Quality Assurance (QA) Program

www.health.state.mn.us/xray

All individuals who operate an x-ray system shall be initially instructed and annually retrained in facility-specific and system-specific safe operating procedures.

ALARA (As Low As Reasonable Achievable)

The principle of limiting the radiation dose of exposed persons to levels as low as is reasonably achievable.

The Minnesota Ionizing Radiation Rule defines ALARA as making every reasonable effort to maintain exposure to radiation as far below the dose limits as practical, consistent with the purpose for which the registered activity is undertaken.

Radiation Safety Officer (RSO)

The radiation safety officer for this facility is _____

Accumulated Occupational Dose

No doctor or staff member who operates the radiographic equipment will receive in one calendar quarter an occupational dose in excess of 25% of the applicable standard. Personnel dosimetry is not required.

Hold of Patients and/or Films

No operating or non-operating personnel will hold patients or cassettes (films).

Except for the operator, no other staff members or individuals will be allowed within the x-ray room during x-ray procedures.

No staff member under 18 years of age will operate radiographic equipment or be exposed to any occupational radiation dose.

Ordering of Radiographic Examinations

The order for radiographic procedure must include clearly stated clinical indications for the examination and be available to procedure personnel at the time of examination.

In the office, the views done, the factors and a brief indication for doing the examination will be recorded in the patient's file.

When x-rays or CT scans are ordered at an outside facility, the request will be in writing and signed by the doctor. The request will include a brief statement outlining the indications for the examination. A copy of this will be kept in the patient's file.

Radiographic Technique Chart

A radiographic technique chart shall be provided in the vicinity of the x-ray systems control panel which specifies the following information:

1. Patient's anatomical size and corresponding technique factors to be used
2. The type of screen-film combination
3. The source-to-image distance
4. For automatic exposure controls (AEC) or photo-timed units, the percent differences between the AEC increments.

Frequency of Tests

Daily (Days X-rays Taken)

Every day films are taken, processor testing needs to be conducted prior to developing the first patient's films. The results of the testing need to be recorded on a quality control log. If corrective actions are needed, they are logged in and the test repeated to insure the processor is in compliance.

Sensitometry and densitometry

Keep films for 60 days. The QA logs are kept until the next State inspection.

Processor temperature check

If you process less than 10 films per week, do QA the first day films are processed.

For days that films are not processed, chart this on the QA log.

Digital X-ray Units

Follow manufacturer's recommendations for quality control requirements. Copy the manufacturer's recommendations and include this in the QA manual. This must identify the tests that are required, the frequency of the test and the acceptable limits. Keep a log of the quality control records until the next inspection.

Quality Assurance Program

Sensitometry
Densitometry

Items Needed

1. Sensitometer/Densitometer
2. Thermometer (NOT Mercury)
3. Fresh box of film
4. Monitoring charts

Set Sensitometer for the appropriate film spectral sensitivity (blue or green).

To Establish Control Values:

- Expose and process a control film for 5 days
- Average results for speed, contrast and gross fog values

Expose Control Film

For double emulsion film, it is recommended that an exposure be made on each emulsion side at opposite ends of the film.

Read the density of the middle of each step.

When the processing chemicals are changed and the processor or hand tanks are cleaned, a new processing control chart is started. The first sensitometric test is the standard or Day 1. The other days are compared to this.

From the sensitometric film, make the appropriate measurements and plot these on the processing control chart. As long as the measurements remain within the tolerance limits, the processor may be assumed to functioning properly. If a measurement falls outside the tolerance range, it should be repeated on a second sensitometric film. If the second measurement also falls outside the tolerance range, appropriate action must be taken to determine the problem. The problem and action taken to correct it should be recorded on the processing control chart.

Sensitometry and Densitometry

For routine processor monitoring, three measurements of optical density are made:

Base plus Fog (Gross Fog)

Measurement is made in the area of the film that has not been exposed.

Tolerance limit +0.03

Speed Index

This is the step with a density nearest 1.2 (speed step). This is a direct indicator of film speed. Variations in processor conditions, such as temperature or developer activity, are monitored on this step.

Tolerance limit ± 0.15

Contrast Index*

1. Select the step closest to but not larger than 2.20.
2. Select the step with the density closest to 0.45 but not lower than 0.45.
3. Subtract the density value obtained in #2 from the density value obtained in #1. This value is the contrast index.

*Shortcut for contrast index determination: Measure the density of the step two steps above the speed step. Measure the density of the step two steps below the speed step. Subtract the lower density value from the higher density value. Use this value as the contrast index.

Tolerance limit ± 0.15

Sensitometry

Automatic Processing

Turn processor on and allow adequate warm-up (10-30 minutes)

Check developer temperature and record on processing control chart (utilize a non-mercury dial thermometer or digital thermometer).

Manual Processing

Turn water on and stabilize the temperature of the developer to 68 degrees. Be sure to stir the solutions before checking the temperature.

If you are utilizing only one stirring rod, always stir the developer first, rinse the stirring rod and then stir the fix.

A separate box of film is used for processor monitoring. Expose film in sensitometer. Process the film and visually compare to the standard film (day 1). If steps match, process radiographs. If there is a significant deviation, determine what the problem is and correct it. Expose and process another sensitometric film.

X-Ray Room Log

Log in each patient and information

Quarterly

Repeat Analysis
First 1000 films
Keep the paperwork until the next state inspection.

Semiannually

Dark Room Fog Test – Keep films until next state inspection

Tolerance limit: ≤ 0.08 increase in density

Method A: Expose film and cassette. 40 inches, non-bucky. Use 50 kVp, 5 mAs or 50 kVp, 2.5 mAs

Take the cassette into the dark room and unload the film. Immediately cover one-half of the film with another cassette or a piece of cardboard. Expose the film for 2 minutes. Process the film. Measure the densities on both ends of the film. The density should be within 0.08. if the density is above normal limits. There is a problem with the safelight or there is a light leak within the dark room.

Method B: Use the fastest film normally handled in the darkroom. Expose both ends of the film with the sensitometer. Immediately cover one-half of the film with a cassette or a piece of cardboard. Expose the film for 2 minutes in the darkroom with the safe light on. Should produce less than a 0.08 increase in the mid-density portion of the film (at a density of about 1.20)

The test should be done in the following instances:

1. If the safelight is changed or additional safelights are added.
2. Whenever the safelight bulb is changed.
3. If faster film is utilized.
4. Whenever it is suspected that dark room fogging is occurring.

Some of the reasons for dark room fogging:

1. There is a dark room light leak.
2. A faulty safelight housing.
3. The safelight filter is faded, cracked, or incorrectly positioned.
4. The illumination intensity is too great. This may be due to: too high a wattage bulb, multiple safelights, or the distance between the safelight and the film is too small.
5. The safelight filter is not compatible with the spectral sensitivity of the film being used.

Annually

Radiation Program Audit
Keep the paperwork until the next state inspection.

Biennially

1. **X-ray machine**

Equipment performance evaluation. Contact x-ray company that services your equipment to complete this evaluation. Keep the paperwork until the next state inspection.

2. **Sensitometer-Densitometer Calibration/Repair**

Contact: Steve Danielson at Acurad Technical Services
Phone: 612-940-9809 or 612-781-2218

Keep the paperwork until next state inspection

3. **Screen-Film Contact** – Keep films until next state inspection

Utilizing a coarse copper mesh, the cassette is covered and exposed. The film is processed and evaluated for evidence of poor contact.

4. **Screen Speed Match** – Keep films until next state inspection

Tolerance limit ± 0.10 for all cassettes.

Four cassettes are grouped together and exposed with factors that will produce a density of approximately 1.20. The films are processed and the density of each is determined. Cassettes that produce film densities in the excess of the tolerance range should be taken out of service.

5. **Integrity of Protective Aprons and Shields** – Keep films until next state inspection

Any flat shields or aprons should be x-rayed for evidence of cracks. Irregular-shaped shields and protective gloves should be x-rayed and visually evaluated for cracks and defects.

Records (Forms/Paper Work)

Keep until next state inspection

Personnel Monitoring

Use if individual receives, or is likely to receive, a dose in any calendar quarter over 25% of the applicable value.

Personnel monitoring records must be preserved for the lifetime of the individual worker or a minimum of 30 years after termination of employment with a facility, whichever is less.

Pregnant Workers

If embryo or fetus has a potential of receiving greater than 0.125 rem (1.25 mSv) during the entire pregnancy, the registrant must:

1. Provide a dosimeter to be worn at the level of the abdomen
2. Limited the dose to the embryo or fetus to 0.05 rem (0.5 mSv) in any one month
3. The total effective dose equivalent to the fetus for a full-term pregnancy must not exceed 0.5 rem (5 mSv)

Gonad Protection

To be used for patients who have procreative potential. Gonad protection will be used when the gonads are in or within two inches (5cm) of the useful beam, except for cases in which the shielding would interfere with the diagnostic procedure. All x-ray machine operators must be instructed as to the proper placement, size, and the type of gonad shielding to be used. Documentation of the instruction must be retained for review.

X-Ray Room Log

Only record the age of the patient if they are a minor

Date	Patient	Age	Study	# Films	Operator	# Repeat films	Reason For repeat

1-Too light 2-Too dark 3-Motion 4-Artifact/Jewelry 5- Pt. Positioning 6-Film Positioning/Collimation 7-Processing 8-Fog 9-Pt./Film ID 10-Other (specify)

Repeat Analysis Form

Year _____

	# of Patients	# of Films Taken	# of Repeats	# For Each Repeat Reason 1	2	3	4	5	6	7	8	9	10	11
Jan/Feb/Mar														
Apr/May/June														
July/Aug/Sept														
Oct/Nov/Dec														
Totals														
% of Repeats	X	X												

1-Too light 2-Too dark 3-Motion 4-Artifact/Jewelry 5-Pt. Positioning 6-Film Positioning/Collimation 7-Processing 8-Fog 9-Pt./Film ID 10-Other (specify)

Date and Details of Any Corrective Action Taken:

X-RAY RECORD FOR PATIENT FILE

DATE _____

NAME _____ DOB_____

X-RAY NUMBER/CLINIC NUMBER _____

PREGNANT NO DON'T KNOW YES

Indications for x-rays_____

_____

_____

Ordering Doctor's Signature_____

	VIEW	CM	MA	S	mAs	kVp
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						