QUALITY ASSURANCE GUIDELINES FOR MAMMOGRAPHY
INCLUDING RADIOGRAPHIC QUALITY CONTROL

National Quality Assurance Coordinating Group for Radiography

NHSBSP Publication No 63
April 2006
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PREFACE

The guidelines have been produced by a working group of the NHS Breast Screening Programme (NHSBSP) National Quality Assurance Coordinating Group for Radiography. They update and replace Radiographic Quality Control Manual for Mammography (NHSBSP Publication No 21, published in April 1999) and Quality Assurance Guidelines for Radiographers (NHSBSP Publication No 30, published in March 2000).

The members of the working group were Sarah Cush, Sheila Johnson, Sue Jones, Diane Passmore, Kaldip Deogun and Zoe Vegnuti.

The working group gratefully acknowledges the work of Anna Burch and Susan Gray in the development and editing of this document. They also wish to record their thanks to Linda Read for word processing the final draft.
1. INTRODUCTION

1.1 Background

The purpose of these guidelines is to facilitate the achievement of all the NHSBSP objectives and standards, in order to contribute to the overall long term aim of a reduction in mortality from breast cancer in women invited for screening.

In 1986, the Forrest report recommended the introduction of breast screening in the United Kingdom. It emphasised that all aspects of the programme would have to be of a very high quality in order to achieve the anticipated reduction in mortality. The best opportunity of detecting breast cancer at a potentially curable stage arises when women are willing to attend for regular screening combined with high quality images produced in a manner which is acceptable and satisfactory for the woman.

Quality assurance (QA) is an intrinsic part of the NHSBSP in maintaining a service which meets national standards and the needs of all women invited for screening. In 1987, a subcommittee chaired by Dr John Pritchard produced QA guidelines for mammography. This document set out:

- outcome objectives and standards for breast screening by mammography
- process objectives – how the outcome objectives and standards are to be achieved
- equipment procurement, testing and maintenance
- staff training
- performance of staff
- management of QA, including the need for clear lines of responsibility and the establishment of regional QA reference centres.

The need for QA was supported by the Department of Health Advisory Committee report Breast Cancer Screening 1991: Evidence and Experience since the Forrest Report. In 1997, the Secretary of State for Health ordered a review of breast cancer screening QA services. Following this, executive letter EL(97)67 clarified the relationships among breast screening services, host trusts and regional QA services. It reiterated the importance of high quality screening services and stated that adherence to national quality standards and rigorous QA were essential elements in the provision of a cancer screening service. The International Agency for Research on Cancer has also recognised that regular tests must be carried out on mammography systems to maintain image quality at an acceptable level.

More recently, the Advisory Committee on Breast Cancer Screening has published a review of the development and future of the breast screening programme in England.
These guidelines give clear and detailed information on the mammographic aspects (both clinical and technical) of breast screening QA and the quality control (QC) of radiographic procedures. They:

- provide a framework for auditing, identifying, reporting and resolving problems
- drive continuous improvement in quality for all radiographic aspects of breast screening service delivery
- promote and encourage the development of a learning culture
- support the promotion of best practice, training and continuing professional development (CPD).

The NHSBSP publishes standards for all aspects of the screening programme, including the performance of mammography equipment. These are summarised in *Consolidated Guidance on Standards for the NHS Breast Screening Programme*. The *Quality Assurance Guidelines for Mammography* are complementary to the QA guidelines produced by other professional groups involved in the breast screening programme.

They are specifically for:

- all mammographers in the NHSBSP
- radiographic line managers
- unit QA radiographers
- regional QA radiographers (RQARs)
- directors of breast screening.

They are also useful to:

- trust management
- QA reference centres
- regional medical physics services
- professional bodies
- primary care trusts (PCTs).

They are of interest to:

- commissioners
- primary care consortia
- training organisations/universities
- women’s groups
- patient advice and liaison services (PALS)
- legal advisers.
1.4 Using the guidelines

At unit level, the guidelines should be used for:

- self appraisal
- peer review
- the audit of individual performance and appraisal
- the development of personal development plans
- induction and training
- informing organisational development and business management processes
- general reference.

At regional level, the guidelines should be used by RQARs for:

- the audit of unit mammographic performance
- reporting unit mammographic performance
- giving support, information and advice to mammographers
- the identification of resource issues to inform the organisational development and business planning processes.

Regional QA radiographers should encourage the use of these guidelines in the everyday working practice of breast screening mammographers.
2. QUALITY ASSURANCE FRAMEWORK

2.1 Responsibilities for quality assurance

The QA programme in the NHSBSP provides a framework for mammographers to develop their performance in all areas. It helps to identify educational and development needs, enabling mammographers to develop to their full potential. They should be involved in all aspects of the breast screening programme in order to develop a full understanding of their role within the team. Mammographic QA in a unit is the responsibility of all mammographers and is monitored by the radiography manager (or the radiographer in charge).

2.2 Multidisciplinary team working

All mammographers should participate fully in the activities of the multidisciplinary breast care team and contribute their expertise where appropriate with an opportunity to attend clinical multidisciplinary meetings. All mammographers in the breast screening programme are expected to rotate through the screening, assessment and, where applicable, symptomatic clinics.

2.3 Roles and responsibilities under IR(ME)R2000

The Ionising Radiations Regulations 1999\textsuperscript{21} (IRR99) impose statutory duties regarding the installation and use of radiation equipment for medical exposure. In particular, regulation 32 requires an employer to make arrangements for a suitable QA programme. The Ionising Radiation (Medical Exposure) Regulations 2000\textsuperscript{22} (IR(ME)R2000) specify requirements placed on four types of duty holder: employers, referrers, practitioners and operators. Table 1 summarises the roles under the regulations that may be taken by mammographers. The duties appropriate to each role are explained in detail in the NHSBSP IR(ME)R Guidance Notes published in December 2000.\textsuperscript{23} Further guidance on ionising radiation protection in the clinical environment is given in Medical and Dental Guidance Notes.\textsuperscript{24} Details of QC procedures are given in Chapter 4.

2.4 Unit quality assurance radiographer

The role of the unit QA radiographer is:

1. To oversee the monitoring of the mammographic image quality in the unit. This should be an educational and developmental exercise.
2. To monitor technical recall and technical repeat examinations, audit the findings and take appropriate action where necessary.
3. To ensure compliance with radiographic QC guidelines (details are given in Chapter 4).

<table>
<thead>
<tr>
<th>Departmental title</th>
<th>Role under IR(ME)R2000 (as detailed in local procedures)</th>
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<tbody>
<tr>
<td>Radiographer</td>
<td>Can act as an operator, a referrer and an IR(ME)R practitioner</td>
</tr>
<tr>
<td>(Radiographer) practitioner</td>
<td></td>
</tr>
<tr>
<td>Advanced (radiographer) practitioner</td>
<td></td>
</tr>
<tr>
<td>Consultant (radiographer) practitioner</td>
<td></td>
</tr>
<tr>
<td>Radiographer helper</td>
<td>Can act as an operator – would always be supervised by a registered radiographer</td>
</tr>
<tr>
<td>Radiographer assistant</td>
<td></td>
</tr>
<tr>
<td>Assistant practitioner</td>
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</table>

Table 1 IR(ME)R2000 roles for mammographers
4. To liaise with medical physics and discuss outcomes of equipment testing.
5. To know who is responsible for the authorisation of suspension from use of equipment when tolerances are exceeded and understand the procedure for taking this action.
6. To maintain strong links with the RQAR and regional QA network.
7. To identify their own educational and development needs through appraisal and a development review process, and seek to address those needs.
8. In conjunction with the health and safety representative, to assist the mammography practitioners in the unit to work in an environment conducive to their health and welfare.
9. To understand the process for ensuring that system failures are highlighted and resolved.

The RQAR represents the mammographers and support staff in the region, provides support and advice and acts as the coordinator for mammographic activities in the breast screening programme. The RQAR is responsible to the regional QA director. Her role is:

1. To take the lead in setting, monitoring and reviewing QA standards for mammography practitioners undertaking breast screening.
2. To coordinate the implementation of QA standards across the profession in conjunction with and liaison with other disciplines.
3. To represent the mammography staff in the region on regional and national committees.
4. To act as a resource for other RQARs, other colleagues and professions.
5. To identify, together with mammographers and managers within the breast screening programme, training and development needs and advise the national office.
6. To develop robust and effective communication networks across the NHSBSP and foster links with the private and symptomatic sector, commissioner/provider groups, primary health care teams and charitable organisations.
7. To be aware of, and encourage and support, relevant research projects to identify further activities that would merit consideration.
8. To provide expert knowledge and skills to the regional QA activities, including QA visits, and take part in external QA visits when required.

The regional QA visit process is undertaken by a multidisciplinary team, and review of each programme takes place at least once every three years. Visits are organised by the regional QA reference centre (QARC). Details of the visit process, including the assessment of radiographic performance, are given in the Guidelines on Quality Assurance Visits.25 The RQAR is a member of the visiting team. The aim of the QA visit is to confirm that the mammographic aspects of the programme conforms to minimum standards, to identify any areas of underperformance and to make recommendations where improvements may be made. In addition, the RQAR may make more frequent informal visits to programmes and
will monitor performance through the data collected by the QARC part of the regional QA dataset. Any concerns identified at these visits should be brought to the attention of the regional QA director.

2.7 National Coordinating Group for Radiographic Quality Assurance

The National Coordinating Group for Radiographic Quality Assurance represents mammographers working in the NHSBSP. The group consists of representatives from each of the English QA regions and one representative from each of Wales, Scotland, Northern Ireland, the Republic of Ireland and the independent sector. In addition, there is a representative from the College of Radiographers, the national breast screening training centres and the national coordinating team. The purpose of the group is to inform and influence the national strategy on radiographic excellence in breast care. Its remit is:

- to coordinate breast screening activity across the profession
- to devise, test and agree professional QA standards
- to monitor and review professional QA standards
- to identify training and development needs of radiographers and mammographers and advise the NHSBSP on how they may be met
- to identify relevant research, monitor progress and assess the implications for the NHSBSP
- to advise the NHSBSP on professional matters
- to identify ways in which links with the independent sector can be maintained and strengthened and the quality of the service maintained
- to encourage acceptance of NHSBSP standards by the symptomatic sector.

The group is committed to ensuring that the delivery of radiographic services in breast screening are of the highest quality. This should contribute to achieving a reduction in the rate of breast cancer deaths in line with the national targets.

2.8 National coordinating team

The national coordinating team is accountable to the national cancer director. The role of the national coordinating team includes:

- developing QA through the national QA coordinating groups
- advising regional directors of public health, as necessary, on the effectiveness of QA in their region
- monitoring the effectiveness of QA systems nationally
- liaising with professional associations and colleges
- negotiating appropriate training for the programme with the national training centres and their satellite training centres.

The national coordinating team in conjunction with the national QA coordinating groups sets national minimum standards and targets for the NHSBSP.
3. QUALITY ASSURANCE OBJECTIVES FOR MAMMOGRAPHERS

3.1 Quality assurance objectives

Quality assurance objectives for mammographers working in the NHSBSP are shown in Table 2. Objectives 1, 2 and 3 are included in the national standards table for the NHSBSP, and a minimum standard and target has been set for these objectives. The remainder of the objectives are statements of best practice, and minimum standards are set for these.

3.2 Image quality and radiation dose (objectives 1 and 2)

The NHSBSP’s objectives are to achieve optimum image quality with as low a radiation dose as practicable. The achievement of these objectives requires mammographers, medical physics services and service personnel to work closely together. Radiographic QC procedures are the means by which this is achieved. Details are given in Chapter 4.

3.3 Repeat examinations (objective 3)

The NHSBSP objective is to minimise the number of women undergoing repeat examinations. This includes technical repeats (TPs) and technical recalls (TCs). Mammographers have a responsibility for regular audit of repeat examinations and should review their own performance against personal, unit, regional and national standards. This may identify equipment problems or indicate a training need. Reference should be made to the technical recall and repeat good practice guide to ensure that repeat examinations are identified and recorded in a standard way.26

Each breast screening unit should ensure that:

- there is good communication between film readers and mammographers
- training is provided to identify what constitutes a TC or a TP
- all TC/TP events are entered onto the IT system in accordance with the good practice guide
- there is sufficient time for audit and peer review.

The radiography manager should monitor TC/TP rates. Information should be collected and monitored for the reasons that women undergo repeat examinations. Collecting and analysing this information is the responsibility of the radiography manager, who should discuss this with the RQAR at regular intervals.

At regional level, the RQAR should monitor the rates and report the regional rates to the national QA coordinating group for radiographic quality control.
### Table 2: Quality assurance objectives for mammography

<table>
<thead>
<tr>
<th>Objective</th>
<th>Criterion</th>
<th>Minimum standard</th>
<th>Target</th>
</tr>
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<tbody>
<tr>
<td>1. To achieve optimum image quality* (national standard 4)</td>
<td>High contrast spatial resolution</td>
<td>≥12 lp/mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimal detectable contrast (approx)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5–6 mm detail</td>
<td>≤1.2%</td>
<td>≤0.8</td>
</tr>
<tr>
<td></td>
<td>0.5 mm detail</td>
<td>≤5%</td>
<td>≤3%</td>
</tr>
<tr>
<td></td>
<td>0.25</td>
<td>≤8%</td>
<td>≤5%</td>
</tr>
<tr>
<td></td>
<td>Aim film density</td>
<td>1.5–1.9</td>
<td></td>
</tr>
<tr>
<td>2. To limit radiation dose (national standard 5)</td>
<td>Mean glandular dose per film for a standard breast at clinical settings</td>
<td>≤2.5 mGy</td>
<td></td>
</tr>
<tr>
<td>3. To minimise the number of repeat examinations (national standard 6)</td>
<td>The number of repeat examinations</td>
<td>&lt;3% of total examinations</td>
<td>≤2% of total examinations</td>
</tr>
<tr>
<td>4. To provide women with accurate messages about breast screening</td>
<td>The percentage of women provided with information about:</td>
<td>100% of women screened</td>
<td></td>
</tr>
<tr>
<td>appropriate to their needs</td>
<td>• the screening test</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• how they will receive their results</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• organisation of the screening programme</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• harms and benefits of screening</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• importance of breast awareness</td>
<td></td>
<td></td>
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<tr>
<td>5. To provide women with comprehensive explanations about the mammographic examinations</td>
<td>The percentage of women provided with explanations about:</td>
<td>&lt;7% of women surveyed will find the examination painful</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• the use of compression</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• mammographic views</td>
<td>100% of women</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• examination times</td>
<td>&gt;95% of women</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>are examined within 30 minutes of their appointment time</td>
<td></td>
</tr>
<tr>
<td>6. To ensure that all health and safety legislation and safe working</td>
<td>The percentage of incidents reported to the NCCPM</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>practices are adhered to</td>
<td>The percentage of critical incidents reported to the MHRA</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>7. To ensure that client confidentiality is maintained</td>
<td>The percentage of staff who have read and understood the requirement for confidentiality</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>8. To ensure professional development takes place</td>
<td>The percentage of mammography practitioners involved in CPD</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The percentage of mammography practitioners with a personal development</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>plan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. To ensure participation in performance appraisal</td>
<td>The percentage of staff involved in annual appraisal</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

* These standards are derived from experience with film-screen systems and are not appropriate for digital mammography systems. New standards and testing procedures for digital mammography systems in the UK are now available. 27
All women who are invited for breast screening, or self request a screen, are sent a copy of *Breast Screening: The Facts*\(^{28}\) to enable them to make an informed decision about whether or not to attend. Mammographers may need to provide further information as appropriate to the woman’s individual needs about:

- the screening test
- how they will receive their results
- benefits and difficulties of screening
- importance of breast awareness
- where to access more detailed information.

Mammographers may participate in health promotion/education activities relating to breast screening and breast care. They should be able to give accurate messages about the benefits and difficulties of the breast screening programme and answer questions accurately and sensitively from women who are currently not invited or not eligible for breast screening and the reasons why. The nationally agreed leaflet and letters should be used, but mammographers may be involved in development of additional locally agreed information.

For the majority of women attending for breast screening, the mammographer will be the only health worker they encounter. Therefore, the mammographer has a key role in the woman’s experience, satisfaction and continued acceptance and uptake of the service. The needs of individual women and their circumstances must be recognised in order to ensure a satisfactory and positive screening experience. Continued uptake of invitations for screening by invited women may be the single most important factor in determining whether the programme is successful in its aim of reducing mortality from breast cancer in the screening population.

The mammographer taking the mammogram is responsible for ensuring that women are informed about the examination and must be aware of current issues in order to be able to answer questions appropriately. The mammographer must give a full explanation of the procedure including the reasons for the use of compression, which some women may find uncomfortable.\(^{29}\) The mammographer should follow the guidance given in *Information and Advice for Health Professionals in Breast Screening*.\(^{30}\)

The mammographer should ensure that:

- the woman’s demographic details are confirmed, eg name, address, date of birth
- all women are appropriately informed and adequately supported; women with learning difficulties or physical disabilities or those whose first language is not English may need additional support
- women with breast implants are given an explanation of the limitations of mammography for them (a national leaflet *Breast Implants and Breast Screening*\(^{31}\) is available)
- an adequate explanation of the mammographic examination (including the use of compression) is provided
• valid consent is obtained
• all women receive a comprehensive explanation about receiving results, second stage screening and breast awareness (a national leaflet Be Breast Aware is available)
• all women are informed about the importance of reporting any changes noticed between screening episodes to their GP
• any significant symptoms reported by women are recorded
• women in the over 70s age group are informed of how to make an appointment when they are next due (a national leaflet Over 70? You are Still Entitled to Breast Screening is available).

Women should feel confident that they have the ability to stop the procedure at any point. When women comply with the procedure, valid consent is implied. When consent is withdrawn, this needs to be clearly documented.

3.6 Equipment fault and incident reporting (objective 6) A database of equipment used by the NHSBSP is maintained by the National Coordinating Centre for the Physics of Mammography (NCCPM). This information is updated every six months by sending equipment lists to each breast screening centre. Mammographers should report any equipment faults to the NCCPM so that these can be added to the database. Blank reporting forms can be downloaded from the NCCPM website. Where further information or action is required, the NCCPM will contact the servicing agents. Meetings are held periodically with the equipment suppliers to discuss faults reported for their equipment. Minutes of these meetings are distributed to all members of the NHSBSP’s equipment, radiographic and physics QA coordinating groups. The Review of NHSBSP Equipment and Equipment Faults is prepared every six months and published internally by the NHSBSP. Mammographers should also comply with local trust protocols for reporting critical incidents.

3.7 Confidentiality and security (objective 7) Mammographers must ensure that privacy and confidentiality are maintained in accordance with trust protocols. Local protocols for maintaining the security of patient identifiable data should be followed. All mammographers should be aware of the NHSBSP’s policies on confidentiality and disclosure of information and on information security.

3.8 Professional development and review (objectives 8 and 9) All mammographers should participate in professional development and performance and development review. Further details are given in Chapter 6.

3.9 Other responsibilities for mammographers Additional responsibilities for mammographers include:
• complying with local protocols for the prevention and control of infections
• ensuring that the screening environment is clean and tidy
• addressing complaints and compliments in accordance with local trust policy
• undertaking, reviewing and appropriately documenting all recommended QC tests (see Chapter 4)
3.10 Monitoring programme performance

All mammographers should participate in measuring the performance of the local programme against the QA objectives for mammography. In addition, they should receive feedback about performance against other national objectives. These include:

- uptake and coverage
- screening round length
- waiting time audits
  - time of appointment to time of examination
  - time between screening and results
  - time between screening and first offered assessment appointment
- acceptance rates for prevalent and incident screening rounds
- short term recall rates
- regular client satisfaction surveys
- compliments and complaints
- risks/near misses/learning from incidents
- non-conformance reports.
4. RADIOGRAPHIC QUALITY CONTROL

4.1 Objectives of radiographic quality control

Radiographic quality control (QC) is necessary:

- to achieve high quality images with as low a radiation dose as reasonably practicable
- to minimise the number of women having films repeated for technical reasons.

These objectives are achieved by a combination of routine QC tests carried out by mammographers, performance tests carried out by the medical physics service, and regular servicing of radiographic equipment. An effective radiographic QC system requires:

- a nominated and competent QA individual, normally a radiographer, in each unit
- schedules for routine monitoring, testing and servicing of equipment
- procedures for reporting of system failures and corrective action
- procedures for the notification of equipment faults to the RQAR and the NCCPM
- criteria for limits of acceptability
- clearly defined responsibilities for the suspension of mammographic equipment
- good communication with medical physics staff
- maintenance contracts for all equipment
- equipment replacement programmes
- staff training and development.

Time must be set aside to allow all aspects of radiographic QC and other QA activities to be carried out.

4.2 Roles in quality control

4.2.1 Role of mammographers

All mammographers should ensure that the protocols for routine QC are followed at all times. They should be involved in equipment specification and selection, acceptance and commissioning testing, and in service testing. The quality of mammography depends on the expertise of mammographers as well as on the performance of equipment. QA objectives for mammographers are set out in Chapter 3 of this document, and guidance on mammographic techniques is given in Chapter 5.

4.2.2 Role of the unit QA radiographer

Each unit normally has a nominated QA radiographer, whose role is defined in section 2.4 of this document. In relation to QC, the unit QA radiographer, in conjunction with the radiography manager, must be responsible for:
Quality Assurance Guidelines For Mammography

• ensuring that QC procedures are in place and that appropriate equipment tests are carried out
• ensuring that the results are recorded, evaluated and monitored
• ensuring that corrective action is taken as appropriate and that it is recorded and evaluated
• ensuring that essential servicing, maintenance and repairs are carried out satisfactorily
• notifying the NCCPM about equipment faults using the appropriate national form, which should be copied to appropriate members of the regional QA team according to local protocols. \(^{35,36}\)

The unit QA radiographer must be given sufficient time to analyse and evaluate the data arising from these procedures and to take appropriate action. It is suggested that, as a minimum, the equivalent of one session (three hours) per week is allocated; the actual amount of time will depend on local circumstances.

4.2.3 Role of the regional QA radiographer

The role of the RQAR is defined in section 2.5 of this document and includes coordination, support and monitoring of the routine QC system. The RQAR, in conjunction with the regional QA physicist, must establish a regional protocol for routine QC of equipment, or approve local protocols.

4.2.4 Role of the medical physics service and regional QA physicist

These roles are defined in Quality Assurance Guidelines for Medical Physics Services. \(^{17}\) There must be close collaboration between radiographers and the medical physics service in the development, operation and monitoring of the QC system.

4.2.5 QC documentation

Each unit must have a method of recording test results to ensure that the information is evaluated and monitored and that corrective action is taken and recorded. A document control system must be used for all written procedures and forms.

4.3 Equipment for mammography

4.3.1 Mammography x-ray equipment

High quality mammography requires equipment which is dedicated to mammography. It is important that the guidance in this document is used in conjunction with the other documents available on the specification and testing of mammographic x-ray equipment. \(^{19,39–41}\) All mammographic x-ray equipment used in the breast screening programme must:

• meet the requirements of all the relevant guidance \(^{19,41}\)
• be correctly installed
• meet all the current health and safety regulations and other legislation
• be utilised in an appropriate environment
• continue to perform to the required standard \(^{19,39–41}\)
• be used correctly.

4.3.2 Mammography trailers

All preinstallation work should comply with the Medical Electrical Installation Guidance Notes \(^{42}\) (MEIGaN). This guidance should be used in...
conjunction with the Department of Health guidance document TRS 89, and adherence to both documents should be included in specifications for enabling work for new or reinstalled x-ray and imaging equipment.

Breast screening trailers are also subject to the requirements of the MEIGaN and TRS 89 guidance. Further specific guidance is included in the Guidance Notes for the Installation of Electrical Supply for NHSBSP Mammography Trailers and in references 45 to 48.

4.4 Protocols for routine quality control

4.4.1 Operational procedures
Each breast screening programme must develop and maintain detailed protocols for the QC of radiographic equipment. Written operational procedures for the routine monitoring, testing and servicing of equipment, based on the following sections in this chapter, must be approved by the RQAR and QA physicist. Normally, all programmes covered by the same QARC use a common set of protocols. Equipment performance and the operation of the QC system in each unit is audited by the RQAR and QA physicist as part of the multidisciplinary QA visit every three years. The QC system and the results produced should be regularly reviewed and modified as necessary in light of changing knowledge and experience. Note that the procedures in this document represent the minimum standard; it will often be necessary for the regional or local protocol to include additional tests to address specific issues relating to particular models of equipment or different working practices.

4.4.2 Remedial and suspension levels
The protocols should include remedial and suspension levels as defined in Guidance Notes on Mammographic X-ray Equipment. There should be written procedures in each screening programme that must be followed if the remedial or suspension levels are exceeded. These procedures should indicate the stage at which screening will be stopped and the named person responsible for making that decision.
A. TESTING MAMMOGRAPHIC X-RAY UNITS

A1 Responsibilities of employers and installers

It is the responsibility of the employer and the installer to ensure that the tests and training described in sections A2–A6 are carried out on all new equipment. The radiography manager should ensure that the test results are satisfactory before the machine is used clinically.

It is also necessary to carry out routine in service testing to verify that the performance has not changed.

Many of these tests are in line with the recommendations made in IPEM Reports 91 and 89.39,40 Mammographers should be familiar with these documents and be ready to assist with the tests as and when appropriate.

At Installation

A2 Electrical and mechanical safety checks

Guidance should be sought from NHSBSP Report 03/01, Guidance on the Electrical and Mechanical Safety Testing of Mammographic X-ray Equipment,49 and from other relevant publications.

A3 Critical examination of the radiation safety features

The installer has to undertake the critical examination in conjunction with a Radiation Protection Adviser.21,40 It is performed to ensure that all the radiation safety features and warning devices are operating correctly.

A4 Acceptance tests

Acceptance should be a formal process in which the supplier demonstrates to the purchaser that the performance of the equipment meets the specification as detailed in the contract.

A5 Commissioning tests

Commissioning tests are carried out by the medical physics service. They ensure that the performance of the unit is optimised and provide baseline performance measurements against which all future measurements will be compared.

A6 Clinical applications training

Clinical applications training should be provided by the equipment suppliers. A record of training dates and details, including a training checklist, should be kept for each mammography practitioner. Training should also be provided for all new starters and should form part of the induction programme.
Routine In Service Tests

A7 Radiation safety inspection and performance measurements

These should be performed at six monthly intervals by the medical physics service.17

A8 Mechanical safety and function checks

The mammographers should be aware of the mechanical safety and functioning of the equipment in normal working and report any faults. A formal assessment should be made at least monthly. These tests should also be included in the routine maintenance contract. Suggested checks are as follows:

Safety – check that:

- the emergency isolator functions correctly
- powered movement of the table is prevented when sufficient compression is applied
- the automatic release of the compression plate after an exposure functions correctly
- the automatic release override is functioning
- the emergency compression release operates correctly
- the compression force is maintained and does not slip
- there are no sharp edges on surfaces, compression plates, support table, etc
- no part of the machine which comes into direct contact with the woman becomes too hot
- radiation warning lights on the x-ray set and at the entrance to the room operate correctly.

Function – check that:

- all movements are free running
- all mechanical/electromechanical brakes function properly
- scale markings are clear on all linear and rotational movements
- all foot switches operate correctly
- all attachments have correctly functioning locks
- the automatic exposure control (AEC) detector moves freely
- the cassette can be inserted and removed easily without snagging
- the retaining force is sufficient to prevent movement of the cassette when the x-ray machine is in the lateral position
- the light intensity from the light beam diaphragm is adequate
- the movement of the compression plate is smooth.
A9 Daily Perspex block test

This test is designed to ensure that the mammographic x-ray unit is producing a consistent output and film density. The following values must first be established for each unit in conjunction with the medical physics service.

Target density – this is the optical density that the unit is aiming for. It should be selected by taking into account local factors (such as the type of film in use) and should be in the range 1.5–1.9.

Baseline mAs – this is the mAs needed to achieve the target density when carrying out the test according to the following protocol.

Frequency

Daily.

This test should also be carried out under the following circumstances:

• following service/repair
• after moving the mobile unit
• when malfunction is suspected.

Equipment required

• Perspex blocks (4 or 4.5 cm according to local protocol). The block(s) should be labelled and the same ones should be used each time.
• Test cassette – this cassette should be labelled and used for all tests.
• Densitometer.
• Film in current use.

Method

Place 4 or 4.5 cm of Perspex centrally on the breast support table against and slightly overlapping the chest wall edge.

Ensure the AEC chamber is at the chest wall position.

Place the loaded test cassette in the cassette holder.

Select all operating parameters as used clinically for this breast thickness. These will include AEC density control setting, AEC mode, collimator and compression paddle. If kV/target/filter are selected manually, always use the same settings for this test.

Apply sufficient compression to activate the AEC (if required). Different types of mammography machine have different AEC systems and it is recommended that local testing protocols specify the level of compression applied for this test.

Make an exposure and record all post-exposure factors (mAs, target material, filter material, kV).

If processing facilities are available, process the film after carrying out sensitometry. If processing facilities are not available, the film should be returned with the others for processing and reading.

Measure the resultant film density and record. The film density measurement should be made on the midline 4 cm from the chest wall edge. It is useful to record the film density graphically in order to identify trends.

The film should be checked for artefacts and other faults, eg beam alignment, grid lines, scratches and processing marks. Artefacts, if present, should be noted on the record sheet and, if substantial, corrective action initiated.

If the machine has a separate AEC system for 24×30 format, the test should be repeated in that mode.
### Limiting values

<table>
<thead>
<tr>
<th>Remedial level</th>
<th>Suspension level</th>
</tr>
</thead>
<tbody>
<tr>
<td>mAs &gt;±5% of baseline</td>
<td>mAs &gt;±10% of baseline</td>
</tr>
<tr>
<td>Deviation in OD from target density &gt; 0.2 (target OD should be in the range 1.5–1.9)</td>
<td>OD outside the range 1.3–2.1 and not correctable by adjustment of AEC density control</td>
</tr>
</tbody>
</table>

On units with automatic kV selection, the mAs will vary depending on the kV. For such units, local systems for checking mAs values should be developed with the medical physics service.
Quality Assurance Guidelines For Mammography

A10  AEC thickness test

This test checks that the AEC performs correctly for varying breast thicknesses.

Frequency

Monthly.

This test should also be carried out under the following circumstances:

• following service/repair
• after moving the mobile unit
• when malfunction is suspected.

Equipment required

• Perspex blocks: 2 cm, 4 or 4.5 cm, and 6 or 7 cm (according to local protocol). The block(s) should be labelled and the same ones should be used each time.
• Test cassette.
• Densitometer.
• Film in current use.

Method

Place 2 cm of Perspex centrally on the breast support table against and slightly overlapping the chest wall edge.

Ensure the AEC chamber is at the chest wall position.

Place the loaded test cassette in the cassette holder.

Select all operating parameters as used clinically for this breast thickness. These will include AEC density control setting, AEC mode, collimator and compression paddle.

Apply sufficient compression to activate the AEC (if required). Different types of mammography machine have different AEC systems and it is recommended that local testing protocols specify the level of compression applied for this test.

Make an exposure and record all post-exposure factors (mAs, target material, filter material, kV).

Process the film (or add to the magazine for batch processing).

Reload the same cassette.

Repeat the above steps for each of 4 or 4.5 cm and 6 or 7 cm Perspex.

Read the resultant densities 4 cm from the chest wall in the midline on each film and record.

Check the films for artefacts and other faults, eg beam alignment, grid lines, scratches and processing marks. Artefacts, if present, should be noted on the record sheet and, if substantial, corrective action initiated.

If the machine has a separate AEC system for 24×30 format, the test should be repeated in that mode.

Limiting values

<table>
<thead>
<tr>
<th>Remedial level</th>
<th>Suspension level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum deviation in OD from value with 4 cm Perspex &gt; 0.20</td>
<td>Maximum deviation in OD from value with 4 cm Perspex &gt; 0.40</td>
</tr>
<tr>
<td>or Range of OD (highest minus lowest) &gt; 0.30</td>
<td>or Range of OD (highest minus lowest) &gt; 0.60</td>
</tr>
<tr>
<td>or Any OD outside the range 1.3–2.1</td>
<td></td>
</tr>
</tbody>
</table>

Local protocols may also set remedial and suspension levels for mAs values.
A11 Image quality test

In mammography, an image test object or phantom contains features which attempt to parallel anatomical and pathological structures in the breast. The test object can provide QC checks on the performance of the imaging system and allow comparison between systems. The test is designed to give an overall assessment of the image quality produced by the whole imaging system. Detailed information on the use of the test object should be obtained from its accompanying instruction manual.

Frequency

Weekly.

This test should also be carried out under the following circumstances:

- following service/repair
- after moving the mobile unit
- when malfunction is suspected.

Equipment required

- Test object(s) suitable for testing compliance with NHSBSP standards.
- Test cassette.
- Densitometer.
- Magnifying glass with the magnification recommended in the user manual.

The same equipment should always be used to ensure standardisation. The test cassette should be loaded at least five minutes prior to use to ensure good screen-film contact.

Method

Place the test object on the appropriate thickness of Perspex (4 cm if using TORMAS or TORMAX) on the breast support table against and slightly overlapping the chest wall edge.

Ensure the AEC chamber is at the chest wall position.

Place the loaded test cassette in the cassette holder.

Lower the compression paddle onto the test object.

Operate the unit in a fixed kV, automatic mAs mode. If the test object has a high or low attenuation feature overlying the AEC detector, it may be necessary to set the mAs manually according to a local protocol.

Select 28 kV, Mo target, Mo filter.

Select an appropriate density setting consistent with normal clinical use.

Make an exposure and record the mAs value.

Process the film, after the appropriate sensitometry tests have been carried out to ensure that the processing conditions are within normal limits.

Following the instructions provided with the test object, measure the film density, view the film and assess and record the details. Care should be taken to ensure appropriate and consistent viewing box brightness, low ambient lighting, masking of bright areas and use of appropriate magnifiers.

Check the film for artefacts.

Where the results do not meet the NHSBSP standards or are significantly different from the usual performance of the unit, the reason should be investigated and, if appropriate, the unit should be suspended from use.
The evaluation of image quality test films is subjective. Variation of scores can be reduced by training and experience. A pool of several competent readers is usually needed in order to ensure that someone is always available to read the test films. Consistency within and between readers should be verified periodically, eg by scoring a standard set of training images.

Consideration should be given to performing an image quality test in magnification mode with a suggested frequency of monthly.

**Limiting values**

<table>
<thead>
<tr>
<th>Remedial level</th>
<th>Suspension level</th>
</tr>
</thead>
<tbody>
<tr>
<td>High contrast resolution:</td>
<td>High contrast resolution:</td>
</tr>
<tr>
<td>&lt;12 line pairs per mm</td>
<td>&lt;10 line pairs per mm</td>
</tr>
<tr>
<td>&gt;25% decrease from baseline value</td>
<td></td>
</tr>
<tr>
<td>Threshold contrast:</td>
<td>Threshold contrast:</td>
</tr>
<tr>
<td>&gt;1.2% for 5–6 mm detail</td>
<td>&gt;1.4% for 5–6 mm detail</td>
</tr>
<tr>
<td>&gt;5% for 0.5 mm detail</td>
<td>&gt;8% for 0.5 mm detail</td>
</tr>
<tr>
<td>&gt;8% for 0.25 mm detail</td>
<td>&gt;11% for 0.25 mm detail</td>
</tr>
</tbody>
</table>
A12 Stereotactic equipment

It is essential that all personnel using the stereotactic device and the biopsy gun are properly trained, as with all equipment, to use such equipment properly and that they maintain this knowledge and skill. A standard detailed protocol must be available in each unit which explains about:

- **needles** – what is used and when and what the process is for checking a new batch or when a supplier is changed
- **biopsy guns** – what needle throws are used and when, what needs to be checked following maintenance and how frequently maintenance is performed, what cleaning is required
- **QC checks on stereo equipment** – when to check, how frequently, when to suspend equipment and the reporting/documentation for this system. Any tests should be undertaken with the needles and gun intended for clinical use. It is also necessary that tests are performed in the pre- and postfired needle positions to check that the core sampling is accurate.

It is important that the accuracy of the stereotactic equipment is regularly checked using a suitable test object. It should be tested weekly, or before each use if the equipment is used infrequently. The device should be checked in three dimensions using the same needle type that is used clinically. The core biopsy needle should be checked to ensure that the core is taken from the correct depth. For the test method, see the manufacturer’s instructions. For further information, see IPEM Report 89.40

### Limiting values

<table>
<thead>
<tr>
<th>Remedial level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Errors of &gt; 1 mm in X or Y or &gt; 3 mm in Z</td>
</tr>
</tbody>
</table>

Where the unit is more than 3 mm in error, it should be recalibrated and rechecked. If this does not correct the error, the responsible mammographer should discuss the situation with the radiologist and make the decision of whether to suspend the equipment until the error is corrected. Any faults subsequently detected should be reported in accordance with local or regional protocols.

A13 Small field digital mammography units

The medical physics service should perform tests on small field digital systems according to NHSBSP Occasional Report 01/09 on a six monthly basis and whenever a new digital detector is installed. These include tests of the detector, the display monitor and the hard copy system. It is recommended that local protocols should be developed for more frequent testing by mammographers in conjunction with the medical physics service. Such protocols should include tests of:

- **AEC performance (eg record pixel value and mAs for exposure of Perspex block)**
- **uniformity and artefacts (eg inspect image of Perspex block)**
- **contrast (eg between different thicknesses of Perspex).**

Further specific guidance will be published by the NHSBSP.
A14 Breast doses

Mean glandular doses should be calculated for a sample of 50 or more women on each x-ray machine one to three yearly. This is carried out by the mammographers in conjunction with the medical physics service according to local protocols based on the method given in IPEM Report 89. The average value of mean glandular dose to 50–60 mm thick breasts should not exceed 3.5 mGy per film, or the local diagnostic reference level (DRL) if this is lower.

The six monthly tests carried out by the medical physics service will include a measurement of the dose to a standard breast to verify that this does not exceed the NHSBSP standard of 2.5 mGy per film at clinical settings.
B. TESTING FILM PROCESSORS

The film used in mammography is particularly sensitive to fluctuations in processing parameters. Every effort must be made to provide and maintain standard processing conditions.

B1 Acceptance and commissioning tests

The acceptance and commissioning tests for the processor serve to ensure that it is operating correctly at optimum performance levels and meets all the current legislation.

B2 Electrical and mechanical safety checks

At acceptance and commissioning, electrical and mechanical safety checks are the responsibility of the installer, and written assurance must be provided to the nominated mammographer that they have been completed satisfactorily.

Any necessary periodic repetition of safety checks will normally form part of the maintenance contract and be included in the engineer’s written report.

The electrical and mechanical safety checks should include ensuring that:

- the unit is securely fixed and allows no access to live or moving parts
- all plumbing, mixing valves, flow indicators, solenoid valves and flow controls are free from leaks and corrosion
- the piping is securely fixed
- there are no impediments to or kinks in the soft pipes.

B3 Control of substances hazardous to health (COSHH) and health and safety regulations

The mammographers should be aware of all regulations about the control of substances hazardous to health (COSHH) and health and safety.

Data sheets on chemicals must be provided by manufacturers and risk assessments must be carried out.
B4 Sensitometry

These tests are designed to ensure that the film processor is performing to the required standard. They should identify any deviation at a sufficiently early stage to enable corrective action to be taken. Changes in processing conditions will affect speed, contrast, maximum density and the fog level as defined below.

Alternative definitions of sensitometric parameters may be used if recommended by the film manufacturer or provided as part of a computerised sensitometry system. However, as a minimum, these must include measures of base plus fog, speed and contrast (also referred to as gamma, gradient or slope).

**Base plus fog**
Measure step 1 or an unexposed area of the film to give the base plus fog level.

**Speed index**
Measure the step with a density in the range 1.0–1.5 above base plus fog. Routinely, the same step should always be used. This is the speed index.

**Contrast index**
Measure the step with a density in the range 2.0–2.5 above base plus fog. Routinely, the same step should always be used. The speed index is subtracted from this value to give the contrast index.

**Maximum density ($D_{\text{max}}$)**
Measure the density of the maximum density step. Note that this is not necessarily the last step on the strip. Routinely, the same step should always be used. This parameter need not be used for routine QC but a baseline value may be recorded so that the value can be checked if a fault is suspected.

**Equipment required for all sensitometric tests**
- Twenty-one step sensitometer.
- Densitometer, checked quarterly with a densitometer calibration strip.
- Film taken from the box kept specifically for sensitometry. This box should be taken from the batch in clinical use.

**B4.1 Setting up and using a processor control chart**

Baseline values for base plus fog, speed, contrast and $D_{\text{max}}$ are obtained by averaging the readings taken from a number of control strips processed at the commencement of a monitoring programme, using a given batch of film and standard processing conditions. Note that fresh chemicals may take several days to reach equilibrium, and care should be taken to ensure that the baseline values are representative of the normal performance of the processor (eg by checking that control strips from several days give consistent results).

**Method**

**Step 1.** Under safelight conditions, expose the films to a sensitometer in a reproducible manner using the sensitometer according to the manufacturer’s instructions. Particular care should be taken to ensure that the light setting matches the spectral sensitivity of the film.

**Step 2.** Always process the film immediately in a reproducible manner, and with the strip in the same position through the processor on each occasion. Variation in the method of processing will lead to variation in the measurement of speed and contrast.
Step 3. Record the developer temperature immediately after processing the film by reading the display on the processor or using an independent thermometer.

Step 4. Repeat the three steps above until sufficient strips have been obtained to give a reliable indication of processor performance (the less stable the processor, the greater the number of strips required).

Following reading of these strips, average values are calculated for base plus fog, speed index and contrast index. These are recorded on the processor control chart (note, for future reference, the step numbers used to calculate the speed and contrast indices). These then become the baseline values against which the performance of the processor is measured.

In order to see any changes and to be aware when action is necessary, the baseline values and limiting values should be marked on the processor control chart. This is done by placing dotted lines on the chart at the appropriate limiting values (ie ±0.10 OD about the baseline value for speed and contrast and 0.03 OD above the baseline value for base plus fog).

The following information should also be recorded on the processor control chart:

- developer temperature
- processor cleaning – should be recorded on the chart with the date
- chemical changes – whenever the processor chemicals are replaced in the processor tanks, this should be recorded. The points on the graph before and after the chemical change should not be joined
- when the film box used for sensitometry has been changed
- when servicing has been carried out
- the type of chemistry being used
- other relevant changes.

B4.2 Routine sensitometry

Frequency

Daily.

Sensitometric tests should also be carried out:

- on installation of the processor to establish baseline measurements
- when there are any changes in processing parameters and/or films
- after servicing and/or repair, while the engineer is still present
- to compare with previous results in the event of a problem with processing.

Sensitometric testing should be carried out at the same time each day. The following times are appropriate:

- before starting film processing each morning
- midway through processing a day’s work.

Method

Follow Steps 1–3 above.

Step 4. Read the values for speed, contrast and base plus fog.

Step 5. Record this information on the processor control chart noting any deviations and trends. Changes may reflect variations in the processor performance, which can significantly affect the radiographic image. Small random up and down changes in plotted points is normal.

Step 6. The appropriate density readings on subsequent control strips are compared with baseline values and plotted in the appropriate section of the processor control chart. Do not connect plotted points if processing has been interrupted, ie if the processing conditions or chemicals have been changed or a new batch of films is used.
Limiting values

<table>
<thead>
<tr>
<th>Remedial level</th>
<th>Suspension level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base plus fog:</td>
<td>Base plus fog:</td>
</tr>
<tr>
<td>&gt; 0.03 OD above the baseline</td>
<td>&gt; 0.06 OD above the baseline</td>
</tr>
<tr>
<td>Speed index:</td>
<td>Speed index:</td>
</tr>
<tr>
<td>&gt; ±0.10 OD about the baseline</td>
<td>±0.2 OD about the baseline</td>
</tr>
<tr>
<td>Contrast index:</td>
<td>Contrast index:</td>
</tr>
<tr>
<td>&gt; ±0.10 OD about the baseline</td>
<td>±0.2 OD about the baseline</td>
</tr>
</tbody>
</table>

If different parameters are used, it will be necessary to establish different (but equivalent) limiting values in cooperation with the medical physics service.

B4.3 Crossover procedure when changing film batch number

It is important to identify any differences caused by variations in speed, contrast and base plus fog between different batches of film. The following procedure should be carried out when there are only 5–10 sheets of film remaining in the box kept for making sensitometry strips or when the batch number in clinical use changes. It should be performed at the same time as routine testing (see section B4.2).

Expose one film from the current box of film and one from the new box, using the sensitometer.
Process both films as nearly as possible at the same time, ensuring that they are correctly identified.
Measure the speed, contrast and base plus fog, using the densitometer.
It is advisable to repeat the procedure on further films from the current and new boxes and take average values of speed, contrast and base plus fog.
Calculate the difference between the old and new values and adjust the baseline values accordingly. For example, if the speed index for the new film is 0.05 higher than the speed index for the current film, add 0.05 to the baseline value for speed index.
Adjustments to baseline values should normally be less than 0.15 because batches outside this limit will fail the film batch acceptance test (see section C4).
Keep records of baseline values and adjustments for future reference.
B5  Developer temperature

Developer temperature can be critical. A variation of 1°C could result in a significant variation in film density.

*Frequency*
Daily.

*Method*
Record the value shown on the processor’s developer temperature indicator. (If the processor does not have an indicator, measure the temperature as described in section B9.2.)

*Limiting values*

<table>
<thead>
<tr>
<th>Remedial level</th>
<th>Suspension level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline ±0.5°C</td>
<td>Baseline ±1.0°C</td>
</tr>
</tbody>
</table>

B6  Batch processing films from mobile units

Before commencing batch processing, the following checks should be made:

- developer temperature
- correct processor cycle time setting
- sensitometric test strip.

B7  Processor cleaning

The film processor should be cleaned according to the manufacturer’s instructions. Special attention should be paid to the crossover rollers as dirty rollers will cause film artefacts.

The processor racks and rollers should be regularly inspected for signs of wear.

All drain pipes should be inspected for leaks and blockages. Water valves should be checked and filters inspected.

B8  Processor maintenance

The film processor and chemical mixer should undergo routine service visits. The following tests should be carried out before the service visit and repeated on completion of the work in conjunction with the service engineer in order that any adjustments can be made:

- sensitometry (if recent values are not available)
- developer temperature checked by thermometer.

A log book should be established in which all service information is recorded and dated.
B9 Additional tests

The following tests may be included in a QC programme on a regular basis (three or six monthly) and/or can be useful when investigating faults. Some may also be carried out by the service engineers at routine services.

B9.1 Processing cycle time

The processing cycle time should be checked to ensure that there is no variation in the speed with which the film passes through the processor. Variations in speed will give variable film density.

Equipment required

- Stopwatch, or watch with a second hand.

Method

Measure the time from the leading edge of the film entering the processor to the leading edge emerging, or from trailing edge entering to emerging.

Limiting values

<table>
<thead>
<tr>
<th>Remedial level</th>
</tr>
</thead>
<tbody>
<tr>
<td>The processing cycle time should be within ±5% of the baseline value</td>
</tr>
</tbody>
</table>

B9.2 Accuracy of developer temperature indicator

The developer temperature is recorded daily as part of the daily sensitometry. This reading is usually taken from the developer temperature indicator. It is therefore important to check the temperature indicators for accuracy using a thermometer if there is a problem.

Equipment required

- Digital or glass/alcohol thermometer.

A glass/mercury thermometer should not be used owing to the risk of contamination if there is a breakage.

Method

Whenever possible, developer temperature should be measured in the same place in the developer and away from the replenisher inlet. This should be compared with the display value to confirm its long term accuracy.

Limiting values

<table>
<thead>
<tr>
<th>Remedial level</th>
</tr>
</thead>
<tbody>
<tr>
<td>The temperature indicator should be within ±0.5°C of the thermometer reading</td>
</tr>
</tbody>
</table>
B9.3  Replenishment rates

The correct replenishment rate will depend on:
- the type of processor
- the area of film processed
- the average density of the film
- the working conditions
- the chemistry used.

Equipment required
- Measuring jug.

Method
Developer and fixer replenishment rates should be measured according to the processor manufacturer’s instructions.

Limiting values

<table>
<thead>
<tr>
<th>Remedial level</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured rate should be compared with the set rate at the last service, assuming similar working conditions</td>
<td></td>
</tr>
</tbody>
</table>

B9.4  Specific gravity

The specific gravity (density relative to water) is a measure of how concentrated the chemicals are. This test can be useful if a fault with a chemical mixer is suspected.

Equipment required
- Hydrometer and hydrometer jar.

Method
Put a sample of developer or fixer into the jar and float the hydrometer in it. Read the hydrometer scale at the surface of the liquid. This is the specific gravity. Samples may be taken from different levels in the processor and/or the automixer to check for faults with dilution or mixing.

Limiting values

<table>
<thead>
<tr>
<th>Remedial level</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>According to chemical manufacturer’s specification. If the value is too high, the chemical is too concentrated; if it is too low, the chemical is too dilute</td>
<td></td>
</tr>
</tbody>
</table>
**B9.5 Residual hypo**

This test is to check the efficiency of the fixing and washing. A residual hypo test is a simple chemical test designed to indicate whether all the sodium or ammonium thiosulphate has been removed from the processed film. Inadequate washing results in a stained and faded radiograph.

*Equipment required*
- Hypo estimation kit (available from manufacturers or photographic suppliers).

*Method*
Follow the instructions on the test kit.

*Limiting values*

| Remedial level | According to film manufacturer’s recommendations |

**B9.6 Silver content**

This measurement gives an indication of the silver content of the fixer.

*Equipment required*
- Silver estimation papers (available from manufacturers or photographic suppliers).

*Method*
Follow the instructions on the test kit.

*Limiting values*

| Remedial level | According to film manufacturer’s recommendations. A high silver content may indicate that the fixer replenishment rate is too low |

Each unit should have established rules for dealing with spent silver and silver recovery.
C. FILM AND DARKROOMS

C1 Film selection

When choosing mammography film, consideration should be given to achieving the national minimum standards for image quality and dose.

C2 Film storage conditions

Film must be stored under suitable conditions at all times. This applies to both unexposed films and exposed, unprocessed film. Film must be stored under the following conditions:

- temperature 15–18°C
- humidity 50–60%
- away from ionising radiation
- away from processing chemicals and fumes
- kept in lightproof conditions at all times.

C3 Stock control

Stock control of film is important in quality control.

On delivery check:

- the expiry date of the film is adequate for the normal rate of use
- batch numbers are consistent
- the delivery date is clearly written on the box.

Regularly check stock levels and expiry dates.

Use film in strict rotation.

Do not use film beyond the expiry date.

C4 Film performance testing – routine, and acceptance of new batches

The routine sensitometric testing assessment of the film processor also serves to provide an assessment of film performance.

Acceptance testing should be carried out for new batches of film. If the batch number is the same as film already in use, then routine sensitometry will be sufficient. If the batch number is different, one sensitometric strip should be carried out on the new batch and compared with the film already in use. Check with the manufacturer which number on the box relates to which batch.

Limiting values

<table>
<thead>
<tr>
<th>Remedial level</th>
<th>Suspension level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed and contrast indices for the new batch differ from current values for film in use. Reset baseline values for sensitometry using the crossover procedure (see section B4.3)</td>
<td>Speed and contrast indices for the new batch are outside ±0.15 of the current values for the film in use. Reject the film batch and query with the film manufacturer (see section B4.3)</td>
</tr>
</tbody>
</table>
C5 Darkrooms

C5.1 Safelight

The safelight filter and bulb should be suitable for the type of film in use. For mammography film, this will typically be a type GBX-2 filter (or equivalent) with a 15 watt bulb. When working under darkroom conditions, the film should be kept at a distance 1.2 metres (4 feet) away from the safelight. Requirements for particular films should be checked with the film manufacturer.

C5.2 Darkroom tests

A subjective check of light-tightness should be made periodically by waiting until eyes have become dark adapted and then inspecting the darkroom for light leaks. An objective test of safe handling time should also be made annually as follows.

Equipment required

- Film loaded in complete darkness (no safelight) and exposed to a midrange optical density (eg film of Perspex block exposed under AEC or step wedge along two sides of film).
- Opaque card.
- Densitometer.

Method

With the safelight on, place the exposed film, emulsion side up, in the usual position where films are handled, cover half the film with opaque card and leave for 2 min. Process the film and measure the densities at symmetrical positions in the covered and uncovered halves. Calculate the density difference. If it exceeds the remedial level, repeat the test with the safelight off to determine whether the fogging is caused by the safelight.

Limiting values (for 2 minute exposure)

<table>
<thead>
<tr>
<th>Remedial level</th>
<th>Suspension level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density difference:</td>
<td>Density difference:</td>
</tr>
<tr>
<td>&gt; 0.10 with safelight on</td>
<td>&gt; 0.20 with safelight on</td>
</tr>
<tr>
<td>&gt; 0.025 with safelight off</td>
<td>&gt; 0.05 with safelight off</td>
</tr>
</tbody>
</table>
D. INTENSIFYING SCREENS AND CASSETTES

D1 Selection

A film/screen/cassette combination which is compatible with the processor and daylight handling system should be selected. Reference should be made to Guidance Notes for Health Authorities and NHS Trusts on Requirements for Films, Screens, and Cassette used in Breast Screening Mammography.51 The resulting dose and image quality must comply with national minimum standards.

D2 Acceptance and commissioning tests

The main function of the acceptance tests for the intensifying screens and cassettes is to ensure that all the screens and cassettes within the set have the same performance characteristics and are free from artefacts. This involves carrying out the performance tests described in section D4 below. If a new type of cassette or screen is used, additional commissioning tests will be required to ensure compatibility with the x-ray set and to establish baseline values for QC tests. The advice of the medical physics service should be sought.

D3 Identification

Once the acceptance and commissioning tests have been satisfactorily completed and the cassettes and screens are accepted for use, the screens and cassettes should be numbered and this number should appear on the images produced.

D4 Performance tests

The sensitivity test and the film/screen contact test should be carried out at acceptance and repeated at least every six months or whenever a problem occurs. The equipment supplier’s recommendations for the frequency of testing should also be taken into account.

D4.1 Sensitivity and artefacts

There may be differences in the thickness and materials used in cassettes with a resultant variation in performance. In order to ensure a matched set of screens/cassettes, an exposure using Perspex blocks should be made with the AEC and each loaded cassette. These tests should be performed on the same x-ray machine and the results recorded. The mAs values should be recorded and the densities of the resultant films measured. The films should also be inspected for artefacts caused by the screen or cassette.

Equipment required

- Mammography x-ray unit.
- Cassettes to be tested.
- Box of films.
- Processing facilities.
- Perspex blocks of 4 or 4.5 cm thickness.
- Densitometer.
**Quality Assurance Guidelines For Mammography**

*Method*

Ensure the processor sensitometry is within limits. Note the speed and contrast indices and the film batch number with the results.

Place the Perspex blocks centrally on the breast support table against and slightly overlapping the chest wall.

Ensure the AEC chamber is at the chest wall position.

Place the loaded test cassette in the cassette holder.

Operate the unit in a fixed kV, automatic mAs mode. Select 28 kV (or the kV in normal use), Mo target, Mo filter.

Select an appropriate density setting consistent with normal clinical use.

Make an exposure and record the mAs value.

Process the film immediately to minimise variations in latent image fade.

Repeat using all the other cassettes and identical parameters.

Measure the density on the resultant image using the densitometer, 4 cm from the chest wall in the midline on each film.

Record the density.

Inspect the film for artefacts.

Calculate the mean values for mAs and optical density for the whole set of cassettes.

Label each screen/cassette that is accepted with the cassette number.

Record all test details in the cassette log book.

*Limiting values*

<table>
<thead>
<tr>
<th>Remedial level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Film density &gt; 0.1 different from batch mean</td>
</tr>
<tr>
<td>mAs more than 5% different from mean</td>
</tr>
<tr>
<td>Artefacts present</td>
</tr>
</tbody>
</table>

If the results for sensitivity are not satisfactory, the tests should be repeated. If the results are still unsatisfactory, the cassettes/screens should be replaced (or rejected and returned to the supplier if new).

It is usual practice to divide cassettes into batches for use in different locations, and the remedial levels apply to within batch variations. When batching cassettes, priority should be given to matching densities as closely as possible. Variation of mAs is of less importance provided that it does not exceed the remedial level.

**D4.2 Film/screen contact**

Poor film/screen contact can reduce spatial resolution. Poor contact can result from damaged or dirty screens.
**Quality Assurance Guidelines For Mammography**

**Equipment required**
- Mammography x-ray unit.
- Cassettes to be tested.
- Box of films.
- Processing facilities.
- Film/screen contact test tool (a mesh with at least 20 lines per cm).
- Densitometer.

**Method**
Clean the cassettes using the manufacturer’s recommended method.

Load the cassettes and leave to rest for at least 5 min.

Place the loaded cassette to be tested on top of the x-ray unit breast support table with the film/screen contact test tool directly on top. On some units it may be necessary to insert a dummy cassette into the Bucky or disable the cassette detection mechanism.

Make an exposure by following the instructions on the test tool.

Process the film.

View the film at a distance of approximately 1 metre and assess the image. If there is poor film/screen contact, this will show as areas of increased density.

Examine and clean any offending screen and repeat the procedure to confirm the findings.

Expert advice may be needed when assessing the image produced.

Record the result in the log book.

If areas of poor contact are seen to have moved after cleaning and reloading, it may be that air is trapped.

It may be necessary to wait for a minimum of 10 min after reloading before repeating the test to allow the air to dissipate. There may need to be a delay between loading the cassette and making the exposure in normal use to overcome this problem.

Cassettes should be used in rotation.

**Limiting values**

<table>
<thead>
<tr>
<th>Suspension level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum of 4 cm² total area showing poor contact (except very close to the identification window)</td>
</tr>
</tbody>
</table>

Cassettes with excessive areas of poor contact should be rejected if new or taken out of service if faults develop. Refer to the supplier for attention.

**D5 Inspection and cleaning**

Clinical films must be inspected for screen artefacts on an ongoing basis and corrective action initiated as necessary. Cassettes and screens must also be checked regularly for any light leakage, physical damage and artefacts.

Intensifying screens should be kept clean at all times. They should be cleaned according to the manufacturer’s recommendations and local protocols. Note that excessive or inappropriate cleaning can damage screens. If cleaning fails to remove an artefact, the screens should be examined to identify any damaged areas. Damaged screens/cassettes should be rejected and replaced.
E. MAMMOGRAPHY VIEWING

E1 Film illuminators

The brightness and colour match of film illuminators is important. Every effort should be made to ensure that all film illuminators in the unit are matched. The test is especially important for viewers that are used to read mammograms.

Viewers should be inspected visually every six months under normal ambient viewing conditions for colour match and uniformity of brightness.

Film illuminators should be regularly cleaned.

Roller viewers should be covered by a routine maintenance contract and the panels cleaned at service.

Objective measurements of viewers and film viewing conditions should be carried out at least annually. This may be done by mammographers or the medical physics service according to local preference.

E2 Film viewing conditions

Very low ambient light levels are required for mammography reporting. Windows in designated reporting rooms should be fitted with blinds or curtains to exclude any background light. Room lights should be controlled by means of a dimmer switch.

A means of masking uncovered areas of the film viewer is essential for maximum visualisation of images – most modern mammography viewers have blinds/shutters that move to exclude extraneous light.

Viewing boxes and roller viewers should be placed so that glare from other equipment does not compromise viewing conditions.

E3 Soft copy viewing conditions

Soft copy monitors are used for small field digital examinations such as stereobiopsies. Consideration should be given to the performance of the monitor and the viewing conditions (see also section A13). Factors such as luminance, resolution and geometry should be tested in accordance with the manufacturer’s guidance. Positioning of the monitors is also important to ensure that there are no extraneous reflections on the screen, eg from film illuminators.
F. OTHER EQUIPMENT

F1 Ultrasound

The NHSBSP follows a protocol for testing ultrasound units. This includes acceptance and six monthly tests to be performed by a medical physics service and regular (weekly) user tests.

F2 Specimen x-ray cabinets

Specimen x-ray cabinets should be subject to acceptance and routine testing (typically six monthly) by the medical physics service.

F3 Other equipment

Consideration should be given to performing QC tests on other equipment if it affects the performance of the screening programme. Examples include mammotome devices, microscopes and equipment used to review images at multidisciplinary team meetings. Local protocols should be developed for this.

G. SUMMARY OF ROUTINE TESTS

<table>
<thead>
<tr>
<th>Minimum frequency*</th>
<th>Test</th>
<th>Refer to section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily</td>
<td>Routine sensitometry</td>
<td>B4.2</td>
</tr>
<tr>
<td>Daily</td>
<td>Developer temperature</td>
<td>B5</td>
</tr>
<tr>
<td>Daily</td>
<td>Perspex block test</td>
<td>A9</td>
</tr>
<tr>
<td>Weekly</td>
<td>Image quality test</td>
<td>A11</td>
</tr>
<tr>
<td>Weekly, or as used</td>
<td>Stereotactic equipment</td>
<td>A12</td>
</tr>
<tr>
<td>Monthly</td>
<td>AEC thickness test</td>
<td>A10</td>
</tr>
<tr>
<td>Monthly</td>
<td>Mechanical safety and function tests of x-ray set</td>
<td>A8</td>
</tr>
<tr>
<td>Six monthly</td>
<td>Visual inspection of film illuminators</td>
<td>E1</td>
</tr>
<tr>
<td>Six monthly</td>
<td>Film/screen contact</td>
<td>D4.2</td>
</tr>
<tr>
<td>Annually</td>
<td>Cassette sensitivity and artefacts</td>
<td>D4.1</td>
</tr>
<tr>
<td>Annually</td>
<td>Dark room safe handling time</td>
<td>C5.2</td>
</tr>
<tr>
<td>Annually</td>
<td>Objective measurements of viewers</td>
<td>E2</td>
</tr>
<tr>
<td>One to three yearly</td>
<td>Breast doses†</td>
<td>A14</td>
</tr>
</tbody>
</table>

*Local protocols may stipulate more frequent testing.
†Carried out in conjunction with the medical physics service.
5. MAMMOGRAPHIC TECHNIQUES

5.1 Introduction

The female breast is composed of soft tissues with inherently low radiographic contrast and little variation in attenuation coefficients. A highly sensitive and sophisticated form of diagnostic radiography is therefore required to demonstrate abnormal pathology reliably. Mammography has been described as the science of imaging, and the art of positioning. Successful mammography is dependent on the performance of the equipment, the expertise of the mammographer and the cooperation of the woman. The skill of the mammographer and various factors associated with the woman undergoing the examination affect the quality of the mammogram. These include the composition and size of the breast, the stature of the woman and her physical and psychological attributes. A good quality mammogram shows all the breast tissue with optimum image detail.

The following criteria are used to judge whether or not an image is adequate for radiological interpretation.

5.2 Criteria for assessment of mediolateral oblique images

See Figure 1.

1. Whole breast imaged
   a. Pectoral muscle shadow to nipple level. The lower edge of the pectoral muscle shadow should reach nipple level whenever possible, to ensure that the posterior aspect of the breast is satisfactorily included on the image.
   b. Pectoral muscle at an appropriate angle in accordance with good practice. This angle varies according to the variations in physical constitution of the individual. It should be at an appropriate angle to enable the axillary tail of the breast to be demonstrated clear of the muscle shadow on the mammogram.
   c. Inframammary angle clearly demonstrated. The inframammary angle should be clearly shown without overlying or underlying tissue. This indicates that the breast has been lifted and that the inferior–posterior part of the breast has been correctly imaged.

2. Nipple in profile
   This is important in order to demonstrate the retroareola area of the breast clearly on the mammograms.

3. Correct annotations
   The following correct annotations should be clearly shown:

   • woman identification
   • anatomical markers
   • positional markers (if used)
   • radiographer identification
   • date and time of examination.
Summary of criteria for assessing MLO images

- Whole breast imaged according to local protocols
- Nipple in profile
- Correct annotations
- Appropriate exposure
- Appropriate compression
- Absence of movement
- Correct processing
- Correct film handling
- Skin fold free
- Absence of artefacts covering the image
- Symmetrical images

Figure 1 Criteria for assessment of mediolateral oblique (MLO) images.
Summary of criteria for assessing CC images

- Medial border imaged according to local protocols
- Some of axillary tail of the breast
- Pectoral muscle shadow may be shown
- Nipple in profile
- Correct annotations
- Appropriate exposure
- Appropriate compression
- Absence of movement
- Correct processing
- Correct film handling
- Skin fold free
- Absence of artefacts covering the image
- Symmetrical images

Figure 2 Criteria for assessment of CC images.
4. **Appropriate exposure**

The exposure varies according to local practice and preference. Research into the OD for the standard breast when measured with 4 cm Perspex currently suggests that an OD of between 1.5 and 1.9 inclusive of base plus fog should be achieved. It is now accepted that an OD of below 1.5 would be inappropriate. Other factors which influence exposure are:

- processing
- compression
- performance of automatic exposure control (AEC)
- selection of appropriate position of automatic exposure control detector
- film quality, ie variation in film batches, poor film stock control and poor storage conditions.

5. **Appropriate compression**

Compression is important in reducing radiation dose, movement blur, geometric unsharpness and overlapping tissue shadows. The compression should be applied slowly and gently to ensure the breast is held firmly in position. The breast should be lifted and the tissue separated while compression is applied to enable better visualisation on the mammogram. The force of the compression on the x-ray machine should not exceed 200 Newtons or 20 kilograms.

6. **Absence of movement**

Movement blur can be due to patient movement, cassette movement or inadequate compression. Image blur can occur if there is insufficient dwell time for the cassettes.

7. **Correct processing**

Sensitometry should be carried out daily to monitor the film processor and ensure optimum processing conditions.

8. **Correct film handling**

Film handling systems should be operating at optimum levels to avoid film artefacts.

9. **Skin fold free**

Skin creases and folds should be removed prior to compression and exposure.

10. **Absence of artefacts covering the image**

Radiographers should ensure that there are no extraneous objects in the image field.

11. **Symmetrical images**

Right and left breast radiographs should match as mirror images when mounted on the film viewer.

5.3 **Criteria for assessment of craniodical images**

See Figure 2.

The craniodical (CC) view should show as much of the breast as possible. A correctly performed CC view will show virtually all except the
most lateral and axillary part of the breast. Local protocols should be agreed as to the degree of lateral and medial orientation. Specifically, the CC should show:

1. Medial border of the breast.
2. Some of the axillary tail of the breast.
3. Pectoral muscle shadow may be shown on the posterior edge of the breast on some CC views depending on anatomical characteristics.
5. Correct annotations.
6. Appropriate exposure.
7. Appropriate compression.
9. Correct processing.
10. Correct film handling.
11. Skin fold free.
12. Absence of artefacts covering the image.

5.4 Inadequate images

Images (MLO or CC) are judged to be inadequate for radiological interpretation for one or more of the following reasons:

1. Part of the breast is not imaged.
2. There is inadequate compression leading to poor quality images.
3. The image is blurred.
4. Processing is incorrect.
5. Exposure is incorrect.
6. Artefacts obscure breast tissue.
7. Skin folds obscure breast tissue.
8. Annotation is inadequate or incorrect.
9. Film fogging.

5.5 Monitoring mammographic technique

Regular monitoring and audit of mammographic technique is essential, whereby the mammography practitioners carry out image assessment against the criteria laid down for the MLO and CC images.
6. STAFFING, TRAINING AND CONTINUING PROFESSIONAL DEVELOPMENT

6.1 Staffing levels

It is important that appropriate staffing levels are implemented to ensure that the quality of the service is not compromised. The minimum screening examination for women attending the NHSBSP is two views at all screens, and experience shows that six minute appointments are acceptable for most routine screening of women for up to age 70 years. Local staffing levels should be based on the number of clinical mammographers needed, and should take account of the local configuration of services, the local skill mix and local trust risk assessments. Allowance should be made for:

- rest breaks
- rotation through screening and assessment clinics
- participation in continuing professional development (CPD) activities
- participation in QC and QA activities including audit and review procedures
- cover for sickness and holiday absence
- attendance at multidisciplinary meetings
- participation in research projects.

Symptomatic mammography and symptomatic ‘fast track’ clinics are funded separately and should not be included in the calculation of staffing levels for screening service delivery. Table 3 provides a guide to staffing levels for delivery of a screening service. The staffing levels are for screening mammography and assessment clinics only. They do not cover radiographer film reading sessions, advanced clinical practice carried out by radiographers or the training roles expected as part of the in house training for assistant practitioners. If radiography managers have a major managerial responsibility with minimal clinical input, they should be excluded from the radiographic staffing calculation for clinical service delivery.

6.2 Performance and development review

Regular review of professional performance is essential. The mammographers in the breast screening programme should receive regular feedback on their performance. This is achieved by participation in formal appraisal and performance review schemes, through informal discussions within the breast screening team and by peer review. Regular peer review should be conducted in order to offer support and encouragement to colleagues to maintain high standards of mammography.

Table 3  Suggested staffing level (WTEs)

<table>
<thead>
<tr>
<th>Uptake Rate</th>
<th>Suggested Staffing Level (WTEs per 10000 Eligible Women)</th>
</tr>
</thead>
<tbody>
<tr>
<td>65–75%</td>
<td>1.3</td>
</tr>
<tr>
<td>76–85%</td>
<td>1.5</td>
</tr>
<tr>
<td>86–90%</td>
<td>1.6</td>
</tr>
</tbody>
</table>

NHSBSP April 2006
The development review process is now linked to the NHS knowledge and skills framework. Further information on this can be found on the Agenda for Change pages of the DH website.

6.3 Underperformance
Where underperformance of an individual is identified, the radiography manager should:

- initiate informal discussions with the individual concerned to identify any possible underlying causes, such as working practices or personal or health problems
- identify and discuss possible solutions
- set out and agree an action plan with a specified time scale, which may include:
  - additional training
  - mentoring
  - review of working practices
  - advice from occupational health on health related issues
- document, review and feedback with the member of staff within the specified timescale
- where actions do not succeed, further advice may be sought from the RQAR and the HR department.

6.4 NHSBSP training programme
In order to achieve the level of expertise required to produce consistently high quality mammograms and to be a fully participating member of the breast care team, mammographers working in breast screening must participate in an approved NHSBSP training programme. Training will ensure that mammographers are technically expert and well informed in order to respond to the individual needs of the woman, and to influence service outcomes.

Training courses are available at one of the national training centres or associated satellite training centres. In most training centres, these are postgraduate courses which are part of university postgraduate education programmes and lead to a postgraduate award. A list of the national training centres with the associated universities is shown in Appendix 2. Details of the training courses offered are available from the training centres and universities listed.

Local training of assistant practitioners is also available. This may be through the NVQ route or through a higher education route that has been approved by the College of Radiographers. All training undertaken in mammography requires participants to meet the occupational standards for mammography. These can be found on the Skills for Health Website.

6.5 Training objectives
Mammographers in the NHSBSP will acquire and maintain the appropriate skills and knowledge. The objectives for training are that the mammographer:

- becomes an effective member of the breast care team and provides a service which is acceptable to the population
6.6 Continuing professional development

Mammographers must take every reasonable opportunity to sustain and improve their knowledge and professional competence. They should promote the professional development and education of students and colleagues. Continuing professional development (CPD) should both meet the learning needs of the individual mammographer and inspire public confidence in their skills. It enables the mammographer to embark on a programme of lifelong learning, which is an investment in quality. Continuing professional development should be a partnership between the individual and the organisation and its focus should be the delivery of high quality NHS services. Continuing professional development also needs to meet individual career aspirations and learning needs.

Each individual:

- must be proactive in developing themselves and their career
- should develop continuously by constantly seeking to improve themselves as a professional and in the quality of care they deliver
- should regard investment of time in learning as being important
- must work within their scope of practice and ensure that any role developments are appropriately, and properly, authorised and supported
- must be aware of their responsibility and duty of care to clients.

![Figure 3 Development review process. KSF, knowledge and skills framework.](image-url)
Continuing professional development (lifelong learning) follows a circular pathway through assessment, personal development planning, implementation and evaluation, as shown in Figure 3.57

6.7 Extended roles and skill mix

Mammographers should develop a personal development plan (PDP) in discussion and agreement with their local line managers. Personal development plans should take account of different learning pathways and identify and take full advantage of opportunities for learning on the job. It is the radiography manager’s responsibility to ensure that regular performance review is undertaken and that underperformance is highlighted and resolved.

Radiographers who extend their roles must be aware that, in all circumstances, they will be legally responsible for their actions. Accountability means being answerable for decisions about work and being professionally responsible for the standard of practice. Tasks must be delegated appropriately by the medical practitioner and the trust must officially approve any role extension. Approval for extended roles is likely to be through the Trust Clinical Governance Committee or at Trust Board level meeting. Appropriate delegation of tasks means that the person to whom the task is delegated:

• is aware of their responsibilities as a health professional68
• works within clear protocols and guidelines
• is trained properly
• is supervised and mentored appropriately
• audits their own work regularly
• works to the agreed clinical standards
• takes responsibility for their actions.

Unauthorised procedures must not be carried out.
REFERENCES

Note that if any of these documents are later revised, the most recent edition should be referred to.

24. Medical and Dental Guidance Notes. Prepared by the Institute of Physics and Engineering in Medicine (IPEM) with the support of the National Radiological Protection Board, the Health and Safety Executive, the Health Departments and the Environment Agencies. York, IPEM, 2002.
36. Review of NHSBSP Equipment and Equipment Faults. Produced six monthly by the NHS Cancer Screening Programmes (internal report).

46. Addendum to MDD/93/33 Guidance Notes for Health Authorities and NHS Trusts on Requirements for Breast Screening Mobile Trailers and Drawing Vehicles. NHS Breast Screening Programme, September 2001 (NHSBSP Occasional Report 01/08).


55. Agenda for Change website www.dh.gov.uk/PolicyAndGuidance/HumanResourcesAndTraining/ModernisingPay/AgendaForChange/fs/en


APPENDIX 1: GLOSSARY OF TERMS

These terms are as used in this document.

**Acceptance tests** A formal process in which the supplier demonstrates to the purchaser that the performance of the equipment meets the specification as detailed in the contract.

**Additional views** Additional views may be performed as part of a recall to an assessment clinic and would normally be undertaken by a radiographer.

**Advanced practitioner*** An advanced practitioner, autonomous in clinical practice, defines the scope of practice of others and continuously develops clinical practice within a defined field.

**Assistant practitioner*** An assistant practitioner performs non-complex, protocol limited clinical tasks under the direct supervision of a registered radiographer practitioner.

**Clinical governance** Clinical governance is a statutory duty for quality improvement at local level. It is defined as ‘a framework through which NHS organisations are accountable for continuously improving the quality of their services and safeguarding high standards of care by creating an environment in which excellence in clinical care will flourish’.

**Commissioning tests** Commissioning tests are carried out by the medical physics service. They ensure that the performance of the unit is optimised and provide baseline performance measurements against which all future measurements will be compared.

**Consultant practitioner*** A consultant practitioner provides clinical leadership within a specialism or an area of service, bringing strategic direction, innovation and influence through practice, research and education, based on specialised knowledge and skills.

**Continuing professional development*** For practitioners there is a professional requirement to maintain competence to practice and a continuing professional development (CPD) portfolio. It is a lifelong process of continuous learning arising from structured reflection on current practice, career and personal aspirations.

**Coverage** The proportion of women resident and eligible for screening who have had a screening mammogram at least once in the previous three years. Women who are ineligible (eg those who have had a bilateral mastectomy) are excluded.

**Mammographer** An assistant radiographer practitioner or a radiographer practitioner who undertakes mammography.
Peer review† Feedback and evaluation on decision processes by a peer or peers.

Personal development plans‡ A personal development plan (PDP) identifies the individual’s learning and development needs and interests and how these will be taken forward. The PDP is the outcome of the planning stage of the development review process.

Practitioner* A practitioner autonomously performs a wide ranging and complex clinical role, and is accountable for his or her own actions and for the actions of those they direct.

Quality assurance Quality assurance is a philosophy which aims to harness the efforts of all staff in order to ensure that every aspect of their work is directed towards the achievement of high quality performance. There are two main aspects of quality assurance: quality management and quality control.

Quality control Quality control is controlling and monitoring the processes to produce quality systems and services. Quality control in breast screening facilitates the production of high quality images with as low a radiation dose as reasonably possible and minimises the adverse effects of the screening process.

Remedial level A remedial level is that level of performance at which remedial action needs to be initiated. The action taken will depend on a detailed assessment of the equipment’s performance and of the risks arising from its continued use.

Supplementary projections Supplementary projections may occasionally be required to complete the mammographic screening examination. This is while the woman is still present either on the mobile unit or at the static unit. These are not classed as technical repeats. This is a professional judgement made only by the radiographer.

Support workers Support worker roles vary according to local protocol, but may include reception duties, chaperoning in clinics, getting clients ready for examination.

Suspension level A suspension level is that level of performance at which it is recommended that the equipment should be removed from clinical use immediately until the performance is corrected. This may arise from the results of routine testing or from a fault condition.

Target film density Target film density is the optical density that the unit is aiming for. It should be selected by taking into account local factors (such as the type of film in use) and should be in the range 1.5–1.9.

Technical recall A technical recall (TC) is when a woman is asked to reattend for the same projection(s), whether mediolateral oblique or craniocaudal to be repeated because the current screening examination is technically inadequate for radiological interpretation. This decision
is made by the radiologist or by a radiographer working within agreed protocols. Any additional views for the purpose of diagnosis should be recorded as assessment.

**Technical repeat** A technical repeat (TP) is when the radiographer/assistant practitioner makes the decision to repeat the same projection(s) after identifying an error. This may be during or immediately after the screening examination and/or processing. The woman is still present in the unit.

**Repeat examinations** Repeat examinations include both technical recalls and technical repeats and together are used to calculate the repeat rate for the unit.

**Uptake** The percentage of women who, having been sent an invitation for screening, attend a screening unit and undergo mammography in response to that invitation. It takes no account of women who do not attend nor of those who do not receive their invitation.

*Taken from Implementing Radiography Career Progression: Guidance for Managers. Society of Radiographers, June 2005.
†Taken from Radiography Clinical Supervision Framework. Society of Radiographers, March 2003.
‡Taken from The NHS Knowledge and Skills Framework and the Development Review Process. Department of Health, October 2004 (page 35).
APPENDIX 2: NATIONAL BREAST SCREENING TRAINING CENTRES AND ASSOCIATED UNIVERSITIES

Jarvis Breast Screening, Diagnostic and Training Centre
Stoughton Road
Guildford
Surrey GU1 1LJ
Tel: 01483 783 260

King’s National Breast Screening Training Centre
King’s College Hospital
Denmark Hill
London SE5 9RS
Tel: 020 7346 3870

South Bank University
Department of Allied Health Professions
Erlang Road
London SE1 0AA

Manchester Breast Screening Training Centre
The Nightingale Centre
Withington Hospital
Nell Lane
Manchester M20 0PT
Tel: 0161 611 3089

University of Salford
Department of Radiography
Frederick Road Campus
Salford M6 6PU

Nottingham International Breast Education Centre
Nottingham City Hospital NHS Trust
Hucknall Road
Nottingham NG5 1PB
Tel: 0115 969 1689

University of Derby
School of Health and Community Studies
Mickleover
Derby DE3 5GX

Sheffield Hallam University
(with effect from June 2006)
Faculty of Health and Wellbeing
Collegiate Crescent Campus
Sheffield
S10 2BP
Quality Assurance Guidelines For Mammography

St George’s Hospital NHSBSP National Training Centre
Duchess of Kent Breast Screening Unit
St George’s Hospital
205 Blackshaw Road
Tooting
London SW17 0BZ
Tel: 020 8725 1534 or 2815

Kingston University
Faculty of Healthcare Sciences
School of Radiography
Penrhyn Road
Kingston-upon-Thames KT1 2EE

West of Scotland Breast Screening Unit
Stock Exchange Court
77 Nelson Mandela Place
Glasgow G2 1QT
Tel: 0141 572 5825

Queen Margaret University College
Division of Radiography
Edinburgh EH6 8HF

Breast Test Wales
Mammography Training Centre
18 Cathedral Road
Cardiff CF11 9LJ
Tel: 029 2039 7222

Cardiff University
Department of Radiography
School of Healthcare Studies
Heath Park
Cardiff CF14 4XN