

Diagnostic X-Ray Imaging Quality Assurance: An Overview

PART II

Hospital Diagnostic Imaging Quality Assurance Program Review

Survey Worksheets

Facility: _____

Address: _____

Radiology Manager: _____

QC Technologist: _____ QA Co-ordinator: _____

Reviewer: _____ Date: _____

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Abbreviations:

(D) Daily (W) Weekly (SM) Semi-Monthly

(M) Monthly (Q) Quarterly (SA) Semi-Annually (A) Annually (N) Never

(H) High (M) Medium (L) Low (N) None

1. Hospital and Radiology Department QA Committees

1.1. Hospital Quality Assurance Committee (QAC)

1. Does the hospital have a QAC? Y/N
 2. Does the hospital have documented QA program? Y/N
 3. Is a copy of the hospital organization available (showing level of responsibility and reporting order)? Y/N
- Comments: _____

1.2. Radiology Department Quality Assurance Committee

1. Does the radiology department have a QAC? Y/N
2. Does the radiology department QAC have an overall strategy with clearly defined work plans? Y/N
3. Does the radiology department have a documented QA program? Y/N
If yes, is a copy of the QA manual available? Y/N
4. Radiology QAC members:
Radiology administrator: _____
Medical physicist: _____
Chief x-ray technologist: _____
Quality control technologist: _____
Hospital service engineer: _____
Private consultants: _____
Others: _____
Comments: _____

5. Radiology department QA program review and reporting structure:
 Who reviews the radiology QA program? _____
 Review schedule:(M) (Q) (SA) (A) (N)
 Is a summary of the radiology QAC audit plan available? Y/N
 Describe the radiology QAC program reporting structure: _____
6. Is a copy of the radiology department's organization chart available (showing the level of responsibility and reporting order)? Y/N
7. Does the radiology QAC serve as an advising committee to give direction, training and/or advice on QA and QC protocols to other hospitals?(M) (Q) (SA) (A) (N)
 If yes, which hospitals? _____
8. Is a member of the department's QAC on the hospital QAC? : Y/N
 Comments: _____
2. **Quality Assurance Training**
1. Is QA training available? Y/N
2. Type of QA training:
 In-house: _____
 Other hospitals: _____
 Outside agency: _____
 Special courses: _____
 Refresher courses: _____
 Other: _____
3. What priority level is placed on QA training?(H) (M) (L) (N)
 Comments: _____

3. Equipment Specification Writing

1. Is the QAC involved in equipment specification writing? Y/N
2. Does QC technologist participate in equipment specification writing? Y/N
3. Who does equipment specification writing? (QAC?, private consultants?, etc.)

4. Is a copy of documented equipment specification writing guidelines available? Y/N
5. Do equipment specifications include acceptance testing criteria? Y/N
6. Is a copy of the equipment specification document sent out for tender
for the last x-ray unit purchased by the hospital available? Y/N
Comments: _____

4. Quality Control Test Equipment List

1. Are QC test equipment available? Y/N
2. List QC test equipment used: (including manufacturer, model and calibration date):

Processing test equipment:	<u>Manufacturer</u>	<u>Model</u>	<u>Calibration Date</u>
___ sensitometer: _____			
___ densitometer: _____			
___ thermometer: _____			
___ stop watch: _____			
___ graduated transparent beaker: _____			
___ darkroom fog test tool: _____			

Radiographic test equipment:	<u>Manufacturer</u>	<u>Model</u>	<u>Calibration Date</u>
___ exposure and exposure rate meter: _____			
___ full range of ionization chambers: _____			
___ electronic irradiation time measuring device: _____			
___ electronic x-ray tube voltage measuring device: _____			

___ collimator and beam alignment tool: _____
___ aluminum filters: _____
___ film screen contact wire mesh: _____
___ star focal spot patterns: _____

Tomography phantoms:	<u>Manufacturer</u>	<u>Model</u>	<u>Calibration Date</u>
___ tomogram scale: _____			
___ tomogram aperture plate: _____			
___ full range body part phantom: _____			
___ uniform density phantom: _____			
___ resolution phantom: _____			
___ step wedge: _____			

Image Intensifier test tools:	<u>Manufacturer</u>	<u>Model</u>	<u>Calibration Date</u>
___ full range of lead (resolution) test patterns: _____			
___ low contrast resolution test tool: _____			
___ high contrast resolution test tool: _____			

Video test equipment:	<u>Manufacturer</u>	<u>Model</u>	<u>Calibration Date</u>
___ oscilloscope: _____			
___ scope camera: _____			
___ video waveform monitor: _____			
___ video signal generator: _____			
___ photometer: _____			

General purpose test equipment:	<u>Manufacturer</u>	<u>Model</u>	<u>Calibration Date</u>
___ chart recorder: _____			
___ other: _____			

5. Equipment Acceptance Testing

1. Does the QAC have an equipment acceptance testing policy? Y/N
 2. Who does the equipment acceptance testing (manufacturer, in-house, private consultants)?: _____
 3. Equipment acceptance test results recorded?..... Y/N
 4. Equipment acceptance test results kept for QC base data? Y/N
 5. Is a copy of equipment acceptance testing results available? Y/N
- Comments: _____

6. Quality Control Testing

The following are general questions regarding the QC testing program and the QC technologist's responsibilities. Further information, about x-ray imaging equipment QC testing, i.e., specific tests, test devices and frequency of testing, is collected based on information from "Radiographic Quality Control, Minimum Standards" from the CAMRT, Appendix A of NCRP Report No.99 and "Diagnostic X-ray Equipment and Facility Survey" of Health Canada publication 94-EHD-184. Questions are listed in a separate survey form.

6.1 X-Ray Equipment Quality Control

1. QC responsibilities (persons in charge and reporting order):
 - Radiology department QC program: _____
 - QC testing: _____
 - QC record keeping: _____
 - QC data evaluation: _____
 - Equipment control parameter setting: _____
 - Equipment repair and services decisions: _____

2. Does the x-ray department have a documented equipment QC test protocol manual? Y/N
 If yes, is a copy of the equipment QC test protocol manual available? Y/N
 Does the manual include QC test protocol for the following equipment? :
- General radiographic equipment? Y/N
 - Fluoroscopic equipment? Y/N
 - Special procedures equipment? Y/N
 - Mammographic equipment? Y/N
 - CT equipment? Y/N
 - Mobile fluoroscopic equipment? Y/N
 - Dedicated procedure equipment? Y/N
 - Film processors? Y/N
 - Other? : _____
3. Is the QC testing done by a private consulting agent? Y/N
 If yes, who? _____
 Reporting protocol: _____
 Consultant objectives: _____
 Radiation safety survey of equipment? _____
 Equipment specification writing? _____
 Acceptance testing? _____
 QC testing of equipment? _____
 Advisor on QA program? _____
 Frequency of consultant contract: (M) (SA) (A) (N)
 Is copy of consultant contract objectives available? Y/N
4. QC technologist available? : (Full-time), (Part-time), (Occasional)
 To whom does the QC technologist report? : _____

5. Does the QC technologist have a specific QC test schedule? Y/N
 If yes, how strictly is it followed? _____
 QC testing schedule priority level:.....(H) (M) (L) (N)
 Is a copy of the equipment QC test schedule available?..... Y/N
 QC test schedule (time spent): ____h/d; ____d/w; ____w/m
 Consequences of not meeting the QC schedule: _____
6. QC technologist responsibility
- | | | |
|-------------------------|-------------------------|-------------------|
| ____ x-ray rooms | ____ darkrooms | ____ processors |
| ____ radiographic tubes | ____ fluoroscopic tubes | ____ mobile units |
| ____ mammography units | ____ CT units | ____ other |
7. How much time spent testing equipment (number of tubes, hours/unit)?
- General radiography? _____
- Fluoroscopy? _____
- Special procedure equipment? _____
- Mammography? _____
- CT? _____
- General film processors? _____
- Dedicated film processors? _____
- Other: _____
8. Does QC technologist have adequate time to carry out QC test required? Y/N
9. Does QC technologist have adequate time to evaluate results of QC tests performed? Y/N
10. Does QC technologist have adequate time to update and maintain QC records? Y/N
11. Are samples of QC tests records (blanks) available? Y/N

12. QC test reporting:
 To whom are QC test results reported?..... Y/N
 What is the reporting structure? _____
 Priority of QC reporting:.....(H) (M) (L) (N)
 Consequences of late reporting: _____
13. QC testing review activity:
 Is equipment QC test program audited?.....(W) (M) (Q) (SA) (A) (N)
 Review method of audit: _____
 Is a copy of the QC audit plan available? Y/N
 Consequences of bad reviews: _____
14. Is QC testing training available for the QC technologist? Y/N
 If yes, where? when? _____
15. Is QC technologist shared with other hospitals? Y/N
 If yes, list hospital and days per week: _____
16. Is the Hospital QC performance compared with other large city hospitals? Y/N
 If yes, who and frequency: Hospital _____ (M) (Q) (SA) (A) (N)
 Comments: _____

6.2. Photographic Equipment Quality Control

The following are general questions regarding the photographic QC testing program and the QC technologist's responsibilities. Further information, about photographic equipment QC testing, i.e., specific tests, test devices and frequency of testing, is collected based on information from "Radiographic Quality Control, Minimum Standards" from the CAMRT, Appendix A of NCRP Report No.99 and "Diagnostic X-ray Equipment and Facility Survey" of Health Canada publication 94-EHD-184. Questions are listed in a separate survey form.

1. Number of automatic processors: _____
2. Number of dedicated processors: _____
3. Processor sensitometric evaluation performed? (D) (W) (SM) (N)

4. Is the developer temperature verified using a thermometer?..... (D) (W) (SM) (A)
5. Replenishment rates checked? (D) (W) (SM) (N)
6. Transport time checked? (D) (W) (SM) (N)
7. Is the manufacturer's time/temperature chart followed? Y/N
8. Are film processors cleaned regularly? (D) (W) (SM) (M) (N)
9. Preventive maintenance program for the processor? Y/N
10. Are the cassette screens cleaned regularly? (D) (W) (SM) (M) (SA) (A) (N)
11. Are screen contact tests done? (W) (SM) (M) (SA) (A) (N)
12. Safelight integrity verified? (W) (M) (SA) (A) (N)
13. Darkroom fog test? (W) (M) (SA) (A) (N)

Comments: _____

1. Does the radiology department have a silver recovery program?..... Y/N
2. Who is in charge of the silver recovery program? _____
3. Is silver recovery done for all automatic processors? Y/N
4. Does the hospital have a policy on effluent disposal? Y/N
5. Are the developer and fixer treated before going to effluent..... Y/N
6. What happens to old or reject-repeat radiograms? _____

Comments: _____

7. **Equipment Performance Records and Record Keeping**

1. Are equipment performance records kept? Y/N
2. Do the equipment performance records include acceptance testing results? Y/N
3. Are the initial and current radiation safety surveys reports available?..... Y/N
4. Are the current year QC tests and results recorded? Y/N
5. Are the past year QC tests and results recorded? Y/N
6. Are the equipment repairs and servicing recorded (frequency and costs)? Y/N
7. Is the equipment down time recorded? Y/N

8. Is a copy of the equipment performance record available? Y/N
Comments: _____

8. Equipment Appraisal and Replacement Policy

1. Does the QAC have an equipment appraisal and replacement policy? Y/N
2. Planned budget allocations for future purchases? Y/N
3. Describe the equipment appraisal and replacement policy budget strategy: _____

4. Is a copy of the equipment appraisal and replacement policy available Y/N

9. Standardization of Exposure

9.1. Radiographic Positioning

1. Is a standard radiographic positioning manual available in each room? Y/N
If no, is it easily accessible? Y/N
Is a copy (sample) of radiographic positioning manual available? Y/N
Comments: _____

2. Current condition of the radiographic positioning manual (indicate on a scale of 1 to 5):

1	2	3	4	5
Poor	-	-	-	Good
Disorganized	-	-	-	Tidy
Ambiguous	-	-	-	Clear
Vague	-	-	-	Precise
Incomplete	-	-	-	Comprehensive
Neglected	-	-	-	Updated

Comments: _____

3. Does the radiographic positioning manual provide instructions about:
 ___ body part to be x-rayed? Y/N
 ___ number of projections required? Y/N
 ___ size of image receptor to use? Y/N

___ part rotation? Y/N
 ___ tube angle?..... Y/N
 ___ central ray location? Y/N
 ___ source-to-image receptor distance? Y/N
 ___ detail of structures to be shown?..... Y/N
 ___ general instructions for positioning?..... Y/N
 ___ illustrations? Y/N
 Comments: _____

4. Radiographic positioning manual update:

Is the radiographic positioning manual updated?..... Y/N
 Who authorizes changes? _____
 Are changes reported through QAC reporting channels?..... Y/N
 Are changes unreported and adopted?..... Y/N
 Comments: _____

9.2. Loading Factors

1. Is there a loading factors chart (or manual) posted in each x-ray room? Y/N
 Is a copy (sample) of loading factors manual available?..... Y/N

2. Current condition of Loading Factor charts (indicate on a scale of 1 to 5):

1	2	3	4	5
Poor	-	-	-	Good
Disorganized	-	-	-	Tidy
Ambiguous	-	-	-	Clear
Careless	-	-	-	Precise
Incomplete	-	-	-	Comprehensive
Neglected	-	-	-	Updated

Comments: _____

3. Does the loading factors chart contain the following information? :

___ patient thickness?..... Y/N

- ☐ child/adult technique?..... Y/N
☐ optimum kVp? Y/N
☐ optimum time, mA, mAs or automatic exposure control? Y/N
☐ focal spot size? Y/N
☐ grid/no grid? Y/N
☐ film-screen combination? Y/N

Comments: _____

4. Is the loading factors chart strictly followed?..... Y/N
 If not, why? _____

5. Loading factors chart changes:
 Is the loading factors chart updated or changed to compensate for equipment
 or processor problems? Y/N
 Who sets the loading factors chart factors? _____
 Who authorizes the loading factors chart changes? _____
 Are the loading factors chart changes reported to QC technologist?..... Y/N
 Are changes unreported and adopted?..... Y/N
 Comments: _____

9.3. Entrance-Skin-Exposure (ESE)

1. Are the ESEs measured for:
 each diagnostic procedure? Y/N
 each x-ray room? Y/N
 each fluoroscopic procedure?..... Y/N
 each fluoroscopic room?..... Y/N
 List the ESE procedures measured: _____
2. Is the ESE schedule reviewed : (M) (SA) (A) (N)
3. Are the ESEs recorded in the QC log book?..... Y/N

If yes, 1) is a copy (sample) of the radiographic ESE record for each room available? Y/N

2) is a copy (sample) of the fluoroscopic ESE record for each room available? Y/N

4. Is there an ESE comparison with other major city hospitals?

If yes, who? _____ How often? (M) (Q) (SA) (A) (N)

Comments: _____

10. Acceptance Criteria for Diagnostic Radiograms

1. Have acceptance criteria for diagnostic radiograms established? Y/N

2. Do the acceptance criteria cover the following points:

1) the visibility of predetermined landmarks clearly defined for each view? Y/N

2) an acceptable density range measured at predetermined anatomical landmarks? Y/N

3) also include three limits of acceptability clearly defined where:

a) the x-ray technologist forwards radiogram to radiologist for reporting? Y/N

b) or the x-ray technologist consults with the radiologist? Y/N

c) or the radiogram is rejected and a repeat is done? Y/N

3. Are the acceptance criteria followed by technologist? Y/N

4. Are the acceptance criteria reviewed? Y/N

Frequency of review: (M) (Q) (SA) (A) (N)

5. Are acceptance criteria compared with that of other major city hospitals? Y/N

6. If yes, Who?, How often? (M) (Q) (SA) (A) (N)

7. If a QA criteria has not been established against which standard are the radiograms checked when the radiologist is not available? (e.g., evening or weekends) _____

How does that affect the repeat rate when the radiologist does become available?

8. Is a copy of the acceptance criteria available? Y/N
Comments: _____

11. Reject-Repeat Analysis Program (RRAP)

1. Does the radiology department have a comprehensive RRAP? Y/N
2. Is a copy of the documented RRAP parameters available? Y/N
3. Who sets the RRAP parameters? : _____

4. Reject-Repeat Analysis parameters:

☐ patient positioning	☐ patient motion
☐ radiograms too dark	☐ radiograms too light
☐ artifacts	☐ tomographic scout radiograms
☐ fog	☐ static
☐ medical reasons	☐ processor malfunction
☐ mechanical	☐ quality control films
☐ clear	☐ black film
☐ Good radiograms	☐ Other
☐ Total waste	☐ Total rejects ☐ Total repeats

Comments: _____

5. Do the RRAP results show how many rejects or repeats were acceptable and should not have been repeated? Y/N
6. Are the RRAP results posted? Y/N
7. Is the repeat percentage analysis evaluated:
 _____ per technologist? _____ per room? Y/N
8. What is the current reject-repeat rate? _____
9. What is the reject-repeat rate for the last six months? : _____
10. What corrective action is used to reduce the reject-repeat rate? _____

11. Reject-repeat rate is based on what workload? _____
12. What is radiology department total workload? _____
13. Is the RRAP compared with other hospitals? Y/N
If yes, who? How often?: (M) (Q) (SA) (A) (N)

Note: RRAP should look at three separate categories:

- 1) Total waste films: all films in the scrap bin? Y/N
- 2) Total rejects: all films except clear and QC films? Y/N
- 3) Total repeats: only those where an additional radiogram was made? Y/N

RRAP should not include radiograms from special

procedures areas (cardiovascular, neurological copy, nor subtraction films.)

Comments: _____

12. QA/QC Document Assessment (Summary)

The following (current) documents should be collected as examples for assessing the Radiology Department's QA/QC program.

<u>Section</u>	<u>Reference Documents</u>
1.1.3. _____	Hospital organization chart (with reporting order)
1.2.3. _____	Radiology department QA manual
1.2.5. _____	Summary of radiology department's QAC audit plan
1.2.6. _____	Radiology department's organization chart (with reporting order)
3.4. _____	Equipment specification writing guidelines
3.6. _____	Equipment specification document (e.g., last purchase)
4.2. _____	List of all QC test equipment
5.5. _____	Equipment acceptance test results
6.1.2. _____	Equipment QC test protocol manual
6.1.3. _____	QC consultant contract objectives
6.1.5. _____	Equipment QC test schedule
6.1.11. _____	Sample QC test records (blanks)

6.1.13.	_____	QC audit plan
7.8.	_____	Equipment performance record
8.4.	_____	Equipment appraisal replacement policy
9.1.1.	_____	Radiographic positioning manual (sample)
9.2.1.	_____	Loading factors chart (sample)
9.3.3.	_____	ESE (sample list of ESEs recorded and date in QC log for radiographic and fluoroscopic examinations for each room)
10.8.	_____	Acceptance criteria for diagnostic radiograms
11.2.	_____	Reject-Repeat Analysis Program parameters