Protocols for the Provision of Neonatal Radiography v3

Protocol Statement:
This protocol is issued to provide Governance, primarily to Diagnostic Radiographers, but to all Medical Professionals involved in the field of neonatal radiography.

Key Points
- Chest Radiography
- Abdominal Radiography
- Chest and Abdominal Radiography
- ‘The Golden Hour’ of Imaging in Neonates
- To view images in PACS
- Process Map
- Radiographer / Operator Sign Off

Paper Copies of this Document
- If you are reading a printed copy of this document you should check the Radiology Directorate Website Radiology - Heart of England NHS Foundation Trust to ensure that you are using the most current version.

Ratified Date: February 2011
Ratified By: M. Watkinson (Neonatal Consultant)
Review Date: March 2012
Accountable Directorate: Group 4: Clinical Support – Radiology
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Meta Data

<table>
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<tr>
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<td>Related documents</td>
<td>- Radiology – For clinicians (<a href="http://www.heft-radiology.co.uk/forclinicians.htm">http://www.heft-radiology.co.uk/forclinicians.htm</a>)</td>
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<td>- Guidelines on the use of Distraction Techniques for the Performance of Radiographic Investigations</td>
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<td>- Radiology Electronic Requesting Policy</td>
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<td>Superseded documents</td>
<td>- Guidelines for the Provision of Neonatal Radiography</td>
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<td>- Guidelines for the Provision of Neonatal Radiography v2.1</td>
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<td></td>
<td>- HPC Standards of Conduct, Performance and Ethics (2008)</td>
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Revision History

<table>
<thead>
<tr>
<th>Version</th>
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</tbody>
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- Good Hope Hospital – Special Care Baby Unit 
- Solihull Hospital – Labour Ward 
- PACS/CRIS & Electronic/Order Comm Requesting 
- Formalise Training both for Radiology and Neonatal Team |
| v3      | Draft  | February 2011 | Dr. G S Jones (Consultant Radiologist), Laurence Skermer (BHH Site Lead for Radiology), Jean Robinson (GHH Site Lead for Radiology), Mike Watkinson (Neonatal Consultant). | To incorporate:  

- Guideline to Protocol 
- Radiology – For clinicians webpage & IR(ME)R 2000 
- ID check to be done by operator and neonatal medical personnel 
- Technique & Gold Standard image for lateral decubitus abdomens 
- A new gold standard image for abdominal imaging 
- Radiographer/Operator Sign Off |
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction</td>
<td>4</td>
</tr>
<tr>
<td>2. Circulation</td>
<td>4</td>
</tr>
<tr>
<td>3. Scope</td>
<td>4</td>
</tr>
<tr>
<td>4. Reasons for Development</td>
<td>4</td>
</tr>
<tr>
<td>5. Aims and Objectives</td>
<td>5</td>
</tr>
<tr>
<td>6. Process</td>
<td>5</td>
</tr>
<tr>
<td>7. Training Requirements</td>
<td>6</td>
</tr>
<tr>
<td>8. Monitoring and Compliance</td>
<td>6</td>
</tr>
<tr>
<td>Neonates</td>
<td></td>
</tr>
<tr>
<td>12. ‘The Golden Hour’ of Imaging in Neonates</td>
<td>16</td>
</tr>
<tr>
<td>13. To View Images in PACS</td>
<td>17</td>
</tr>
<tr>
<td>14. Radiology Process Map</td>
<td>18</td>
</tr>
<tr>
<td>15. Radiographer / Operator Sign Off</td>
<td>19</td>
</tr>
</tbody>
</table>
(1) Introduction

Achieving high quality radiographs in neonates can be a challenge, even in Departments of Radiology in specialist children’s hospitals. It is perhaps even more of a challenge in a more general department as children form a small proportion of the work undertaken.

These protocols aim to improve the practical working knowledge of radiographers carrying out Neonatal Radiography with the aim of producing high quality imaging.

The protocol will be followed by all Radiographers undertaking Radiology examinations in the Neonatal Unit (NNU) at Birmingham Heartlands Hospital, Special Care Baby Unit (SCBU) at Good Hope Hospital and Labour Ward at Solihull Hospital within Heart of England NHS Foundation Trust.

(2) Circulation

This protocol should be read by all Clinicians, acting as referrers, and Operators involved in and responsible for the provision of neonatal radiography.

(3) Scope

The protocol was developed with the assistance of Dr. G S Jones (Consultant Radiologist) and Irina Tiron (Staff Grade Neonatology) both of which carried out an audit on the quality of Neonatal Chest radiography and more recently abdominal radiography. Laurence Skermer, Jean Robinson (BHH & GHH Site Leads for Radiology) and Maria Reynolds (Plain Film Lead) were also consulted within Heart of England NHS Foundation Trust. In addition practice was compared with local specialists at the Birmingham Women’s Health Care NHS Trust as a peer for locality.

Research was undertaken into National Recommendations for standards of Radiography and the European Guidelines on Quality Criteria for Diagnostic Radiographic Images were incorporated.

(4) Reason for Development

This protocol was developed following an audit which was performed into the quality of Neonatal Chest imaging and more recently Abdominal imaging. Concerns were raised that there was a lack of consistency of radiographic technique and findings suggested that standards could be improved, for the benefit of patients and service users.

It is important that high quality radiographs are produced to answer the clinical question, whilst minimising radiation dose to neonates and staff. Therefore, the first image produced should be to a high diagnostic quality maintaining exposure As Low As Reasonably Practicable as the majority of haematopoiesis occurs in the liver and...
bone marrow making this category of patient radiosensitive. Haematopoiesis is the formation of blood cellular components, stochastic effects of radiation poses leukaemia as a risk factor.

It is imperative that Radiation Protection Regulations are adhered to. These include Ionising Radiation Regulation 1999 and Ionising Radiation (Medical Exposure) Regulations 2000, in order to reduce unnecessary radiation dose.

(5) Aims and Objectives

This protocol refers to all radiology examinations performed in the Neonatal Unit at Birmingham Heartlands Hospital, Special Care Baby Unit at Good Hope Hospital and Labour Ward at Solihull Hospital within Heart of England NHS Foundation Trust.

The objectives of this guideline are to improve radiographic standards, resulting in a standardised, high quality and cost effective service which minimises radiation dose to both the patient and employee. It should therefore be used to guide training of professionals. It provides a checklist of actions for performing:

- Chest Radiography in Neonates
- Abdominal Radiography in Neonates
- Chest and Abdominal Radiography in Neonates

whilst abiding by IR(ME)R 2000 Procedures 1, 2 & 6

(6) Process

Radiology Requesting

An Electronic Radiology Request / Order Comm will be submitted for every radiological examination through the iCare Vortal. All mandatory fields will be completed prior to submission of the request. Please include:

- Referrers Details – Full Name, Title, Bleep/Mobile Number

N.B. In the event of the iCare Vortal having a System Failure or a referrer having an access problem a Radiology Request form printed from the intranet under ‘R’ > Radiology – For clinicians:

http://www.heft-radiology.co.uk/docs/clinicians/Radiology%20Request%20Form%20Nov%2009.pdf.

Request forms must detail the following before any radiology procedure is performed:

- Patient name, address, date of birth, PID and the patient’s Consultant.
- Examination being requested
- Clinical justification criteria
- Date request is made
- Signature identifying the referring clinician
• Role Title of the referrer
• Extension / Bleep number of referrer

Please continue to Bleep the BHH Radiographer on 2448 / GHH Radiographer on 8151 / SHH Radiographer on 6029 for ALL URGENT REQUESTS!

(7) Training Requirements

Heart of England NHS Foundation Trust will provide suitably trained radiographers to undertake neonatal radiography. Training is to include practical supervision from a Band 6 Senior Radiographer and provision of detailed knowledge of this departmental protocol. Newly qualified and newly recruited members of staff should be given extra support to enable them to build their knowledge, skills and confidence in working with neonates.

This guideline will be disseminated throughout the Radiology Directorate with a copy being held in the Standing Operating Procedures File which can be found electronically on the Radiology and Neonatal Shared Drives. Detailed teaching sessions, in the form of CPD sessions will be performed by Jean Robinson (GHH Site Lead / Advanced Practitioner) and/or Thomas Lowbridge (BHH Advanced Practitioner) to consolidate the protocol; these will then be included in the induction programme for all radiology staff. Training will also be disseminated to the Neonatal Unit Team so all staff are aware of their own requirements to assist Radiology in obtaining optimal imaging and to streamline workflow.

(8) Monitoring and Compliance

Band 5 radiographers should have their images checked by a Band 6 Senior Radiographer which will be documented in the event comments on CRIS.

Band 6 radiographers should have their images checked by a Band 7 Advanced Practitioner where possible and will be documented in the event comments on CRIS.

Further Clinical Audits into quality control to monitor protocol compliance and feedback results to colleagues.

Maintain competency sign off records for new operators, found within the departmental local induction document.

Practical observation of new operators by a Band 6 Senior Radiographer.

Upon radiological report an IR1 form will be completed where an examination is deemed non-diagnostic and becomes a Radiation Incident.
9. **Protocol for the Provision of Chest Radiography in Neonates**

1. An Electronic / Order Comms Request will be submitted to the Heart of England NHS Foundation Trust Radiology Department detailing the examination requested with supporting clinical information. This must be justifiable against Radiographic Protocols / Guidelines January 2011. *(N.B. In the event of the iCare Vortal having a System Failure or a referrer having an access problem a Radiology Request Form should be printed from the intranet under ‘R’ > Radiology – For clinicians: [http://www.heft-radiology.co.uk/docs/clinicians/Radiology%20Request%20Form%20Nov%2009.pdf](http://www.heft-radiology.co.uk/docs/clinicians/Radiology%20Request%20Form%20Nov%2009.pdf) with the referrer supplying the sufficient medical data relevant to the medical exposure requested as set out in IR(ME)R 2000 Procedure 2: To Identify Individuals Entitled to act as Referrer, Practitioner or Operator.)*

2. Operator authorises referral in accordance with Radiographic Protocols / Guidelines January 2011 which include:
   - Respiratory Distress Syndrome (RDS),
   - Chronic Lung Disease (CLD),
   - Pulmonary Interstitial Empyema (PIE),
   - Meconium Aspiration Syndrome,
   - Pneumothorax,
   - Chest Infection
   - Abnormal blood gases,
   - Pneumomediastinum.
   However, further indications may include:
   - Position of catheters/lines/tubes,
   - Pleural Effusion,
   - Previous antenatal ultrasound abnormality suspected,
   - Congenital Heart Disease,
   - Post Operative.
   A practitioner, identified under IR(ME)R, should be consulted regarding any concerns over the clinical referral. Authorisation is indicated by ‘accepting’ the request on CRIS.

3. The operator initiating the exposure is responsible for making the final check on identifying the patient before proceeding as set out in IR(ME)R 2000 Procedure 1: To Correctly Identify the Patient prior to Medical Exposure. In addition to this procedure, the operator along with the Neonatal health care professional should confirm the identity of the neonate together. The operator should then indicate the name and ID badge number of the neonatal health care professional on the request form.

4. The incubator should be parallel to the floor prior to positioning with the neonate nest being removed. Any artefacts, i.e. lines, drains, ET tube etc., that may overly the chest cavity should be removed where possible. The neonate should not be positioned underneath the port hole in the roof of the incubator to prevent artefact.
5. To minimise any risk of cross infection paper towels and NHS clear polythene bags (size 12 x 15”, NHS order number MVB 029) must be used. Polythene bags are provided by radiology and are used to protect/cover the CR Cassette with the aim of preventing cross infection. Paper towels can be obtained on the Neonatal Unit and should be placed between the neonate and the polythene bag.

6. It is the operator’s responsibility, with the assistance of a Neonatal health professional, to position and immobilise the neonate. The neonate’s head should be straight with arms raised above reducing the risk of rotation to the chest and any radiation dose to the neonate’s arms. The pelvis should also be immobilised.

7. Collimation is paramount as the majority of the haematopoiesis occurs in the liver and bone marrow, making them extremely radiosensitive. Collimation should include:
   - **Superiorly**: at the level of the chin, nothing above this level should be irradiated.
   - **Inferiorly**: just below the level of the nipples.
   - **Laterally**: to include the lateral chest walls.

8. Lead protection should be used to protect the orbits and abdomen.

9. kVp’s of less than 60 should not be used. The average exposure for a neonatal CXR is 60-65kVp / 0.80-1.00mAs at 100cms FFD as per European Guidelines on Quality Criteria for Diagnostic Radiographic Images in Paediatrics (1996). It is imperative that the FFD remains consistent for all examinations. Anatomical markers should also be used.

10. Expose at peak inspiration where possible.

11. Local rules are in place for all medical exposures and these need to be adhered to, in keeping with Ionising Radiation Regulations 1999.

12. Imaging should be evaluated using the ten point check list i.e. Correct patient ID, Area under examination, Correct projection, Contrast, Density, Collimation, Anatomical Marker, Gross error / artefact, Need for repeat, Any pathology / Normal variant demonstrated, Need for further projections – **GOLD STANDARD** demonstrated below:
13. Imaging will be sent to PACS and available to the referring / reporting clinician for evaluation / report. Radiographers will check PACS to ensure imaging has been sent.

14. All work to be completed on CRIS using Exam Code: XCHES in accordance with IR(ME)R Procedure 6: The Assessment of Patient Dose and Administered Activity.

15. A Consultant Radiologist will provide a report which will appear in iCare upon Verification.

1. An Electronic / Order Comms Request will be submitted to the Heart of England NHS Foundation Trust Radiology Department detailing the examination requested with supporting clinical information. This must be justifiable against Radiographic Protocols / Guidelines January 2011. (N.B. In the event of the iCare Vortal having a System Failure or a referrer having an access problem a Radiology Request Form should be printed from the intranet under ‘R’ > Radiology – For clinicians: http://www.heft-radiology.co.uk/docs/clinicians/Radiology%20Request%20Form%20Nov%2009.pdf with the referrer supplying the sufficient medical data relevant to the medical exposure requested as set out in IR(ME)R 2000 Procedure 2: To Identify Individuals Entitled to act as Referrer, Practitioner or Operator.)

2. Operator authorises referral in accordance with Radiographic Protocols / Guidelines January 2011 which include:
   - Necrotising Enterocolitis (NEC)
   - Meconium Ileus,
   - ? Perforation,
   - Suspected Intussusception,
   - ? Obstruction / ? Constipation,
   - Position of catheters / lines,
   - Previous antenatal ultrasound abnormality suspected.
A practitioner, identified under IR(ME)R, should be consulted regarding any concerns over the clinical referral. Authorisation is indicated by ‘accepting’ the request on CRIS.

3. The operator initiating the exposure is responsible for making the final check on identifying the patient before proceeding as set out in IR(ME)R 2000 Procedure 1: To Correctly Identify the Patient prior to Medical Exposure. In addition to this procedure, the operator along with the Neonatal health care professional should confirm the identity of the neonate together. The operator should then indicate the name and ID badge number of the neonatal health care professional on the request form.

4. The incubator should be parallel to the floor prior to positioning with the neonate nest being removed. Any artefacts, i.e. lines, drains, nappies etc., which may overly the abdominal cavity should be removed where possible. Do not position/expose the neonate underneath the port hole in the roof of the incubator to prevent artefact.

5. To minimise any risk of cross infection paper towels and NHS clear polythene bags (size 12 x 15”, NHS order number MVB 029) must be used. To minimise any risk of cross infection paper towels and NHS clear polythene bags (size 12 x 15”, NHS order number MVB 029) must be used. Polythene bags are provided by radiology and are used to protect/cover the CR Cassette with the aim of preventing cross infection. Paper towels can be obtained on the Neonatal Unit and should be placed between the neonate and the polythene bag.
6. It is the operator’s responsibility, with the assistance of a Neonatal health professional, to position and immobilise the neonate. The neonate’s head should be straight with arms raised above reducing the risk of rotation to the abdomen and any radiation dose to the neonate’s arms. The femora should also be immobilised.

7. Collimation is paramount as the majority of the haematopoiesis occurs in the bone marrow, making it extremely radiosensitive. You should therefore collimate:
   - **Superiorly:** to include the top of the diaphragm.
   - **Inferiorly:** to symphysis pubis.
   - **Laterally:** to include the lateral abdominal walls.

8. Lead protection should be used to protect the thorax and male gonads.

9. kVp’s of less than 60 should not be used. The average exposure for a neonatal CXR is 60-65kVp / 0.80-1.00mAs at 100cms FFD as per European Guidelines on Quality Criteria for Diagnostic Radiographic Images in Paediatrics (1996). It is imperative that the FFD remains consistent for all examinations. Anatomical markers should also be used.

10. Expose at peak expiration where possible.

11. Local rules are in place for all medical exposures and these need to be adhered to, in keeping with Ionising Radiation Regulations 1999.

12. Imaging should be evaluated using the ten point check list i.e. Correct patient ID, Area under examination, Correct projection, Contrast, Density, Collimation, Anatomical Marker, Gross error / artefact, Need for repeat, Any pathology / Normal variant demonstrated, Need for further projections – **GOLD STANDARD** demonstrated below:
13. Imaging will be sent to PACS and available to the referring / reporting clinician for evaluation / report. Radiographers will check PACS to ensure imaging has been sent.

14. All work to be completed on CRIS using Exam Code: XABDO in accordance with IR(ME)R Procedure 6: The Assessment of Patient Dose and Administered Activity.

15. A Consultant Radiologist will provide a report which will appear in iCare upon Verification.

Imaging for ? Necrotising Enterocolitis (NEC) and ? Perforation
The referrer may request a Horizontal Beam Lateral abdomen or a left side down decubitus abdomen to identify free air.

**Technique**
- The neonate should be turned on to their left side and lifted onto a sponge pad in order to obtain full area of interest.
- CR Cassette should be placed behind the neonate
- Horizontal Central Beam
- Centre at the level of the Pelvic Crests in the midline
- Raise arms above the head and immobilise the femora

**Collimate:**
- **Superiorly:** to include the top of the diaphragm.
- **Inferiorly:** to symphysis pubis.
- **Laterally:** to include the lateral abdominal walls.

Extra staff may be required to assist during this procedure.

**GOLD STANDARD** demonstrated below:

1. An Electronic / Order Comms Request will be submitted to the Heart of England NHS Foundation Trust Radiology Department detailing the examination requested with supporting clinical information. This must be justifiable against Radiographic Protocols / Guidelines January 2011. (N.B. In the event of the iCare Vortal having a System Failure or a referrer having an access problem a Radiology Request Form should be printed from the intranet under ‘R’ > Radiology – For clinicians: http://www.heft-radiology.co.uk/docs/clinicians/Radiology%20Request%20Form%20Nov%2009.pdf with the referrer supplying the sufficient medical data relevant to the medical exposure requested as set out in IR(ME)R 2000 Procedure 2: To Identify Individuals Entitled to act as Referrer, Practitioner or Operator.)

2. Clinical indications, as per Radiographic Protocols / Guidelines January 2011, can be found on pages 7 and 10 of this protocol. A practitioner, identified under IR(ME)R, should be consulted regarding any concerns over the clinical referral. Authorisation is indicated by ‘accepting’ the request on CRIS.

3. The operator initiating the exposure is responsible for making the final check on identifying the patient before proceeding as set out in IR(ME)R 2000 Procedure 1: To Correctly Identify the Patient prior to Medical Exposure. In addition to this procedure, the operator along with the Neonatal health care professional should confirm the identity of the neonate together. The operator should then indicate the name and ID badge number of the neonatal health care professional on the request form.

4. The incubator should be parallel to the floor prior to positioning with the neonate nest being removed. Any artefacts, i.e. lines, drains, ET tube, nappies etc., that may overly the chest or abdominal cavity should be removed where possible. Do not position/expose the neonate underneath the port hole in the roof of the incubator to prevent artefact.

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7. Collimation is paramount as the majority of the haematopoiesis occurs in the bone marrow, making it extremely radiosensitive. You should therefore collimate:
   - **Superiorly:** at the level of the chin, nothing above this level should be irradiated.
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8. Lead protection should be used to protect the orbits and male gonads.

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10. Expose at peak inspiration where possible.

11. Local rules are in place for all medical exposures and these need to be adhered to, in keeping with Ionising Radiation Regulations 1999.

12. Imaging will be evaluated using the ten point check list i.e. Correct patient ID, Area under examination, Correct projection, Contrast, Density, Collimation, Anatomical Marker, Gross error / artefact, Need for repeat, Any pathology / Normal variant demonstrated, Need for further projections – **GOLD STANDARD** demonstrated below:
13. Imaging will be sent to PACS and available to the referring / reporting clinician for evaluation / report. Radiographers will check PACS to ensure imaging has been sent.

14. All work to be completed on CRIS using Exam Code: XCHAB in accordance with IR(ME)R Procedure 6: The Assessment of Patient Dose and Administered Activity.

15. A Consultant Radiologist will provide a report which will appear in iCare upon Verification.

**Imaging for Long Line Position**
- There is no longer a need for Niopam 200 to be administered to establish a long line position.
12. ‘The Golden Hour’ of Imaging in Neonates

‘The Golden Hour’ in Neonatology within Heart of England NHS Foundation Trust relates to the first hour from Birth, where diagnostic tests are required to provide clinicians with information in the attempt of stabilising a neonate’s condition. Diagnostic Radiography falls within this ‘Golden Hour’ and as a result of the IT implementation within Radiology; workflow requires clarification to ensure smooth working processes for the best patient management to be obtained. To enable this to occur the following procedures should be followed:

An electronic request should be submitted to Radiology wherever possible. However, it is anticipated that in exceptional circumstances it will not be possible for a referrer to submit an electronic request without compromising their patient’s care. In such exceptional circumstances the Radiology Department will not want to hinder that patient’s care and therefore attend this situation without the electronic request. In such circumstances a paper request will be accepted. If the radiographer believes this exception to be misused an IR1 form and a subsequent investigation will take place.

In the event of a paper request being submitted:
1. Is the neonate in ‘The Golden Hour’ of birth?
2. Is the neonate in a Critical Condition?
3. Is there a system problem i.e. systems down, referrer access issues?
4. Is there a problem in registering the neonate on HISS? (In this case an IR1 may be required – seek advice from a Senior Band 6 Radiographer)

If you can answer YES to one or more of these questions proceed with the following:

1. Prioritise the neonate for imaging as soon as possible and relay an estimated time frame to the neonatal unit.
2. Assess the paper request on the unit for clinical history and Identify the neonate as per IR(ME)R Procedure 1.
3. Carry out imaging as per protocol.
4. Return to Radiology and manually register the Neonate in CRIS
   - Enter Surname, Forename, DOB and Sex, hit return key to generate patient search.
   - Select [New Patient] from the right hand menu
   - Enter patient demographics (ensure you have correct information from the patient/mothers notes)
   - Select [Save Patient] from the right hand menu
   - Select [New Event] from the right hand menu and register event as normal
5. Process imaging and show imaging to a Band 6 Senior Radiographer prior to sending your imaging to PACS – check imaging is available for viewing on the IMPAX client.
6. Contact the Neonatal Team to inform them that imaging is available and to search on PACS via Surname, Forename.

NB. Imaging will be matched up with a true HISS/CRIS record by the clerical team on the following day enabling the referrer to search by a neonates PID.
13. To View Images in PACS
When the examination is complete and the radiographer has sent the images to PACS they will contact the Neonatal Team / Referrer and inform them that the images are available. Search for the patient under Patient Last, First Name. Searching under Patient ID will not be possible if the neonate has not been registered in HISS.

Imaging should usually be available within 15 minutes of the images being taken, on average. If they are not available please contact Radiology to chase this up.
Radiographer / Operator Sign off

Radiographers Name: ____________________  Site: BHH* / SHH* / GHH*

The protocol for the provision of neonatal radiography v3 has been read and fully understood on _____ / _____ / 20___.

Radiographer Signed: ____________________ Date: _____ / _____ / 20___

Band 7 Signed: ____________________ Date: _____ / _____ / 20___

The sign off page of this SOP must be scanned into the Departmental Training Matrix and retained in the radiographer’s personal file for reference.