

Introduction

The World Health Organization (WHO) was founded in 1948 and is a specialised agency of the United Nations. It promotes technical co operation for health among nations, carries out programs to control and eradicate disease and strives to improve the quality of human life. WHO has four main functions:

- To give world wide guidance in the field of health.
- To set global standards for health.
- To co-operate with governments in strengthening national health programs.
- To develop and transfer appropriate health technology, information and standards.

The WHO definition of health

“Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.”

The International Society of Radiographers and Radiological Technologists (ISRRT) was formed in 1959 to act as a link between radiographers and radiological technologists throughout the world. The Society is dedicated to the improvement of standards of practice in radiation medicine technology. It is a non-political organisation and is not a trade union. It is a not-for-profit organisation.

The ISRRT is recognised as the international representative of radiation medicine technology throughout its official relationship as an international non-governmental organisation with WHO. It also has association with the United Nations and other organisations such as the International Society of Radiology, the European Society of Radiology, and the International Commission for Radiological Education.

WHO recognised the need to improve the standards of radiation medicine throughout all regions of the world. ISRRT, as part of this project, has entered into an agreement with WHO to produce a number of radiography technical workbooks, on various topics, for use in developing countries. This workbook on quality assurance is the first of these books.

Kenya was the country chosen to pilot the project.

Purpose of this workbook

It is preferred to call this a **workbook** rather than a manual or textbook, because the intent is to, not only give technical information, but to set practical exercises that students can work through, responding to specific questions. Above all, the students should feel that they have actually carried out the tasks themselves and will be more confident to teach others and ensure that these exercises continue to be carried out in their respective areas.

The topic of this workbook is quality assurance, so all material is designed to assist in the maintenance of the highest quality of work that can be achieved, under the prevailing conditions.

Quality assurance

The overall management program, put in place to ensure that a comprehensive range of quality control activities work effectively.

Quality control

The means by which, each area of interest is monitored and evaluated.

A Quality Assurance Program should be comprehensive, looking at all aspects of the work involved in producing high quality radiographs. This program should be cost effective and achieve its aims.

The ultimate responsibility for setting up, running, evaluating and taking remedial action lies with the head of department, although appropriate delegation may be necessary. It is important that someone accepts that responsibility and ensures that the program happens effectively.

This workbook will be used by radiographers who are being trained through a Centre of Excellence to:

- achieve a good working knowledge of quality control routines.

- return to their respective areas after completed training to teach other members of their staff to carry out the routines that they have learned.

In this way it is hoped that quality assurance will be practised routinely and effectively.

If so:

- Heads of departments will find that the standard of radiography will be maintained at the highest level.
- Work environments will be improved.
- Tasks will become easier.
- Repeat films will be kept to a minimum.
- Staff job satisfaction will increase.
- Patients will receive less radiation and less inconvenience.
- There will be fewer equipment failures.
- Costs will be kept down.
- A record and audit trail will exist as proof of high standards.

Achieve some of these and this workbook has been worth while!

Who the workbook is aimed at

This workbook is aimed directly at radiographic staff members of any X-ray department, who:

- are considered to have an adequate background and training in radiography,
- are concerned about the need to achieve the highest possible standards,
- have the ability and interest to learn and to teach others.

Indirectly this workbook is aimed at all radiographic and darkroom staffs through the selected member of staff chosen to undergo the initial training.

Heads of departments selecting the member of staff who is to undergo training should consider the personal attributes of their staff members and nominate the person who is most likely to achieve all of the aims.

What this workbook aims to achieve

- Increase awareness, interest and understanding of quality assurance issues.
- Enable radiographers to establish and continue to carry out an effective quality assurance program.

- Provide a comprehensive knowledge, advice and experience in quality control methods.
- Provide the knowledge and skills to carry out basic care and maintenance of imaging equipment.
- Raise standards.
- Reduce imaging costs.
- Improve job satisfaction.
- Improve health and safety issues.

Summary of this workbook

This workbook contains:

- Background information.
- A questionnaire seeking information about each students own department.
- A pre test of student's knowledge.
- Advice on teaching methods.
- Health and safety issues.
- Six modules giving technical information regarding effective routines and quality control techniques.
- Each module contains relevant tasks the student must perform.
- How to make simple test tools.
- Copies of quality control documentation.
- A post test of student's knowledge.
- Glossary of terms.
- Reference list.
- A feedback questionnaire.
- A final assessment of student performance during the course.

How to use this workbook

Once a radiographer has been selected and training dates set, this workbook should be made available to the student at least *two weeks* in advance of the commencement of the training period, so that adequate pre reading and discussion can be carried out.

The student must be encouraged to discuss the content of the workbook with other members of staff during this pre reading period.

The section headed STUDENT'S OWN DEPARTMENT, must be *completed by the student before commencement of the course*. This takes the form of a questionnaire which, when completed should give the tutor a background knowledge of the student and their work environment. This background information will allow the tutor to apply the correct emphasis when providing and supervising the training.

The student must complete a PRE TEST prior to starting the course. This is an assessment of the stu-

dent's relevant knowledge *before* the course. This will be compared to the results of a similar POST TEST completed by the student *after* completion of the course. These tests are for student information and course evaluation only and are *not* used in student assessment.

The section on TEACHING TECHNIQUES first gives a broad overview of teaching methods. This is followed by the recommended approach to teaching with this workbook. *Both tutor and student should read this section.*

The section on HEALTH AND SAFETY draws attention to all the health and safety issues appropriate to an X-ray department and how to make the work environment a safe and healthy one.

The workbook is divided into modules.

- The student should work through one module at a time, studying the technical information and testing methods.
- At the end of each module, tasks have been set. The student must carry out each task and answer the questions asked.
 - The tutor will assess the completed **tasks and answers**, adding any appropriate comments.
 - A **Satisfactory/Unsatisfactory** grade will be given.
 - All **Unsatisfactory** exercises must be repeated before beginning the next module.

All necessary equipment will be provided by the Centre of Excellence. The tutor will ensure that the student understands the technical information given in the workbook and will supervise and advise during the practical exercises.

The APPENDICES contain information on making **simple test tools, report forms, record sheets, test result sheets** and **exposure charts**, for use in the student's own department.

The GLOSSARY contains a list of **terms**, found in the text, with meanings.

The REFERENCES provide a source of further reading.

The POSTTEST must be answered on completion of the course.

The FEEDBACK QUESTIONNAIRE must then be completed and the workbook handed to the tutor for final assessment and handing on to the Head, Centre of Excellence, for final approval.

The workbook will then be handed back to the student who will use it, on returning to their own department, to train other members of staff and to ensure that a quality assurance program is established and carried out on a regular basis.

Roles and responsibilities

The Head, Centre of Excellence

The Head, Centre of Excellence will:

- Hold the overall responsibility for the organisation and presentation of the training program related to this workbook.
- Be responsible for the selection of suitable tutors and ensure that they are fully trained and aware of their obligations.
- Ensure that all necessary facilities and equipment are available.
- Arrange for workbooks to be in the hands of students at least *two weeks* before they start their course, for pre reading and discussion with colleagues.
- Ensure that all training related to this workbook is carried out satisfactorily.
- Receive, review and sign all completed workbooks and return them to the tutor for onward transmission to the student.
- Take any necessary action arising from completed workbooks, student performance or student behaviour.
- Review the feedback questionnaire, completed by the student, and take any appropriate action.
- Give feedback to the tutor.
- Arrange for follow up checks to be carried out, after a suitable period of time, on each student and what they have achieved in their own department since completing the course.
- Evaluate follow up reports and take any necessary action.

The tutor, Centre of Excellence

Each student will be allocated a tutor from the staff of the Centre of Excellence. The tutor will:

- Be responsible for students to whom they have been allocated.
- Be readily available to students during their training.
- Supervise and teach students during their training.
- Familiarise his/her self with the workbook, in particular the section on teaching techniques.
- Formulate a strategy for teaching this course and implement it.
- Read the questionnaire STUDENT'S OWN DEPARTMENT, completed by the student, and devise an appropriate training program.
- Ensure that all necessary equipment is available.

- Ensure that the training program is carried out.
- Evaluate all tasks carried out by the student and write appropriate comments and a grading at the end of each task sheet.
- Ensure that tasks graded “Unsatisfactory” are repeated before the student progresses to the next module.
- Mark pre and post course tests, completed by the student, and make the student aware of the results.
- Write a final report on the student’s performance.
- Submit the student’s completed workbook to the Head, Centre of Excellence for final approval.
- Return the workbook to the student.
- Give adequate feedback to the student.
- Ensure that the student is fully aware of their responsibility to teach the course topics to fellow staff members on returning to their own department.
- Discuss with and advise students on how to carry out their own training programs.
- Advise the student that a follow up check will be made to assess the benefits of the course.

The student

The student will:

- Complete all pre reading, discuss the material with colleagues and fill in the questionnaire,

STUDENT’S OWN DEPARTMENT, before starting the course.

- Carry out the PRETEST immediately before starting the course.
- Attend all scheduled teaching, practical and administrative sessions.
- Complete all modules, by first reading the technical information, carrying out the allotted tasks under the supervision of their tutor, and then answering the questions.
- Submit the workbook to the tutor, for evaluation, upon completion of each task.
- Repeat any task assessed as “Unsatisfactory” before progressing to the next module.
- Carry out the POSTTEST immediately upon completion of the course.
- Complete the FEEDBACK QUESTIONNAIRE.
- At the end of the training period, and when all tasks have been satisfactorily completed, hand the workbook to their tutor for final evaluation and submission to the Head, Centre of Excellence for formal approval. The workbook will be returned.
- On return to their own department, use the workbook and newly gained knowledge and expertise to establish a quality assurance program and train colleagues, under the direction of their Chief Radiographer.

Questionnaire

Student's own department

In order for this course to meet your needs, your tutor must know something about the department in which you work. Please answer the following questions in the spaces provided, before you commence the course.

1. How many X-ray examination rooms are there? _____

2. Tell us what X-ray equipment you have. e.g. general purpose table with bucky etc.

ROOM 1

ROOM 2

ROOM 3

3. Tell us what accessory equipment you have. e.g. Cassettes, positioning pads etc.

4. How many darkrooms are there? _____

5. State the type of film processor in each darkroom. e.g. manual/auto, type, make, model, processing cycle.

DARKROOM 1

DARKROOM 2

DARKROOM 3

-
-
-
6. How many staff act as radiographers? Qualified radiographers _____ Others _____
7. Is there an "out of hours service"? YES/NO
8. How many darkroom technicians are there? _____
9. Do you already run any form of Quality Assurance Program? YES/NO
10. If YES state here what you do
-
-
-
11. List any quality control test tools you have
-
-
12. If you have any quality assurance issues you particularly want covered, state them here
-
-
-
13. Give an indication of how busy your department is. Number of examinations per year/week/day _____
14. Summarise the types of examinations carried out. e.g. extremities, chest, spine.
-
-
-
-

Thank you

Pre test

This test must be completed by the student *before starting the course*. The intention is to test your knowledge on the topics covered by this workbook *before the course*.

You will be tested again when you have completed the course so that you have an idea of how much you have learned.

The results of these tests are for information only and will not affect your course result.

Instructions

This is a multiple choice test. In each question you are given three possible answers.

Read each question carefully.

Indicate the answer that you feel is the most accurate by placing an "X" in front of the letter preceding it.

Example:

A personal radiation monitor (TLD) should be worn

- a) Outside a lead rubber apron.
- X** b) Under a lead rubber apron.
- c) There is no need to use one when wearing a lead rubber apron.

Answer: b)

All questions must be answered

1. What is meant by the term "quality assurance"?
 - a) The equipment is covered by an insurance policy.
 - b) Everyone must produce perfect films.
 - c) A system which attempts to maintain a high quality of work all round.

2. What is meant by the term "quality control"?
 - a) A practical exercise which carries out quality checks.
 - b) A staff member who supervises quality.
 - c) An X-ray machine system that gives the correct exposure.

3. Reject film analysis means?
 - a) To ask the radiographers how many films were repeated that day.
 - b) A detailed study of film wasted over a period of time.
 - c) Counting all the films accidentally fogged in the darkroom.

4. A grid ratio is ?
 - a) Ratio of the width of a grid to its length.
 - b) Ratio of the height of the lead strips to their length.
 - c) Ratio of the height of the lead strips to the distance between them.

5. A stationary grid is?
 - a) A grid that is fitted in a bucky.
 - b) A grid that can be carried around.
 - c) A series of shelves for filing papers.

6. To test for poor film screen contact:
 - a) X-ray a lot of paper clips on the face of the cassette.
 - b) Open the cassette and look.
 - c) Place a sheet of fine wire mesh inside the cassette with the film and make an exposure.

7. To check if the light field and the X-ray field of a collimator are correctly aligned:
 - a) Look into the collimator mirror.
 - b) Open and close the collimator shutters rapidly.
 - c) Place metal markers on the face of a loaded cassette to indicate the light field and make an exposure.

8. The coincidence of the X-ray and light fields of a collimator are said to be acceptable when:
 - a) The X-ray field is 15 mm inside the light field at 100 cm FFD.
 - b) The X-ray field is 3 mm outside the light field at 100 cm FFD.
 - c) The X-ray field is 8 mm inside the light field at 100 cm FFD.

9. The wattage of a light bulb in a darkroom safelight facing down should be:
 - a) 15 watts.
 - b) 50 watts.
 - c) 100 watts.

10. Static electricity:
 - a) Produces an overall grey fog on processed film.
 - b) Produces black lightning like marks on processed film.
 - c) Reduces the effect of the intensifying screens.

11. A densitometer:
 - a) Accurately assesses film density.
 - b) Determines the efficiency of lead rubber.
 - c) Determines the light output of intensifying screens.

12. A Sensitometer:
 - a) Is a motion detector.
 - b) Is a radiation detector.
 - c) Is a device for making test strips used in film processor monitoring.

13. Fixing time in manual processing should be:
 - a) Two minutes.
 - b) Twice the clearing time.
 - c) Twenty minutes.

14. X-ray film should be:
 - a) Stored at a temperature of 10° to 20°C.
 - b) Stored lying flat.
 - c) Handled only in total darkness.

15. Stock rotation, related to film storage, means:
 - a) Turning the film boxes around.
 - b) First in first out.
 - c) First in last out.

16. A characteristic curve:
 - a) Determines the shape of an object.
 - b) Represents the characteristics of the developer.
 - c) Is a graphical representation of the relationship between the exposure received by the film and the density produced, following processing.

17. Safelights facing down should be installed:
 - a) No less than 130cm above the workbench.
 - b) No less than 100cm above the workbench.
 - c) At least 150cm above the workbench.

18. Automatic processing developer temperatures should be:
 - a) 20°C.
 - b) 25°C.
 - c) 35°C.

19. In manual processing the film should be:
 - a) Agitated every 30 seconds in the developer.
 - b) Placed in the developer and not touched until the timer sounds.
 - c) Agitated by moving the film sideways.

20. In manual processing, when transferring the film from the rinse to the fixer, the film should be drained into:
 - a) The rinse.
 - b) The fixer.
 - c) Doesn't matter.

21. In addition to a visual safelight check you should:
 - a) Hold an unexposed film against the safelight for one minute.
 - b) Expose sections of a film to safelight for progressively longer times.
 - c) Stand in the centre of the darkroom holding a film for one minute.

22. If the lid has accidentally been left off a box of unexposed films in white light:
- Throw all the films away.
 - Put the lid back on and do nothing until someone tells you their films are fogged.
 - Process three films and inspect.
23. The First Aid treatment for a processing chemical splash in the eye is:
- Blink continuously for 30 seconds.
 - Wash thoroughly.
 - Wipe the eye with a tissue.
24. The test to determine optimum development time is:
- Develop test strips for differing times and compare.
 - Develop an unexposed film and inspect.
 - Develop test strips for the same length of time.
25. When shutting down an automatic processor:
- Clean crossovers and leave lid partially lifted.
 - Switch off and leave it.
 - Turn water off only.
26. Developer temperature should be checked:
- Only when film densities look different.
 - Once a week.
 - Daily.
27. Replenishment rates in automatic processors are checked by:
- Catching the amount pumped in a graduated flask.
 - Asking the manufacturer.
 - Measuring the drop in level of the replenishment bottle/tank.
28. To check that a generator always gives the same output when using the same exposure factors:
- Watch the mA meter during the exposure.
 - Expose three separate on the same film, using the same exposure factors.
 - Expose three different cassettes using the same exposure factors.
29. A spinning top test is used to:
- Check the accuracy of the timer.
 - Check the accuracy of the mA.
 - Check the accuracy of the kV.
30. To test for constancy of radiation output of an X-ray unit:
- Make several exposures using a different kV each time.
 - Make three exposures keeping the kV the same, but varying the mA.
 - Make three exposures keeping the kV and mAs the same but varying the mA and time.