloves and aprons if holding a child
- Gonadal shielding of at least 0.5 mm Pb
- Clothing and diapers create artifacts
- Avoid using ABC or ABS
- Use shortest possible patient-to-image distance

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Pediatric Fluoroscopy



- Collimate to area of interest
- May have to manually override automatic collimation
- Cine frame rates to a minimum
- Grids increase radiation & are not necessary for use with infants
- Photospot, spot film cameras, and digital photospot cameras/recording preferable to conventional spot film imaging

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Mobile Operation

- An audible indicator when radiation is produced
- Time accumulator incorporated into the video display
- Analog or digital video storage system
- “Last frame hold” feature (LIH)
- Longest possible “cone” / “spacer” to increase SSD

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Mobile Operation



- C-arm cover
- Properly functioning locks
- Equipment in good physical condition
- Appropriately cleaned & covered

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Mobile Fluoroscopic Equipment

- Structural shielding will be the same if used in a fixed space
- Minimum 12" SSD
- Image intensification MUST be provided
- Shall be impossible to operate if collimating cone or diaphragm is not in place
- Maximum permissible dose rate shall not exceed 5 rads/min @ 30 cm (12")

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Mobile Fluoroscopic Equipment

- Personnel monitoring **REQUIRED** for those using mobile equipment
- Protective aprons of at least 0.25 mm Pb worn if one is likely to receive 5 mR/hr or more
- Use boost position (high level control button) only when necessary
- If boost is used, there must be a continuous audible signal

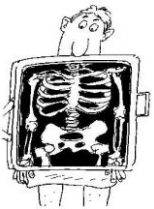
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Responsibility & Supervision

California Title 17

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Activities & Supervisory Categories



- Authorizing Personnel
- Documentation of licensure
- Monitoring and Maintenance Records
- Incident Notification
- Continued Education
- Safety Provisions

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Supervisor Responsibility



- Shielding
- Equipment registration
- Supervision of operators

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Authorized Personnel

- Only those persons with valid permits or certification
- Licentiates of the healing arts, including MD's, DO's, DPM's, and DC's
- Those with Fluoroscopy supervisory permits

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Authorized Personnel (cont)



- Those with Radiology supervisory permits (general radiology)
- Dermatological supervisor and operator permits for low level skin treatment.

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Authorized Personnel (cont)

- Certified technologist with at least 2 years of formal training
- Students in approved programs
- Physician assistants with formal training and certification
- Limited permit technician with less than 2 years of formal training can not do Fluoroscopy

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Scope of Practice

- Supervision is limited to scope of practice
- Technologists and PAs may only practice under approved supervision
- Technologists do not interpret x-rays or imply intent to do so

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Display of Documents

- Certificates and permits issued by the RHB must be posted in the place of work.
- Photocopies will suffice for individuals with multiple employers
- Permits must be prominently displayed.
- For large groups a list of licensed/certified individuals will suffice with information about the location of the actual documents.

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Display of Documents

Sign Posted at ALL Entrances to ATLAS



- California regulations RH-2364 "Notification to Employees" must be posted.

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Record Keeping



DATE	TIME	LOCATION	TYPE	VALUE
1/15/15	08:00	LABORATORY	TEST	0.05
1/15/15	08:00	LABORATORY	TEST	0.05
1/15/15	08:00	LABORATORY	TEST	0.05
1/15/15	08:00	LABORATORY	TEST	0.05
1/15/15	08:00	LABORATORY	TEST	0.05

- Calibration, test, survey, repair for a period of 3 years
- Receipts of transfer and or disposal kept 3 years
- Dosimetry reports kept indefinitely

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Record Keeping

- Dosimetry reports come out monthly or quarterly
 - In units of rem or mrem
- Badge reporting not to exceed one year
- Film processor records logs 1 year

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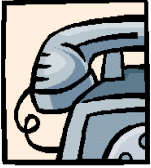
Over-Exposure of Monitoring Badges



- An over exposure of a film badge, or dosimeter type device is considered to be presumptive evidence of exposure and **not definitive information**

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Reporting Over Exposures



- Immediate notification means by phone
- 24 hr notification means by phone
- 30 day notification means in writing
- In all cases written follow up occurs in 30 days

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Immediate Notification



- 25 Rem (0.25 Sv) to the total body
- 75 Rem (0.75 Sv) to the eyes
- 250 Rem (2.5 Sv) to the skin

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24 Hour Notification



- 5 Rem (0.05 Sv) Total body
- 15 Rem (0.15 Sv) to the eyes
- 50 Rem (0.5 Sv) to the skin
- Again, to be done by phone

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Request For Renewal

- Must be filed 30 days prior to expiration
- Changes of address must be reported in 30 days

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Inspection of Equipment

- Machinery not meeting specification shall not be operable
- The State (RHB) can inspect without notice at any time

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Structural Shielding



- Must be in compliance with state specifications
- Primary Barrier 1/16 inch lead or equivalent
- Secondary Barrier 1/32 inch lead or equivalent
- 6 feet 8 inches

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Health And Safety Code



- Un-Lawful operation shall be in violation of HSC Sec (107075)
- Failure to operate within codes is a misdemeanor
- Regulations fall under state law (California Code of Regulations)

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Permit Holders

- Be familiar with procedure to be done prior to exposure
- Clear Fluoroscopy room of all non-essential personnel prior to exam
- Collimate to the area of interest
- Eliminate artifacts

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Permit Holders (cont)

- Patient gonadal shielding is mandatory (unless it interferes with the exam)
- Maintain a technique chart which is consistent with the ALARA principle
- Observe proper positioning
- Take steps to avoid motion

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Scope of Supervision

- Direct: Under personal supervision.
 - The Supervisory personnel works ***directly*** with the technologist / PA
- Indirect: The supervisory personnel is available for direct supervision

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Operator Performance

- Perform duties correctly and conscientiously
- Wear protective aprons of at least 0.25 mm during fluoroscopy
- Avoid holding patients

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Technologist Performance

- Know appropriate views to take
- Use optimal film and processor techniques if using film/screen
- If using CR (cassette-based radiography) use the correct algorithm for the body part

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Radiation Protection



- Protective lead aprons minimum of 0.25 must be worn
- Monitoring device at the collar of the apron for Fluoroscopy & at waist for routine radiography
- Technologist should remain behind secondary barrier
- Maintain at least 6 feet during portable operation.

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Radiation Protection



- When possible devices such as eye wear, thyroid shielding, gloves, or use mobile shielding
- Standard thicknesses of lead aprons eliminate about 96% of exposure from scatter
- Monitoring required when one could receive 1/10 of the annual EfD

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Continuing Education

- No less than 10 CEUs at renewal every 2 years
- At least four (4) of the credits address radiation safety for the clinical uses of fluoroscopy
- Documentation must be maintained for four (4) years following the date the credits were earned

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Continuing Education (cont)

- “Approved continuing education credits” means one hour increments of instruction received in subjects related to the application of X-ray to the human body, which have been accepted for purposes of licensing, credentialing, assigning professional status, or certification, by any of the following entities:
 - American Registry of Radiologic Technologists (ARRT);
 - California Physician Assistant Committee;
 - Medical Board of California;
 - Osteopathic Medical Board of California;
 - California Board of Chiropractic Examiners; or
 - Board of Podiatric Medicine.

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