Llywodraeth Cymru
Welsh Government

GIG CYMRU NHS WALES

Partneriaeth Cydwasanaethau
Gwasanaethau Ystadau Arbenigol

Shared Services Partnership
Specialist Estates Services

WHBN 09-03

Welsh Health Building Note

Neonatal Units

Disclaimer

The contents of this document are provided by way of general guidance only at the time of its publication. Any party making any use thereof or placing any reliance thereon shall do so only upon exercise of that party's own judgement as to the adequacy of the contents in the particular circumstances of its use and application. No warranty is given as to the accuracy, relevance or completeness of the contents of this document and NHS Wales Shared Services Partnership – Specialist Estates Services shall have no responsibility for any errors in or omissions there from, or any use made of, or reliance placed upon, any of the contents of this document.

Note: Heath Building Notes (HBNs) and Health Technical Memoranda (HTMs) issued by the Department of Health in England are being superseded by specific Welsh editions, which will be titled Welsh Heath Building Notes (WHBNs) and Welsh Health Technical Memoranda (WHTMs) and which will use the same numerical coding. When using these guidelines, always refer to the relevant publications page on the NHS Wales Shared Services Partnership – Specialist Estates Services website for the latest approved document, particularly where an HBN or HTM is referred to in the text.

Intranet: **http://howis.wales.nhs.uk/sites3/page.cfm?orgid=254&pid=39106**

Internet: **http://www.wales.nhs.uk/sites3/page.cfm?orgid=254&pid=6142**

Published by NHS Wales Shared Services Partnership – Specialist Estates Services

This guidance is based on Health Building Note 09-03 Neonatal units guidance published by the Department of Health in 2013.

This publication can be accessed from the NHS Wales Shared Services Partnership – Specialist Estates Services website **www.wales.nhs.uk/ses**

Welsh Health Building Note 09-03 - Neonatal units

Overview

This Welsh Health Building Note (WHBN) covers the policy and service context, and planning and design considerations, for neonatal units.

It covers all types of unit providing care for neonates who require more than the routine care provided in maternity units. This includes cot space provision for special care, high dependency care and intensive care, and the associated clinical and non-clinical support facilities, including facilities for families.

It describes spaces that are unique to a neonatal unit. It also describes any variations to common hospital spaces and clarifies requirements for these spaces, where necessary. For a full list of space components, see the example schedules of accommodation for a 5000-birth neonatal intensive care unit and a 2500-birth special care unit.

Neonatal units are always co-located with a maternity unit. This guidance should be read in conjunction with Welsh Health Building Note (WHBN) 09-02:2013 Maternity facilities, which includes requirements for the routine care of neonates within the maternity unit.

Acknowledgements

WHBN 09-03:2016 *Neonatal units* is based on Health Building Note 09-03 *Neonatal units* published by the Department of Health in 2013. NHS Wales Shared Services Partnership – Specialist Estates Services is grateful to the Department of Health for its permission to adapt the original guidance for application in Wales.

The contents of the original document was reviewed by NHS Wales Shared Services Partnership – Specialist Estates Services.

Contents

1

Chapter 1

Policy context

1.1 Most babies are, and remain, healthy and receive routine care at their mother's bedside before going home with their family. However, approximately 10% of babies require some form of specialist support at birth, with 1–3% requiring neonatal intensive care.

1.2 Increasing numbers of very small premature babies are being born alive and surviving, owing to the increasing capability of technology and development of healthcare expertise. These babies may require quite prolonged periods of supportive care over several weeks.

1.3 Neonatal units provide care for babies in formal, managed 'networks', determined in alignment with the provision of maternity and obstetric care. The ultimate objective is to provide equitable, safe and effective services providing the best possible outcome for babies and their families. This guidance reflects the advice provided in *Toolkit for high quality neonatal services* published by the Department of Health in England in 2009, the underlying key principles of which are relevant across the entire UK, *All Wales Neonatal Standards, 2nd ed* (NHS Wales 2013) and *Service standards for hospitals providing neonatal care* (BAPM 2010).

1.4 Babies are nursed in cots or incubators in an area or type of unit appropriate to their need for life-support systems, intensive care and treatment, monitoring and observation or isolation. A mixture of multi-cot rooms and single-cot rooms are usually provided.

1.5 Family-centred care is a philosophy of care that helps families whose baby is in hospital to cope with the stress, anxiety and altered parenting roles that accompany their baby's condition. It puts the physical, psychological and social needs of both the baby and their family at the heart of all care given. Ultimately family-centred care may enhance attachment between a baby and the family and result in improved long-term outcome for both.

1.6 Parents are encouraged to visit and stay with, handle and care for their babies. The environment and facilities must be supportive of the needs of the family whatever the type of unit. This is particularly important when a baby is moved for ongoing intensive care.

2

Chapter 2

Service context

2.1 Neonatal units provide care for babies in formal, managed 'networks', determined in alignment with the provision of maternity and obstetric care. *The Toolkit for high quality neonatal services* (DH 2009) includes an example of a network structure.

Levels of neonatal care

2.2 The level of care that a unit provides will be decided according to the overall organisation of the network of care within the region. There are three categories of care above and beyond the routine care provided in a maternity unit, summarised below:

Special care

2.3 Special care is providing the care of less immature premature babies who no longer need high dependency or intensive care while they grow to a stage of maturity ready for discharge. This includes tube feeding, maintenance of body temperature and monitoring; and the care of babies recovering from illnesses or operations, for example treatment of infections, jaundice and special nutrition.

2.4 There will normally be a 1:4 ratio of staff to babies.

2.5 Units that provide special care but no higher level of care are referred to as special care units (SCUs).

High dependency care

2.6 High dependency care is providing higher levels of clinical care including for those recovering from intensive care. This includes babies receiving oxygen for immature lungs as they breathe on their own, sometimes assisted by higher pressure given via nasal prongs; and babies on intravenous nutrition or treated with chest drains or for convulsions, infections or metabolic problems. There will normally be a 1:2 ratio of staff to babies.

2.7 Units that provide high dependency care also need to be able to provide short-term intensive care **(see paragraphs 2.8 – 2.13)** and are referred to as local neonatal units (LNUs). They also provide special care.

Intensive care

2.8 Neonatal intensive care is needed for:

- babies born prematurely, simply to support organ systems until they have matured; and
- babies who are ill or who have life-threatening congenital disorders.

2

2.9 The greater the immaturity, the more needs to be done to support a baby's breathing, often with mechanical ventilation, and to protect it from infection and to achieve growth equivalent to that which occurs in the womb. Thus, even babies who are otherwise well but very premature require intensive care simply to support their life until their organ systems undergo maturity. This includes sophisticated mechanical ventilation with oxygen, intravenous feeding, and the use of incubators to control body temperature and protect from infection. It also involves treatment of illnesses that are more common in such vulnerable babies.

2.10 Neonatal intensive care is also required for a small number of larger, more mature babies who become ill from complications of delivery, from infection or metabolic disorders or when surgical or other treatment is required for congenital anomalies such as congenital heart disease, disorders of the lung or gut, or of other organs.

2.11 Intensive care, frequently needed for a period of weeks, is then followed by further weeks of high dependency or special care provided in neonatal units as the babies grow to maturity.

2.12 Short-term intensive care may be required for less immature babies who need mechanical assistance from a ventilator to breathe, and for some this may only be for one or two days as the effect of artificial substances (surfactant) given through the breathing tube located in their lungs takes effect and they can move to high dependency care **(see paragraphs 2.6-2.7)**.

2.13 There will normally be a 1:1 ratio of staff to babies.

2.14 Units that provide intensive care are referred to as neonatal intensive care units (NICUs). They also provide high dependency and special care.

Categories of neonatal unit according to the level of care they are able to provide					
Type of unit	Routine care	Special care	High dependancy care	Intensive care	
Midwifery (no neonatal unit)	Y				
Special care unit	Y	Y			
Local neonatal unit	Y	Y	Y	Y**	** As agreed within the network
Neonatal intensive care unit	Y	Y	Y	Y***	*** May also provide neonatal surgery
Note: This definition of a local neonatal unit envisages it providing only short-term intensive care. It is, however, important to recognise that in using the proposed clinical categories a large proportion of high dependency work will be provision of nasal continuous positive airway pressure (CPAP), which under former standards was included with intensive care activity.					

2

Relationships with other services

2.15 Other related services that need to be taken into account when planning neonatal provision include:

- neonatal surgery: where possible, medical and surgical neonatal services should co-exist;
- obstetrics and foetal medicine services, which should function in parallel with a neonatal network, especially for high-risk pregnancies;
- children's services: SCUs and LNUs can only operate as part of a general paediatric unit, alongside an obstetric unit, because neonatal staffing is shared with the general paediatric service, although in certain circumstances a NICU may be stand-alone;
- other specialised services: in perinatal centres (that is, those providing fetal and maternal medicine), paediatric sub-specialties (cardiology, haematology, endocrinology, gastro-enterology, hepato-biliary, radiology, nephrology, neurology) provide important specialist input when required. These and surgical specialties (otolaryngology, neurosurgery, ophthalmology, cleft lip and palate services) are critical to providing the range of support for the pregnant woman and her newborn baby. Not all these services need to be provided on the same site. Arrangements would need to be made with a perinatal centre associated with, but not necessarily on the same site as, a NICU for support from these services.

Family-centred care

2.16 Parents are encouraged to visit and stay with, handle and care for their babies, and high priority should be given to the needs of the family. This is especially important when a baby is moved for ongoing intensive care. Accommodation for families should be within easy reach of the neonatal unit, including family rooms (for couples and siblings), bathrooms, basic self-catering facilities and a play area for siblings of infants receiving care. Day facilities should also be included, to provide a space for non-resident families and for other visitors. Usually only two people are allowed to be present at one time in the cot area.

2.17 Transitional care and 'rooming in' facilities are increasingly being provided, where parents can look after their baby/babies with supervision from midwives and neonatal professionals for up to two weeks, prior to transfer home. This guidance assumes the following:

- transitional care: the mother requires further care and support, which takes place in multi-bed bays generally associated with postnatal beds;
- rooming in: the focus is on the neonate who has been unwell and care takes place in single rooms generally associated with the neonatal unit.

3

Chapter 3

Scope and size of provision

3.1 The number and distribution of cots should be decided locally. The following questions should be addressed:

a. What is the size of the population served?

b. What are the demographic trends that will influence the number of deliveries in the area served?

c. Will the unit provide care for neonatal surgical patients?

d. Will the unit act as a tertiary referral centre?

e. What are the existing and predicted networks in the region?

f. Does the unit serve predominantly low-risk deliveries?

g. Will the perinatal centre attract many in-utero transfers of mothers with high-risk pregnancies?

h. Is it likely that nearby acute general hospitals will close in the coming years, causing the unit to expand its cot numbers?

j. Is it intended to return special care infants to the local acute hospital once intensive care has been completed?

3.2 Neonatal care should be planned on a population base of 1 million or more, taking into account demographic trends and changes. In the average population, there is a requirement of 0.75 cots per 1000 birth population for intensive care, 0.7 cots per 1000 birth population for high dependency care and 4.4 cots per 1000 for special care. Not all special care occurs on the neonatal unit and, although the percentage varies, a significant amount of special care occurs next to the mother as transitional care.

3.3 It is recommended that considerable flexibility is maintained within a neonatal unit. A baby's care requirements may change between intensive care and high dependency care and it is preferable not to move the baby. High dependency areas should therefore be equipped to enable intensive care to take place. Some designated special care rooms should also be equipped for intensive care, as this allows emergency movement of infants from intensive care in the event of fire. It also allows special care cots to be used for intensive care at a time when an outbreak of infection has occurred in the intensive care rooms (Laing *et al* 2004).

4

Chapter 4

Functional relationships

Relationships with the maternity unit

4.1 The neonatal unit should be as close as possible to the birthing rooms and obstetric theatre(s), ideally immediately adjacent on the same floor, for easy transfer of the baby in case of complications. If the structure of the building precludes the neonatal unit and birthing rooms and theatres being on the same floor, they should be on adjacent floors and with a dedicated lift for emergency transfers.

4.2 There should be easy access from the postnatal area to the neonatal unit, so that the mother can easily see her baby, bearing in mind that the mother may also require access to see her baby during the night.

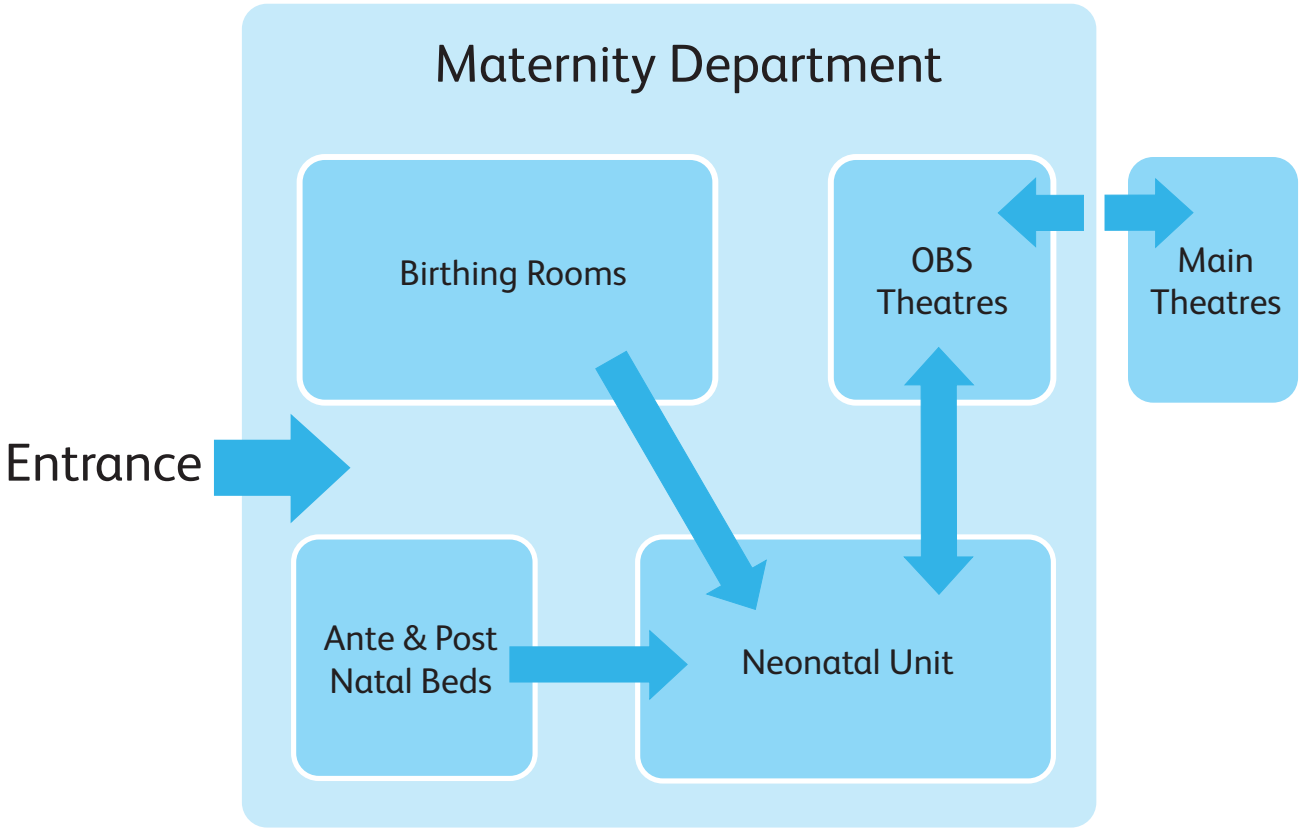


Figure 1 Relationships with the maternity department

Relationships with external facilities

4.3 Where there are paediatric surgical services on site, neonatal units should have direct access to the paediatric operating theatres. Ideally there should be ready access to the mortuary and the viewing area for the bereaved.

4

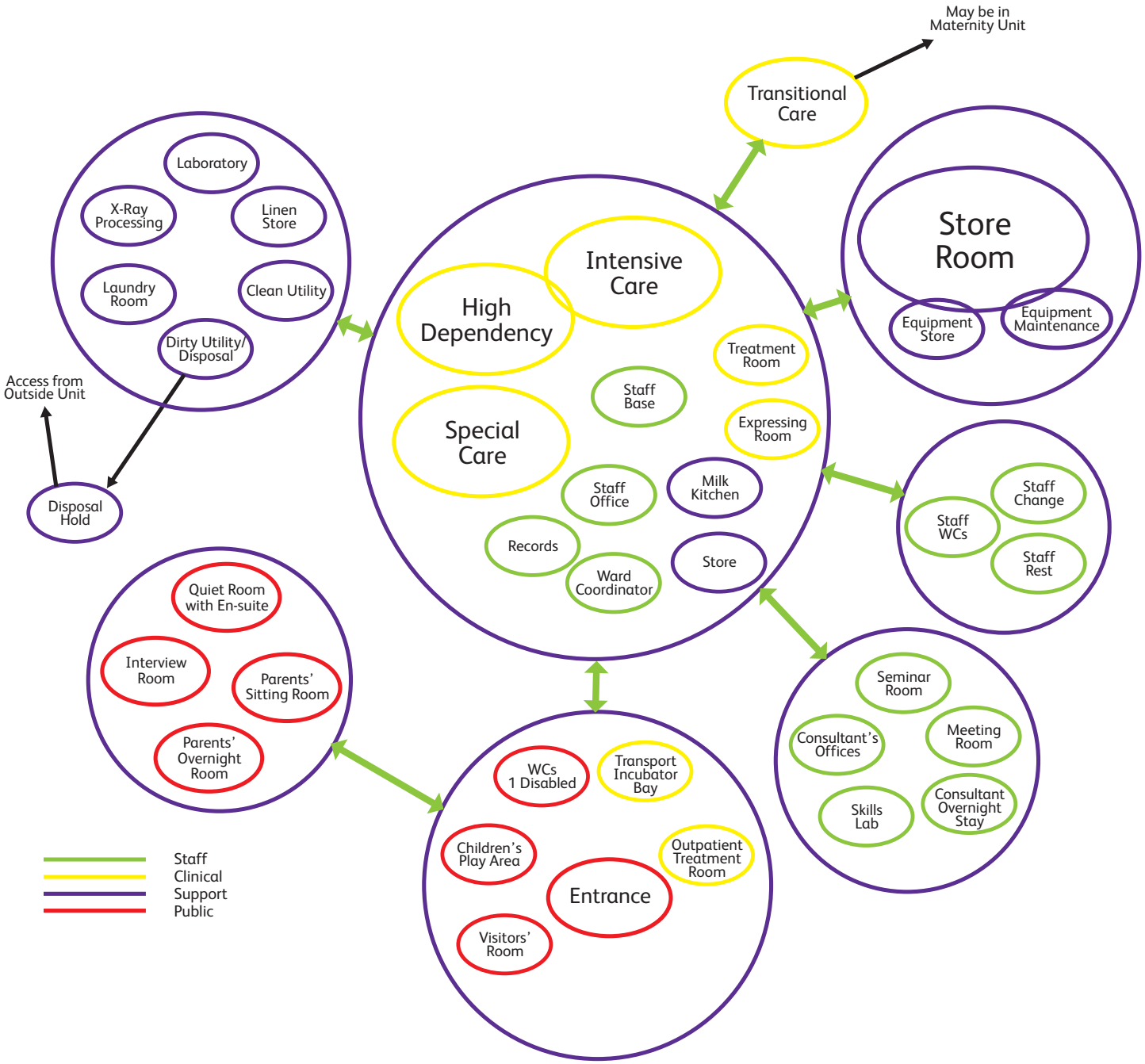
Internal relationships within the neonatal unit

4.4 Key relationships within the neonatal unit include:

- Clinical support areas should be as close as possible to clinical care areas. Such support facilities include the near patient testing laboratory, pharmacy, equipment storage, milk storage, clean and dirty linen store.
- Family access is required to the waiting area, interview rooms, support services, for example, social work and community neonatal nursing, and recreational facilities.
- The clinical manager's office should be located on the same floor as the neonatal unit, easily available to all staff and, by arrangement, to families.
- In LNUs and NICUs, the attending consultant's office should be located within the neonatal unit.
- On-call accommodation should be located in the neonatal unit or immediately adjacent to it.
- Consultant and research offices can be located further away from the clinical care area.
- In larger units, the milk kitchen should have an associated, separate store **(see paragraphs 11.7-11.9).**
- The milk expression room should be located close to the milk kitchen.

4

Figure 2 Internal relationships within the neonatal unit



5

Chapter5

Design considerations

Security

5.1 Security is an issue of importance for staff, mothers and babies: *'A robust system must be in place for their protection. Babies born in hospital should be cared for in a secure environment to which access is restricted. An effective system of staff identification is essential. A robust and reliable baby security system should be enforced, such as closed-circuit television, alarmed mattresses. Strict criteria for the labelling and security of the newborn infant are essential'* (RCOG, RCM, RCA *et al* 2007). Security systems should not compromise the ability of staff to carry out their work or to respond to emergencies when required.

5.2 For further specific information, see also under 'Design considerations' in WHBN 09-02:2013 *Maternity facilities.*

Access

5.3 Balanced with the need for security is the issue of access. All doors between the maternity area and the neonatal unit, and also those within the neonatal unit, should be designed to maximise convenience as well as safety and security. If automatically locking magnetic doors are to be used, consideration should be given to difficulties that may arise in wheeling incubators/cots from room to room in an emergency when the security doors have locked down.

5.4 Access must be ensured for mothers on trolleys or in wheelchairs. Widths of doors, corridors and corners should be considered so that mothers have access to all clinical areas.

Fire

5.5 Robust fire response and evacuation procedures are a critical element for all neonatal units. As the movement of cots/incubators may not be desirable it is essential that the layout of the unit minimises the need for wholesale evacuation.

5.6 To this end, in addition to the generic requirements for 'very high dependency' departments as detailed in the *Firecode* WHTM 05-02 series, all multi-cot space areas should be contained in 30 minute fire resistant enclosures (sub-compartment standard). This should align with the preferred six-cot room arrangement as detailed in **Chapter 7** and **8**.

5.7 The balance between security and emergency egress also needs to be coordinated to ensure safe fire procedures without jeopardising security arrangements.

5

Neonatal care environment

5.8 There is some evidence **(see paragraph 5.15)**. that the environment in a neonatal unit can affect a child's physiology, clinical course of treatment, rate of recovery and developmental outcome. Leaving a premature baby in a poor environment for even a very short period of time can permanently damage its development.

5.9 The neonatal care environment should be designed to be as close as possible to the womb in terms of the following: timing, touch, motion, taste, smell, hearing, memory, vision. The senses come on stream in this order, and the running order should not be interrupted. The environment in every neonatal area therefore needs to be completely controllable in terms of noise, light, smell, view, etc.

5.10 For example, sound levels should be controlled and kept below 40 db (a womb-like level). This means controlling air-conditioning noise, telephone and paging system sounders and all other extraneous background noise. Stainless steel sinks and troughs can be very noisy; where used, care should be taken to avoid high water flow that results in excessive noise. Waste bins should be foot-operated with soft-close tops. Consideration should also be given to noise levels from floor coverings, door closers, etc. This needs to be balanced with the need to minimise healthcare associated infections (HCAIs). Sound monitoring equipment may help to maintain low noise levels.

5.11 Similarly, the visual environment should be fully controllable and it should be possible to black it out. In intensive care cot areas, it should ideally be possible to control lighting to individual babies, possibly within the design of the incubator.

5.12 Natural light should be provided to all clinical areas, quiet rooms and parents' bedrooms. Babies' cots should be positioned no closer than 600 mm from any external window. Radiant heat gain should be minimised with shading to prevent overheating. Full consideration should also be given to the need for family privacy.

5.13 Artificial lighting should be chosen very carefully. All artificial lighting should be indirect, except for lights needed for procedures, and it is preferable that each light should be individually controlled. This is particularly important in special care areas where a relatively well child can sleep in darkness even when another infant in the same room is being examined. The ability to achieve darkness is very important, not just for the sleeping infant but also for procedures such as echocardiography and chest transillumination. Window shading is essential, and blinds should be provided with privacy glass screen type or vertical cleanable type.

5.14 Detailed guidance is also included in paragraph 5.8.2 of *Lighting Guide 2: Hospitals and health care buildings* (CIBSE 2008).

5.15 Useful studies into the impact that the environment, including lighting, has been carried out by Graven *et al* (1992, 1997, 2008).

5.16 See also the NIDCAP (Newborn Individualized Developmental Care and Assessment Program) website at: **http://nidcap.org/en/**

6

Chapter 6

Public spaces

Entrance and reception

6.1 A single access point should be provided for all patients. If there is direct access from the outside of the hospital, an entrance lobby should be provided. It is unlikely that an entrance/reception would be staffed on a full-time basis. The entrance to the unit should have controlled access and be visible from staff bases, either directly or through CCTV links and an intercom link.

6.2 There should be a hand-hygiene station just inside the main door and clearly visible on entry. This should comprise:

a. a scrub sink, wash-hand basin or antiseptic hand wash, subject to local policy;

b. a notice board;

c. a shelf on which to place items whilst washing hands;

d. secure coat hanging and lockers for personal belongings, although these may be located within the parents' sitting room.

6.3 An area for the reception of mothers, partners and visitors should be conveniently located near the entrance to the unit. See 'Entrance, reception and waiting' in WHBN 00-03:2013 *Clinical and clinical support spaces.*

Parents' quiet room/Interview room

6.4 This room will be used for counselling and to provide distressed parents with privacy and quiet. Consideration should be given to furnishings, which should be comfortable and domestic but should meet the requirements of infection control. There should be no telephone or television in this space. Parents may spend time here with a dying baby. The room should be located:

a. close to WCs to allow discrete access, or alternatively an en suite should be provided;

b. to allow distressed parents to leave the unit without passing the cot areas.

6.5 This room may also be used for staff activities and confidential discussions.

6.6 In addition to a parents' quiet room, a large NICU may require a separate interview room. See 'Consulting, examination and interview spaces' in WHBN 00-03:2013.

7

Chapter 7

Intensive care cot areas

7.1 Cots will normally be located in several multi-cot rooms. This design has the advantage that observation of infants is unrestricted by walls and curtained windows. Particular attention should be paid to reducing noise levels. Neonatal intensive care cots should be positioned closest to the birthing rooms.

7.2 Overall, a six-cot room arrangement is the preferred option to aid observation and create an intimate, personal atmosphere. In intensive care, infants will be nursed on a one-to-one basis, whereas in high dependency a nurse commonly looks after two infants, so there may be an advantage in preserving even numbers to maximise nursing efficiency and flexibility in use. For example, if there are ten intensive care cots, rooms may be designed to accommodate six and four infants rather than having five in each.

7.3 Individual bedrooms may be provided for each infant and family. In this case, continuous electronic monitoring is required, with a central console where dedicated staff can respond to any information requiring intervention.

7.4 A minimum of one single or a two-cot nursery, equipped to intensive care levels, will be required for cohort nursing and other functions.

Note: Whether a single/two-cot arrangement is chosen, each cot space must comply with the recommended space and services requirements. NICU/perinatal centres may require two or three rooms. A reclining chair(s) or a pull-down bed(s) should be provided.

7.5 A separate viewing room is not considered necessary. Even in units providing the highest level of intensive care, facility should be made to allow the presence of parents in the baby's cot space. Adequate space is required for a sick mother to be brought in on her bed (see **Figure 5** 'Intensive care multi-cot room: example layout' under 'Cot area requirements')

Cot space requirements

General cot space requirements

7.6 Each cot space should be able to accommodate the following:

a. all-round access to the incubator;

b. space to enable staff to manoeuvre the incubator, themselves and equipment safely;

c. clinical equipment permanently located around the incubator;

d. any mobile equipment that may be required;

e. a minimum of five members of staff (to attend the baby in an emergency situation);

7

f. space for the mother to express discreetly at the cot-side;

g. at least two chairs to accommodate visitors.

Specific equipment/service requirements

7.7 Each cot space requires within the space itself:

a. an incubator;

b. space for a supplies trolley and dressing trolley;

c. a dripstand (although this may be mounted on the medical supply unit);

d. four computer ports;

e. a staff call system;

f. WiFi capability (based on local decision);

g. a whiteboard.

7.8 Equipment used intermittently at the cot space includes:

a. EEG machine;

b. ECG machine;

c. mobile imaging equipment.

7.9 Babies' lives will depend on the environmental conditions and life-support systems in each nursery, and adequate provision of engineering services is essential. For maximum flexibility, this WHBN assumes the following equipment and services are provided at each cot space:

a. 24 single switched socket-outlets to be supplied by no fewer than two separate isolated power supply (IPS) systems;

b. where a risk exists to patient safety as a consequence of power loss, each IPS should be further connected to an uninterruptible power supply (UPS);

c. multi-parameter monitoring;

d. ventilation and humidification equipment;

e. two infusion pumps;

e. six to eight syringe pumps;

f. two medical vacuum terminal units;

g. an examination luminaire – mobile lights are not generally recommended;

j. three medical oxygen terminal units;

k. three 4-bar medical compressed air terminal units;

m. a suitable number of equipotential earth bonding points for the connection of external medical equipment.

Medical supply units

7.10 Each cot space requires a ceiling-, wall- or floor- mounted medical supply unit to provide medical gases and socket-outlets for the wide range of equipment required. Care should be taken in the selection and mounting of medical supply units to ensure relatively unimpeded access to the neonate by staff and to meet infection control requirements.

7.11 A ceiling-mounted system provides unobstructed access and uncluttered floor space around the cot. This WHBN is based on the provision of a pendant style medical supply unit, but beam system solutions are also possible. Project teams may wish to specify shelving as part of the medical supply unit; staff should be discouraged from placing items on top of incubators, which can create noise inside them.

7.12 Cabinetry systems are not recommended because of the potential limitations in the flexibility of the use of space.

7.13 See the BAPM's *Designing a neonatal unit* (Laing *et al* 2004) for detailed comment on each type of medical supply unit.

7.14 An early decision should be taken because of the structural support required for overhead medical supply units. All medical supply units should be manufactured and installed in accordance with BS EN 11197:2009.

7

Intensive care cot space: Activity envelope and critical dimensions

7.15 Based on a detailed space study of activities within an intensive care cot area, the recommended core clinical space envelope within a multi-cot environment is 13.5 sq m. The critical dimensions are 4.13 m × 3.27 m, plus 600 mm access space (4.13 m × 3.87 m = 16 sq m). For further information, see *Two case studies using mock-ups for planning adult and neonatal intensive care facilities* (Hignett *et al* 2010).

7.16 When evaluating an existing facility, cot space provisions that are equivalent to approximately 90% of the recommended length (which equates to 80% of the recommended area) should be considered acceptable.

7.17 The recommended allowance of 20 sq m per cot space given in the schedule of accommodation in **Appendix 1** includes the core cot space, access space and an allowance for the following core support space:

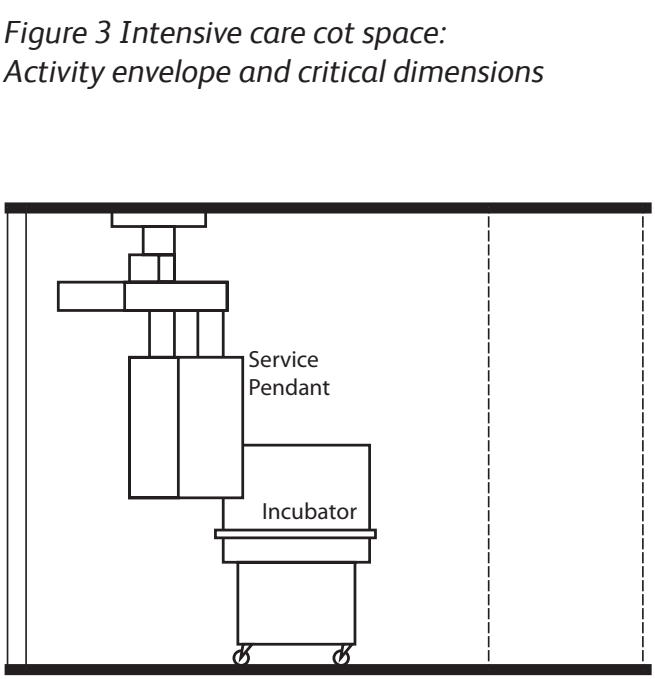
a. pharmacy preparation, including controlled drugs;

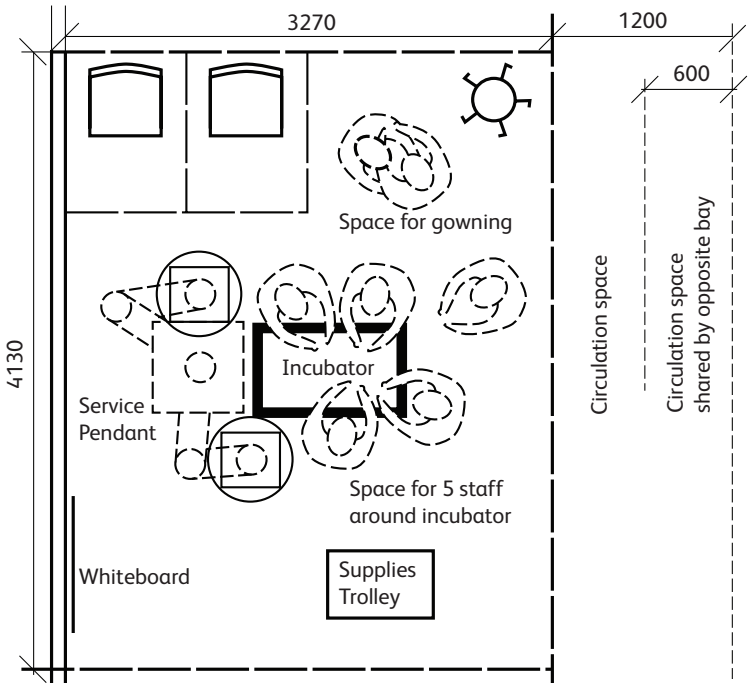
b. refrigerated storage of milk and feeds; and

c. clinical hand washing/scrub sinks and local disposal.

7.18 Project teams will need to consider optimal configurations of cot areas to accommodate the above, plus the relationship with a staff communication base. N.B. the staff communication base is not included in the 20 sq m allowance

Figure 3 Intensive care cot space: Activity envelope and critical dimensions





7

Intensive care single-cot room: example layout

7.19 The single-cot room is based upon the same space study as for the core clinical cot space in a multi-cot bay, except that with the indicative room layout/area allowance, consideration has been given to the:

a. positioning and impact of the door position on the room;

b. provision of clinical wash facilities within each room;

c. provision of a dedicated small pharmacy preparation area with each room.

7.20 The recommended allowance of 20 sq m per cot space given in the schedule of accommodation in **Appendix 1** includes the core cot space, access space and an allowance for the following core support space:

a. pharmacy preparation, excluding controlled drugs;

b. refrigerated storage of milk and feeds; and

c. clinical hand washing/scrub sinks and local disposal.

7.21 For single-cot rooms, while the allowance is identical to a multi-cot bay, the detailed content and space requirements are different; there is a greater requirement for access space, with space to allow for the door and walls, and there is a smaller space requirement for pharmacy preparation.

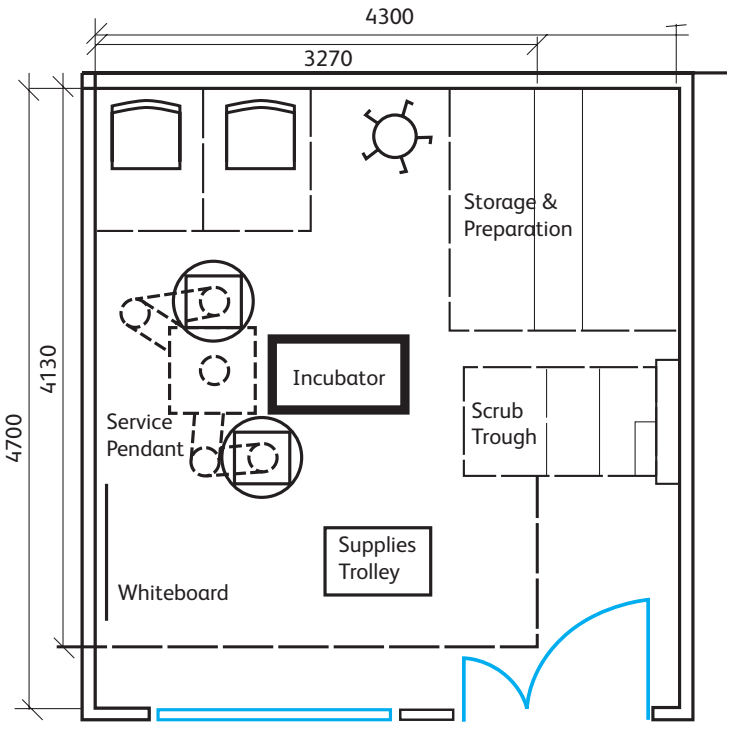


Figure 4 Intensive care single-cot room: example layout

7

Cot area requirements

7.22 In an intensive care cot area, there should be a scrub-up trough accessible from each cot space. A minimum quantity of one scrub facility should be provided per two cot spaces. They should ideally have heat-sensitive automatic sensors that activate the flow of warm water appropriately.

7.23 A clock with a sweep seconds hand should be clearly visible from each cot space. There should be one telephone point per four to six cots, for staff use; this may be located at a staff communication base if included within the cot area.

7.24 Each nursery will require mechanical ventilation with cooling, humidification and controlled air movement. It should be possible to independently vary room temperatures in the range 23°C to 30°C. Temperature and humidity control may be enhanced internally to the incubator to avoid conflict with the needs of staff and babies. Windows on external elevations should be designed to avoid condensation and to prevent excessive solar gain. The general lighting should be constant throughout the clinical areas and have good colour-rendering, and the intensity should be variable, through provision of a dimmer switch. The design of the windows should ensure that cot spaces are not subject to direct sunlight.

7.25 See also **paragraph 5.8,** 'Neonatal care environment'.

Circulation and storage

7.26 In addition to the cot spaces there should be space in the centre of the room to allow large pieces of equipment for radiography and ultrasonography to pass to the furthest cot without intruding on the space allocated to another family. Other items in transit may include incubators, ventilators, multiparameter monitors, infusion stands and phototherapy machines.

7.27 Space is required within the care areas for storage of the neonate's personal effects and some clinical supplies. Much of the baby's personal items can be accommodated on the incubator shelves. All regularly used facilities and supplies should be accommodated in a supplies trolley in each bay. Top-up storage clean utility, etc should be located nearby.

Pharmacy/working area

7.28 To minimise the need for staff to leave the neonatal care area, each intensive care room should include, within the room itself, sufficient work space to enable the safe preparation of medicines and feeds for more than one baby at a time.

7

7.29 The space for the preparation of medicines should consist of:

a. a controlled drugs cupboard (not single-cot rooms);

b. a drugs fridge;

c. a drugs cupboard for those medicines used frequently;

d. sufficient work surface for drug preparation (one person in a single-cot room, two people in a multi-cot room).

Note: Agreement should be reached at the earliest opportunity with the main pharmacy regarding the implications of providing multiple numbers of controlled drugs cupboards.

7.30 In addition, but separately, each intensive care room requires a milk or feeds fridge.

7

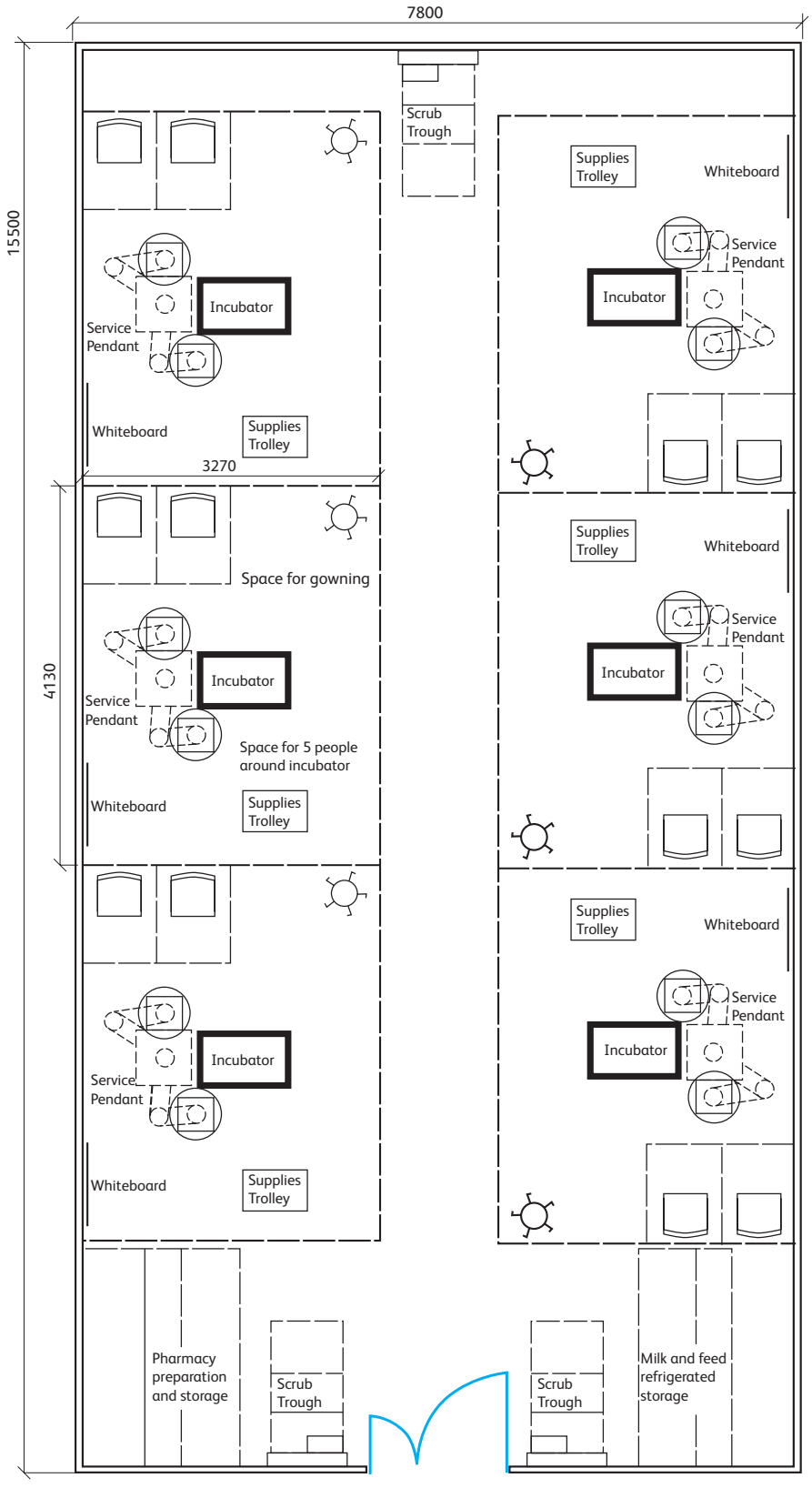


Figure 5 Intensive care multi-cot room: example layout

8

Chapter 8

High dependency cot areas

8.1 To allow flexibility of use of space, the high dependency care cot areas should be designed and equipped to allow intensive care to occur if necessary. Therefore, the guidance in **Chapter 7**, 'Intensive care cot areas' should be applied to high dependency care cot areas.

9

Chapter 9

Special care cot areas

9.1 The guidance in **Chapter 7**, 'Intensive care cot areas' should also be applied to special care areas designated for emergency intensive care (during fire or infection; see **Chapter 3**, 'Scope and size of provision').

9.2 Rooms that are allocated to special care, and that are not to be used at any time for intensive care functions, should be designed carefully with the safety of the infant and the relaxation of families in mind. In most instances, major clinical interventions are not likely to be undertaken in special care areas. The whole atmosphere should be more domestic and supportive of parents taking responsibility for their infant's care.

9.3 A minimum of one clinical wash-hand basin should be provided per three cots.

9.4 Staff should give careful thought to storage of all items of care, including the infant's own clothes. Ideally, a small wardrobe should be provided at each cotside.

9.5 There should be facilities for filling, emptying and storing a baby bath(s), bathing the infant and changing nappies.

9.6 Cot spaces should not include medical supply units or cabinetry bays. However, each cot space will require two medical oxygen outlets, two medical air outlets and one suction outlet, along with eight single socket-outlets.

9.7 Two lockable, temperature-controlled fridges should also be provided, one for milk and one for feeds. Consideration may be given to the provision of individual lockable lockers for the use of parent-administered medicines (one per cot space).

Special care: activity envelope

9.8 No specific space studies have been carried out for activities within the special care cot space. However, based on the BAPM's recommendation in *Designing a neonatal unit* (Laing *et al* 2004) and a review of recent projects and existing spaces, the recommended core clinical space envelope within a multi-cot environment is 9 sq m, including access space.

9.9 This assumes that resuscitation is not undertaken in the special care cot space but that babies are instead transferred to an adjacent intensive/high dependency care cot space.

9.10 The recommended allowance of 11.5 sq m per cot space given in the schedule of accommodation in **Appendix 1** incorporates the cot space, access space and an allowance for the following core support space:

a. space for filling, emptying and storing baby baths and for baby changing;

b. space for the refrigerated storage of milk/feeds.

9

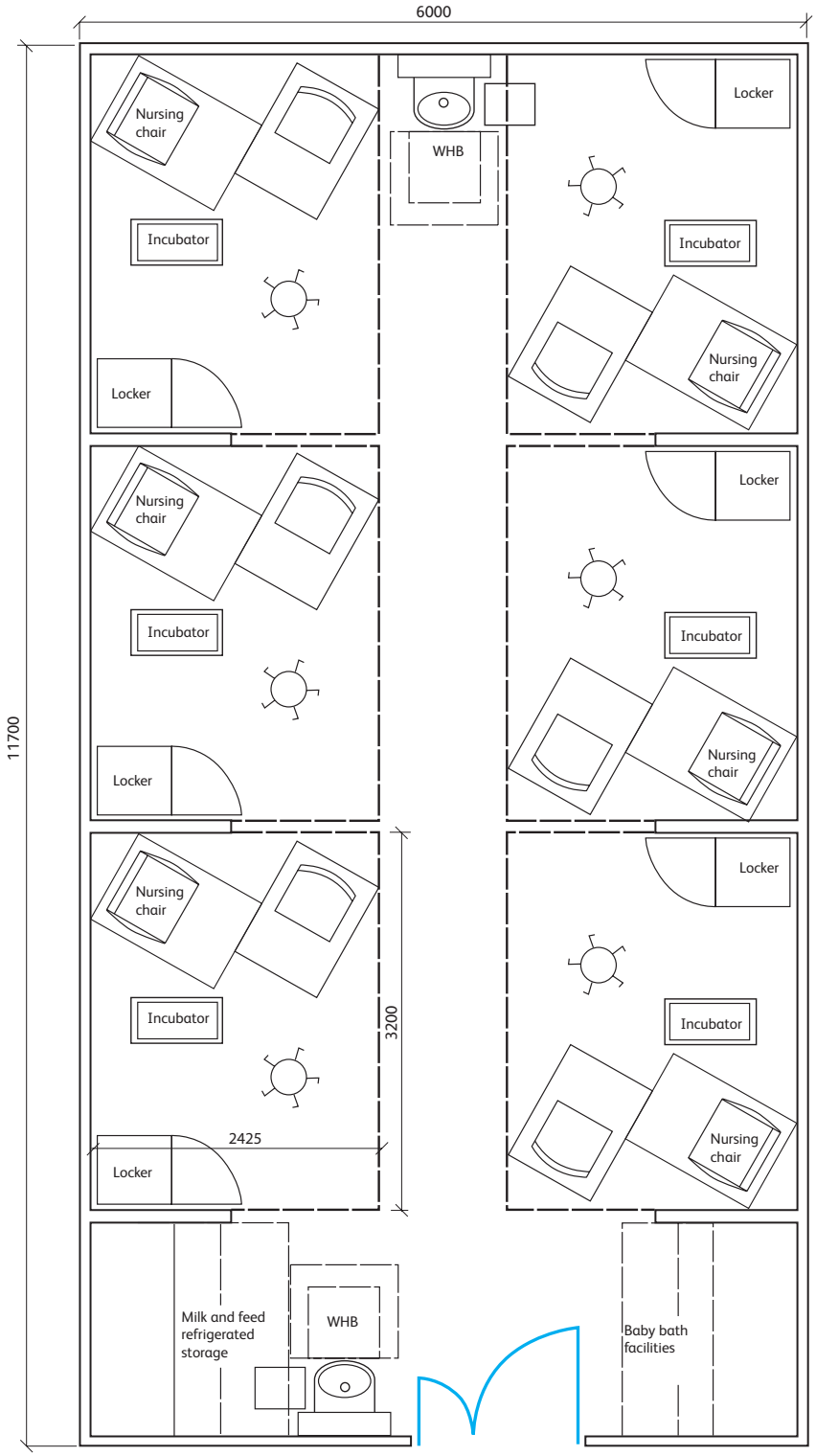


Figure 6 Special care multi-cot room: example layout

9.11 Project teams will need to consider optimal configurations of cot areas to accommodate the above, plus the relationship with a staff communication base. Note: the staff communication base is not included in the 11.5 sq m allowance.

10

Chapter 10

Other clinical spaces

Staff communication base

10.1 The staff communication base is the organisational centre of the unit. It should consist of an open-plan area located close to the geographical centre of the area it serves with sufficient access to cot areas. It may be located adjacent to the general office.

10.2 Observation of babies will take place directly within the cot areas. In a small SCU, a single communication base should be sufficient, which could be combined with reception. A large NICU may provide multiple communication bases serving groups of cots.

10.3 The specific considerations are as follows:

a. There should be space for storing neonatal records; records can be stored off site following discharge from follow-up.

b. Nurse-to-nurse calls, monitoring display units and alarms should all be located within the base.

c. In addition to the general space for a computer terminal and associated equipment, digital X-ray viewing facilities are required, which should include diagnostic quality imaging screens; NICUs may require more than one screen.

10.4 See 'Staff communication base' in WHBN 00-03:2013 *Clinical and clinical support spaces.*

General office/clinical administration room

10.5 The general office is the administrative centre of the neonatal unit. The room consists of shared workstations with associated power and data points. Facilities are required for storing any paper sheets required for the efficient running of the unit. See 'Offices' in WHBN 00-03:2013.

Transfer/reception area

10.6 There must be space for preparing a baby for transfer out and for receiving and stabilising a baby when the transfer team arrives, including space for a mobile intensive care unit, in the form of a trolley. Typically a transfer team may include two or three staff and the handover team a further one or two staff, as well as trolley attendants. In SCUs and LNUs, a multi-purpose single-cot room or intensive care/high dependency care cot space may be used; NICUs normally include a separate dedicated room. If a separate dedicated room is provided, this should be located near the entrance to the unit and be equipped to the same level as an intensive care cot space.

10.7 See **Chapter 7**, 'Intensive care cot areas'.

10

Resuscitation facilities

10.8 Facilities for neonatal resuscitation should be carefully thought out for each area in which babies are cared for. In intensive care and high dependency areas, resuscitation is commonly carried out in the incubator itself.

10.9 In special care areas, it is very difficult to resuscitate infants in open-topped cots with fixed walls. A stand-alone special care unit should provide a space equipped to intensive care standard, containing an open radiant-heated cot or resuscitaire, with appropriate facilities including piped gases and vacuum suction, electric sockets, laryngoscopes, equipment for assisted ventilation and a secure store for drugs. This may be provided in a single-cot room or in a bay within the special care area. In a special care unit combined with intensive/high dependency care, consideration may be given to using intensive or critical care spaces for resuscitation. The schedule of accommodation is based on the use of a single-cot room.

Inpatient treatment room

10.10 The majority of procedures can be undertaken within the neonatal care area at the cot or incubator side. However, a dedicated space is required for babies coming into the unit from maternity for ultrasound examination etc.

10.11 This guidance assumes that in a SCU/LNU a generic treatment room will be sufficient (omitting the couch), whereas in a tertiary referral unit a single-cot room equipped for intensive care should be provided. If laser therapy is to be carried out, the room should be protected by screens that are proofed against argon lasers, and fitted with a warning system to prevent staff from entering inadvertently while laser therapy is being carried out. See **Chapter 6**, 'Treatment rooms' in WHBN 00-03:2013 regarding the design of a generic treatment room, and **Chapter 7**, 'Intensive care cot areas' in this WHBN regarding cot space requirements.

Transitional care

10.12 Regarding transitional care provision, see **paragraph 2.16**, 'Family-centred care', and also paragraphs 8.50-8.53, 'Multi-bed spaces' in WHBN 09-02:2013 *Maternity facilities.* Consideration may be given to the provision of individual lockable lockers for the use of parent-administered medicines (one per cot space).

10

Parents' overnight/rooming-in room(s)

10.13 Access to overnight accommodation should be available for parents of very sick babies within a 10-minute walk of the cot areas. This is particularly important for units that are tertiary referral centres, where parents may live many miles from the unit. The overall provision should be based on the average number of babies requiring intensive care, with an allocation of one overnight room per intensive care cot. These rooms may be provided in a number of different ways subject to local policy and requirements, including an apartment block, B&B etc.

10.14 A minimum of two domestic-type en suite bedrooms (one a double bedroom) should be provided within, or adjacent to, the neonatal unit itself for 'rooming in'; these may also be used as overnight rooms (see **paragraph 2.16,** 'Family-centred care'). The location should allow families to exit the unit without having to pass through cot or visitor areas. These rooms should include space for cots and be equipped with nurse call, oxygen and suction. The furnishings and decor should be chosen with great care but should meet infection control requirements.

10.15 Radio sound, a TV outlet, a telephone point, a desk and an over-bed light may also be provided. There should also be easy access to beverage making facilities and a microwave within close proximity to the parents' overnight/rooming in rooms.

10.16 Consideration may be given to the provision of individual lockable lockers for parental administration of medicines and for local cleaning and storage facilities. Rooming-in families will have access to the day/support facilities in the neonatal unit.

Outpatient examination room (optional)

10.17 Many units offer a daily 'drop-in' clinic for unscheduled patients. These infants are commonly those who are diagnosed in the community as jaundiced or those who have lost more than 12% of their birth weight. An examination room may be provided close to the unit entrance. It should be equipped with two chairs, an examination surface, an examination lamp, and facilities for weighing a neonate and for phlebotomy. A standard single-sided consulting room is considered sufficient in size and function, although the reclining treatment chair should be replaced by a smaller examination surface with the inclusion of baby scales. See 'Examination/physical therapy room' in WHBN 00-03:2013.

Chapter 11

Clinical support spaces

Parents' sitting room

11.1 Each unit should have a designated family area where parents can relax. The room should appear welcoming and should have easy access to beverage making facilities and a microwave. Beverage making facilities that incorporate a microwave should be separate from the family area. It may be an advantage to keep the parents' sitting room as an open plan area, to ensure that use of the area is not abused.

11.2 Coat hanging and lockers may be provided in this area. Provision should be made for television, radio, etc; telephone and television jack points should also be included; and computer links with internet access should be provided.

11.3 Adjacent to, or contained within, the parents' sitting room there should be a family education area. This area should contain a guide to the unit, leaflets on common neonatal conditions, information on help available to families, internet access and audiovisual resources for educational purposes.

11.4 As part of the parents' sitting room a secure play area should be provided for children accompanying adults. Young children should be able to play or read in safety without disturbing adult attendees. The location of the play or reading area should facilitate easy and constant observation. If possible, there should be access to a suitable outside play area. Playground equipment and surfacing should comply with BS EN 1176-3:2008 and 1176-4:2008 and BS EN 1177:2008.

Laundry room

11.5 A laundry room is required, located in the parents' communal area, for washing and drying baby clothes. Equipment should be to industrial standard and should include a washing machine and dryer. A stainless steel sink and drainer, and a worktop with cupboards, should be provided, all to industrial standard.

Milk expression room

11.6 Comfortable private rooms with lockable doors should be provided for mothers to express breast milk, using an electric pump provided by the unit. Sterilizing facilities are required close by. The rooms should include facilities for hand washing, a chair and access to a fridge for the exclusive use of expressed breast milk. (See also **Chapter 7**, 'Intensive care cot areas' and **Chapter 9**, 'Special care cot areas' regarding the provision of fridges in these areas.)

11

Milk kitchen

11.7 A milk kitchen is required for the following:

a. the preparation of formula feeds;

b. the separate sterilization of bottles for each neonate (if not carried out at the cot side, that is, in special care);

c. the refrigerated storage of milk etc if not in a separate store;

d. the storage of pre-packed baby foods (identified by neonate);

e. the storage of baby bottles, teats, equipment and disposable items;

f. in large units, the pasteurisation of donor milk;

g. in small units (where only a single fridge is required), the frozen storage of milk/feeds.

11.8 Parents and staff should have ready access to this area. Subject to local policy, there should be a separate, identified storage facility for each baby as well as sufficient preparation area where tuition can take place.

11.9 Project teams should refer to the NICE guidelines (2010) on donor breast milk banks.

Milk kitchen store

11.10 In larger units (NICUs), a separate room should be provided for the refrigerated storage of special formula baby feeds and breast milk banks and the refrigerated/ frozen storage of human milk feeds. The quantity of refrigerated/frozen storage required will depend upon the size of unit and use of local refrigeration within the cot rooms.

Bereavement suite

11.11 A bereavement suite generally consists of two interview rooms that are interconnected, one with space for a cot/crib to contain the deceased infant.

11.12 The first room should be for the counselling of relatives.

11.13 The second room should be for relatives to quietly sit with their deceased infant.

11.14 The quality of the environment and atmosphere within the suite is of great importance.

11.15 The suite should:

a. be located away from any parents' overnight stay accommodation: it may be provided within the neonatal unit or could be co-located with maternity if easily accessible and separate access points are provided;

b. have decor that is domestic, informal and relaxing;

c. be close to WCs to allow discrete access, or alternatively an en suite should be provided;

d. allow distressed parents to leave the unit without passing the cot areas.

Near patient testing room

11.16 Near patient testing is essential, located close to the intensive care cot areas. It is a standard requirement to be able to test blood gas tensions within the confines of the unit and a major advantage to be able to measure concentrations of electrolytes, sugar, lactate, bilirubin and coagulation. A room should therefore be available where blood gas analysis and other frequently required tests can be performed. See 'Near patient testing room' in WHBN 00-03:2013 Clinical and clinical support spaces.

Equipment store

11.17 A store is required for cots/incubators, ventilators, monitors, infusion stands, imaging and phototherapy equipment; its size will be dependent on whether used items of equipment will be cleaned and recycled within the unit or centrally in the hospital. The room should be equipped with extensive shelving. At least 20 electrical sockets are required for charging battery operated equipment.

Maintenance area

11.18 Facilities are required for cleaning, decontaminating and maintenance of incubators and other equipment. The location of such facilities will depend upon local hospital operational policies, but they may be provided in the sterile services department or within the neonatal unit. This WHBN assumes that facilities are provided within the neonatal unit, in which case they should be arranged so that there is a progression from 'dirty' to 'clean' areas for cleaned equipment before maintenance.

Transport incubator bay

11.19 An area should be provided in the unit to store all the equipment that needs to be readily available to staff involved in transferring babies out of the unit. This may be a separate space within the main store, but should be as close as possible to the unit entrance.

12

Chapter 12

Staff spaces

Skills lab

12.1 A skills lab can be invaluable for learning and practising simulated procedures; this will be a project option. The use of a generic seminar room is appropriate, as long as there is access to storage for a resuscitaire, incubator, ventilator, mannequin, and to several chairs for when the room is used for general seminar functions.

Staff on-call room(s)

12.2 Two doctors' on-call rooms should be provided within the neonatal unit or within very easy access of the unit, sufficiently distanced from busy corridors and extraneous noises to allow adequate rest opportunities. They should have a reclining chair, wash-basin, desk, chair and wardrobe; at least one room should have a single bed. They should have en suite WC/shower facilities. There should be a telephone in each room. Sound attenuation is desirable. Staff may also use the room during the day as a place to study.

Offices

12.3 Office accommodation (including photocopying facilities) should be provided according to local need, including an office to comply with Royal College (RCPCH) requirements. See 'Offices' in WHBN 00-03:2013 *Clinical and clinical support spaces.*

Chapter 13

Specific engineering considerations

Piped medical gases

13.1 Where nitric oxide is administered, the associated anaesthetising equipment should be provided with integral scavenging, discharging to a safe outside location. See HTM 02-01 Parts A & B:2006 *Medical gas pipeline systems.*

Ventilation

13.2 High dependency/intensive care areas will require a controlled environment using mechanical ventilation with comfort cooling to achieve appropriate ventilation and temperature control.

13.3 In high dependency/intensive care areas there are conflicting requirements, since staff require comfortable working conditions whereas babies need to be maintained at a higher temperature and humidity to mitigate body heat loss and dehydration. To overcome this, it is recommended that the ventilation system is designed to maintain a space temperature in the range 23–26°C, and that the required microclimate for each baby is achieved by the heating and humidification provided by the incubator. It is not always possible to keep the neonate within the incubator for procedures and therefore it is vital that the locations of any ventilation grilles are carefully considered in relation to the incubators.

13.4 Conventional incubators may not allow the required conditions to be maintained when access is required to the baby. It is therefore strongly recommended that consideration is given to the selection of incubators that are designed to 'ramp up' heating and humidification to maintain the required conditions when the incubator cover is removed.

13.5 The design of the ventilation and cooling system should ensure that stable temperatures are maintained and that air movement in the vicinity of the cots/ incubators is controlled. See HTM 03-01 Parts A & B:2007 *Specialised ventilation for healthcare premises.*

Fire detection and alarm systems

13.6 In cot areas, beacons should be used in place of alarm sounders to avoid unnecessary disturbance to babies. Departmental fire alarm repeater panels should be strategically located recognising the need to minimise disturbance to neonates. See the WHTM 05 *Firecode* series.

Resilience of electrical supplies

13.7 Certain life-supporting equipment, such as infusion pumps, should include battery back-up.

13

13.8 Where equipment is permanently installed or where there is the possibility of equipment theft, switched double pole 13-amp spur outlets should be used in preference to socket outlets. See WHTM 06-01 Parts A & B:2007 *Electrical services supply and distribution.*

Lighting systems

13.9 See paragraph 5.8.2 in the CIBSE Lighting Guide 02 (2008) *Hospitals and health care buildings* for recommended luminance levels for cot and incubator locations.

13.10 In cot areas the luminaires should be positioned to avoid glare onto the cots. Additional separately switched luminaires may be required over or near to the cots to provide the require levels of luminance for medical procedures.

13.11 In incubator areas, higher levels of luminance are required for the care and examination of babies. This should be achieved by a combination of low-glare general lighting and high-luminance luminaires integral to, or attached to, the associated medical equipment.

13.12 In this unit it is essential that clinical standard colour rendering is specified to ensure accurate determination of skin tone. To simplify supply and storage of replacement lamps and maintenance of the lighting systems, consideration should be given to the use of clinical standard colour rendering throughout the department.

13.13 It is important in neonatal facilities to achieve a relaxed, informal atmosphere in areas where lighting does not have a clinical function. This may be achieved by indirect sources including wall lighting and uplighting.

Entertainment systems

13.14 Entertainment facilities, such as television and radio/music systems, may be provided in parent rooms. See HTM 08-03:2011 *Bedhead services.*

Lifts

13.15 It is not practical to plan a neonatal unit on more than one level. Where this is the case, lifts must comply with the overall passenger and goods lift strategy for the building.

13

Hot, cold and drinking water services

13.16 Guidance on the design and installation of hot and cold water supply and distribution systems plus the requirements for the control of *legionellae* and other water borne pathogens is contained in the HTM 04-01 series *The control of Legionella, hygiene, "safe" hot water, cold water and drinking water systems.*

13.17 Prior to designing the hot and cold water services supplying neonatal care facilities, the project team should undertake a risk assessment of the susceptibility of patients, given the range of treatments provided. This risk assessment should be co-ordinated with the Water Safety Group.

13.18 This risk assessment should identify any special measures required in the physical infrastructure and operational policies necessary to minimise the risk of legionellae, *Pseudomonas Aeruginosa* and other water borne pathogens. A method statement should be produced from the risk assessment to clearly state how the new and – if applicable – the existing water systems will be installed and maintained respectively to ensure that water quality is not compromised during the works. Refer to the HTM 04-01series for further information.

13.19 The design of the pipework systems and associated equipment together with the specification of water outlets etc, should enable the maintenance of the water systems in accordance with WHTM and Health and Safety Executive requirements. The design should be agreed with the project team and Water Safety Group and it should be designed so that maintenance has a minimal adverse effect on patient care. The routing of pipework, location of valves and zoning of the systems must all be taken into consideration. Where water services supplying neonatal care facilities are connected to an existing hospital system, facilities should be provided for the safe connection and isolation of pipework systems. When selecting water outlets consideration should be given to their compatibility with point-of-use filtration should the need arise for filters to be fitted. Refer to the HTM 04-01 series for further information.

13.20 All hot and cold water pipework, valves and fittings should be fitted with a high standard of insulation – complete with an insulated support system where provided by the manufacturer – and vapour-sealed, to ensure protection against frost, surface condensation, heat loss and heat gain. In addition, hot and cold water pipework should be run separately where practicable. If this is not possible clear separation, both vertically and horizontally must be demonstrated. Separation will help to minimise heat gain further. Refer to the HTM 04-01 series for further information.

13.21 The domestic hot water supply should be taken from the general hospital calorifier installation at a minimum outflow temperature of 60°C and distributed to all outlets so that the return connections at their locations is not less than 55°C. The final return temperature at the calorifier should not be less than 50°C. See: the HTM 04-01 series on the control of *Legionella; L8, Legionnaires' disease: The control of legionella bacteria in water systems* (HSE 2013) and its associated technical guidance HSG 274 part 2 (HSE 2014) for more information.

14

Chapter 14

Cost information and schedules of accommodation

Introduction

14.1 For all types of health building, it is important that building costs and revenue expenditure are best value and consistent with acceptable standards. In applying this guidance, the need for economy should always be of prime concern. Where appropriate, space should be shared between similar activities taking place at different times. However, this solution should not be detrimental to the proper functioning of the spaces involved, nor to the needs of users.

14.2 The costing methodology for strategic outline case (SOC) and outline business case (OBC) stages in Wales remain based upon departmental cost allowances (DCA) updated by Welsh Health Estates Notification (WHEN) 10/14 *Measures to update 2002/2003 DCAG's for changes in specification (ie changes not covered by MIPS), to 8th July 2010*. Updating of departmental cost allowances guides (DCAGs) for inflation is by BCIS PUBSEC. The BCIS (previously BIS) PUBSEC indices are available from the BCIS (there is a subscription charge for this service). The indices, reporting level and location factor are advised quarterly by NHS Wales Shared Services Partnership – Specialist Estates Services (NWSSP-SES), to NHS Wales Trusts and health boards and their framework cost advisors. This quarterly advice is based upon the quarterly NHS Capital Planning Newsletter issued by the RICS to user group members (Health Service Index Focus Group).

14.3 The DCAGs for this WHBN reflect the total building, engineering and accommodation requirements for neonatal facilities located on an acute hospital site, where common services are shared. Costs are based on a typical two-storey new-build unit on a greenfield site with no planning constraints. The DCAG's most applicable relate to the, now superseded, HBN 21:1996 and are therefore indicative only. Contact NWSSP-SES for further guidance when applying to WHBN 09-03.

14.4 DCAGs are exclusive of VAT, building and planning fees and all local authority charges, and are based on a location factor of 1.00.

On-costs

14.5 An allowance for on-costs (such as communication space, external works, external engineering services and abnormals) should be added to the DCAGs.

14.6 Project teams should assess all likely on-cost implications of individual sites and schemes at the earliest opportunity.

Location factors

14.7 Location factor adjustments should be applied to works costs (that is, DCAGs plus established on-costs) to take account of local market conditions. It should be noted that the location factor to be used in Wales may vary from the PUBSEC location factor for NHS, for Wales. If so, the rationale will be explained in the monthly advice from NWSSP-SES to health boards, Trusts and framework cost advisors.

14

Schedules of Accommodation

14.8 The schedules of accommodation in **Appendix 1** include the following example units:

- Example 1: neonatal intensive care unit serving 5000 local births, but also including 11 intensive care/high dependency cots for transfers from a network of 19,500 births. It excludes neonatal surgery.
- Example 2: special care unit serving 2500 local births.

14.9 Costing by DCAG and on-costs may not be appropriate on works of alteration or refurbishment, or to works which are not adequately covered by WHBNs. The best process for costing should then be discussed with NWSS-SES. Providing sufficient information is available to the cost advisors, it is recommended that costs produced using DCAGs and on-costs are supported by separate elemental estimates and an analysis made of any cost difference prior to submission of costs for funding approval.

Dimensions and areas

14.10 The critical dimensions of an area are determined by the spatial requirements of any activities to be carried out within it. Space requirements for various generic activities appear in WHBN 00-02:2013 *Sanitary spaces*, WHBN 00-03:2013 *Clinical and clinical support spaces* and WHBN 00-04:2014 *Circulation and communication spaces.*

14.11 Planning teams should have data available at the earliest stages of a project to enable the approximate assessment of sizes involved. Areas used for the purpose of establishing cost allowances are listed in the schedules of accommodation. These areas do not represent recommended sizes and should not be regarded as specific individual entitlements.

14.12 The efficient planning of a building may necessitate a variation to the areas given. For example, in the refurbishment/conversion of older property:

- rooms tend to be larger than the areas given;
- some rooms may be too small or in the wrong location for efficient use;
- circulation space tends to form a larger than normal proportion of the total area.

Circulation spaces

14.13 All internal corridors, small vertical ducts, spaces occupied by partitions/walls and other space for circulation, are costed in the DCAGs. Provision is also made for 5 % planning zone and 3 % engineering zone adjacent to the external walls.

14

14.14 Circulation figures included in the DCAGs are those anticipated for new-build facilities. Where constraints are encountered, for example in refurbishment/conversion of older types of property, this figure may increase.

Communication spaces

14.15 Hospital 'streets', staircases and lifts (linking spaces) are not included in the DCAGs. Costs related to these elements, along with a suitable space allowance, should be made in the on-costs.

Land costs

14.16 DCAGs are exclusive of all land costs and associated fees. However, costs associated with land costs should be included in business case submissions, and may therefore have an important impact on the overall cost viability of a scheme.

Engineering services

14.17 Engineering services listed below are included in the cost allowances (see **Chapter 13** and Activity DataBase for further information). Primary engineering services are assumed to be conveniently available at the boundary of the department.

Mechanical services

14.18 The following mechanical services are included in DCAGs:

- heating – low pressure hot water system;
- ventilation – mechanical supply to, and extraction from, clinical areas, and other areas requiring mechanical ventilation such as WCs and showers (excludes ventilation plant, such as air handling units or extract fans);
- cold water – central supply to service points including drinking water (excludes storage tanks);
- hot water – supply from a central system (excludes storage and generation);
- piped medical gases – oxygen, nitrous oxide and medical air (400 kPa).

Electrical services

14.19 The following electrical services are included in DCAGs:

- departmental distribution boards;
- general lighting, as required by task;
- examination lighting (examination lamps);
- staff location system;
- emergency luminaires, as appropriate;
- socket-outlets and other power outlets for fixed and portable equipment;
- supplementary equipotential earth bonding;
- uninterruptible power supply (UPS) and equipment;
- fire, security, and controlled drug cupboard alarm systems;
- TV/radio wireways;
- telephone internal cabling distribution and outlets (exclude handsets);
- data wireways;
- building management system.

Equipment (Group 1)

14.20 The following Group 1 equipment is included in DCAGs:

- Controlled drugs cupboards;
- Dishwasher;
- Impulse clocks.

A1

Appendix 1

Example schedules of accommodation

Example 1: Neonatal intensive care unit – serving 5,000 local births, but also including 11 intensive care/ high dependency cots for transfers from a network of 19,500 births. Excluding neonatal surgery.					
ADB code	Room name/function	Unit area allowance (sqm)	Quantity	Net internal area (sqm)	Notes
	Public spaces				
	Entrance, reception and visitors' facilities				
	Entrance				Small foyer space. Could be shared with other service, eg maternity. Area assumed to be included within communication allowance.
V0671	Visitors' locker station	8.0	1	8.0	Scrub sink or alcohol gel, parent lockers, coat hanging rack. Would form part of entrance area. 1 sqm per 6 cots, rounded up. Minimum 3.
	Reception (size based on number of places)	5.5	1	5.5	Single place allowance assumption as either stand-alone space or addition to staff communication base.
J1255-01	Waiting area (size based on number of places)	2.25	10	22.5	Includes children's play area and 10% wheelchair places. Nominal allowance for 10-person waiting area.
V1131	Nappy changing room	5.0	1	5.0	Primarily used for siblings.
	Infant feeding room	6.0	1	6.0	
M0724	Parents' quiet room / interview room	8.0	2	16.0	2 per 24 cots. Minimum 1.
V0922	WC: independent wheelchair	4.5	2	9.0	Allowance for separate male and female provision and distributed locations for discrete use.
V1121	WC: semi-ambulant	2.5	2	5.0	Allowance for separate male and female provision and distributed locations for discrete use.

A1

	Clinical spaces				
	Cot spaces				
	Staff communication base allowance (size based on number of places)	5.5	7	38.5	Allowance of 1 place per 3 cots included within ITU/HDU cot area plus 1 place for ward clerk. Minimum 2 place. May be dispersed among the multi-cot bay areas subject to local design/organisation.
	Office/clinical work area: 3-person	12.0	2	24.0	Assumption 1 room per 20 cots approx. Minimum 1. May be located behind staff communication base.
	Single cot nursery: neonatal	20.0	3	60.0	Minimum 1 for cohort nursing and other functions. May be used for intensive or high dependency care. Assume 3/4 of cot requirement in SCU transferred to LNU or NICU.
	Multi-cot nursery: neonatal intensive care (size based on number of cots)	20.0	10	200.0	
	Multi-cot nursery: neonatal high dependency care (size based on number of cots)	20.0	6	120.0	
	Multi-cot nursery: neonatal special care (size based on number of cots)	11.5	24	276.0	
	Neonatal treatment room	20.0	1	20.0	1 for every 24 or more cots. Facility for laser and more complex treatments.
	Neonatal transfer space	20.0	1	20.0	Normally expected to be provided in NICU for preparing a baby for transfer out and/or for receiving and stabilising a baby when the transfer team arrives. May use ITU cot space instead.

A1

ADB code	Room name/function	Unit area allowance (sqm)	Quantity	Net internal area (sqm)	Notes
	Parent support				
D0434-02	Rest room with mini kitchen (size based on number of seats)	1.8	15	27.0	Allowance 1/3 place per cot. Minimum 7 place. Lounge with beverage bay incorporated. Can be used by relatives staying overnight.
	Laundry room	10.0	1	10.0	For washing children's clothing.
	Relatives' overnight stay				May also be used for rooming in if oxygen and medical gases are included.
D1311	Overnight stay: single	13.0	1	13.0	1 relatives' overnight stay room per ITU cot space is required within 10 minutes' walk of the unit; 2 must be within or adjacent to the unit itself, and the remaining rooms can be located elsewhere provided they are within 10 minutes' walk of the unit.
V1323	Shower room: semi-ambulant: standing use	5.0	1	5.0	
D1312	Overnight stay: double	17.0	1	17.0	
V1631	Shower room: independent wheelchair	5.0	1	5.0	
Y1510	Cleaners' room	8.0	1	8.0	May not be required if all relatives' rooms are within or adjacent to the main department.
W1585-01	Storage: linen	3.0	1	3.0	
	Storage: equipment and consumables	8.0	1	8.0	

A1

	Bereavement suite				
	Bereavement interview room	8.0	1	8.0	These rooms should be located away from any relatives' overnight stay; they could be co-located with the birthing suite of the maternity unit, but separate access points would need to be provided.
	Bereavement viewing room	12.0	1	12.0	
	Clinical support				
	Room for expressing milk	6.0	2	12.0	2 required for a large unit.
	Kitchen: milk feeds preparation	12.0	1	12.0	Large units (with 36 cots plus) will require separate refrigerated store.
	Refrigerated supplies store	8.0	1	8.0	For refrigerated and frozen milk/feeds.
L1308	Near patient testing room	8.0	1	8.0	
T0535	Clean utility room	16.0	1	16.0	
Y0431	Dirty utility room	8.0	2	16.0	
Y0646	Disposal hold: 3000 litres	12.0	1	12.0	Separate dirty linen store has not been included. If local policy requires dirty linen disposal it is assumed that it could be dealt with in this area.
W1584-04	Storage: clinical equipment	1.0	40	40.0	Allowance of 1 sqm per cot based on project evaluations. Bulky equipment eg ventilators, incubators etc. Assumed to include 1 spare cot for every 4 cots. Actual requirements subject to local policy.
	Storage: ready to use medical gas cylinders	4.0	1	4.0	
	Storage: linen	6.0	1	6.0	Local policy permitting.
	Equipment servicing/ decontamination suite	40.0	1	40.0	Allowance included in a large unit for receiving, cleaning and repairing incubators. Local policy may vary.

A1

ADB code	Room name/function	Unit area allowance (sqm)	Quantity	Net internal area (sqm)	Notes
	Parking bay for large equipment	4.0	4	16.0	1 per 12 cots. Minimum 2. Includes mobile X-ray and transport incubator.
G0180-01	Parking bay for resuscitation equipment	2.0	1	2.0	
Y1510	Cleaners' room	8.0	1	8.0	1 per unit (excluding cleaners' room for relatives' overnight stay).
	Staff spaces				
	Staff support				
	Changing area: staff (size based on number of lockers)	1.4	60	84.0	1 locker per cot for ITU, 0.5 per cot HDU and 0.25 per cot SC, plus between 2 and 5 to allow for all staff. Multiply by 2 to allow for shift changeover. Multiply by 1.1 to allow for variation in male/female split. Includes uniform exchange, showers and a number of individual changing rooms.
	Shower room: ambulant	2.5	2	5.0	Additional shower rooms to allow for male and female segregation.
	Changing room: semi-ambulant	2.0	4	8.0	Additional individual changing rooms to allow for male and female segregation.
V1010	WC: ambulant	2.0	2	4.0	1 WC per 25 staff including wheelchair accessible. Minimum 2 scheduled to allow for separate male and female provision.
	Admin area: shared use	6.6	10	66.0	2 desk spaces for every 1000 births.
H1304-02	Seminar room: 15 places (incl. 1 wheelchair place)	25.0	1	25.0	Also used as a skills lab.
W1585-02	Storage: general	8.0	1	8.0	En suite to seminar room for flexibility in use of room.

A1

D0434-03	Rest room with mini kitchen (size based on number of seats)	1.8	20	36.0	Overall staff requirements will vary by cot allocation and quantity of other staff. Total staff numbers have been estimated at twice the number of staff directly required for the number and type of cots.
M0251	Office: 1-person	8.0	2	16.0	Attending consultant and ward manager within unit only.
	On-call accommodation				
D1311	On-call overnight stay room	13.0	1	13.0	
V1323	Shower room: semi-ambulant: standing use	5.0	1	5.0	
	Net Total Planning – 5% Sub-Total Engineering zone -3% Circulation - 22% Gross Total DEPARTMENTAL TOTAL			**1421.5** 71.1 1492.6 44.8 328.4 **1865.8** **1866.0**	
	Optional accommodation				
	Play area: outside				Area subject to local decision
P0808	Vending machine	3.0	1	3.0	
J1414	Children's play area	4.5	1	4.5	
	Information/resource centre: 3 person	12.0	1	12.0	Shared facility that could be co-located with maternity.
	Examination room	12.0	1	12.0	May be located near the entrance for outpatient examination.

A1

ADB code	Room name/function	Unit area allowance (sqm)	Quantity	Net internal area (sqm)	Notes
	Parking bay	2.0	1	2.0	
H1304-02	Skills lab	25.0	1	25.0	For flexibility this is assumed to be a generic seminar room.
W1585-02	Storage: general	8.0	1	8.0	En suite to skills lab, for flexibility in use of room.
M0251	Office: 1-person	8.0	1	8.0	Option provision to replace area allowance for open plan office space, but not generally recommended.
M0252	Office: 2-person	12.0	1	12.0	Optional provision to replace area allowance for open plan office space, but not generally recommended.
M0254	Office: 4-person	24.0	1	24.0	Optional provision to replace area allowance for open plan office space, but not generally recommended.
	Net Total Planning – 5 % Sub-Total Engineering zone -3 % Circulation - 22 % Gross Total **DEPARTMENTAL TOTAL**			**110.5** 5.5 116.0 3.5 25.5 **145.0** **145.0**	

A1

Relationship of schedule to ADB room names The ADB room codes listed may not carry a title, in ADB, identical to the room function in the schedules. Use of the appropriate ADB room code will, however, result in the correct room being accessed.
Relationship of schedule to ADB for scalable rooms (ie those for which a recommended room size does not exist) ADB room code relates to one example size of this space and does not reflect space requirements of these schedules. Projects will scale up/down according to schedule
Rounding of scalable rooms The number of waiting spaces and lockers (in the communal changing areas) has been rounded to the nearest multiple of 5. The number of seats in the staff rest rooms has been rounded to the nearest multiple of 10. The number of workstations in the open plan offices has been rounded to the nearest even number.
Optional accommodation Accommodation that is not expected in all departments, but, dependent on local policy, may be needed in addition to or instead of rooms listed in the schedule.

A1

Example 2: Special care unit – serving 2,500 local births					
ADB code	Room name/function	Unit area allowance (sqm)	Quantity	Net internal area (sqm)	Notes
	Public spaces				
	Entrance, reception and visitors' facilities				
	Entrance				Small foyer space. Could be shared with other service, eg maternity. Area assumed to be included within communication allowance.
V0671	Visitors' locker station	3.0	1	3.0	1 sqm per 6 cots, rounded up. Minimum 3. Scrub sink or alcohol gel, parent lockers, coat hanging rack. Would form part of entrance area.
	Reception (size based on number of places)	5.5	1	5.5	Single place allowance; assumed to be either stand-alone space or addition to staff communication base.
J1255-01	Waiting area (size based on number of places)	2.25	10	22.5	Includes children's play area and 10% wheelchair places. Nominal allowance for 10-person waiting area.
V1131	Nappy changing room	5.0	1	5.0	Primarily used for siblings.
	Infant feeding room	6.0	1	6.0	
M0724	Parents' quiet room/ interview room	8.0	1	8.0	2 per 24 cots. Minimum 1.
V0922	WC: independent wheelchair	4.5	2	9.0	Allowance for separate male and female provision and distributed locations for discrete use.
V1121	WC: semi-ambulant	2.5	2	5.0	Allowance for separate male and female provision and distributed locations for discrete use.

A1

	Clinical spaces				
	Cot Spaces				
	Staff communication base allowance (size based on number of places)	5.5	2	11.0	Allowance of 1 place per 3 cots included within ITU/HDU cot area plus 1 place for ward clerk. Minimum 2 place. In small units may also be combined with reception. May be dispersed amongst the multi-cot bay areas subject to local design/organisation.
	Office/clinical work area: 3-person	12.0	1	12.0	Assumption 1 room per 20 cots approx. Minimum 1. May be located behind staff communication base.
	Single cot nursery: neonatal	20.0	1	20.0	Minimum 1 for cohort nursing and other functions. May be used for intensive or high dependency care but assumed to be used for special care resuscitation in SCU/small unit. Assume 3/4 of cot requirement in SCU transferred to LNU or NICU.
	Multi-cot nursery: neonatal special care (size based on number of cots)	11.5	11	126.5	
	Treatment room	16.0	1	16.0	Facility used for ultrasound etc in LNU and SCUs. Includes resuscitation equipment.
	Parent support				
D0434-02	Rest room with mini kitchen (size based on number of seats)	1.8	10	18.0	Allowance 1/3 place per cot. Minimum 7 place. Can be used by relatives staying overnight.
	Laundry room	10.0	1	10.0	For washing children's clothing.
	Relatives' overnight stay				
D1311	Overnight stay: single	13.0	1	13.0	
V1323	Shower room: semi-ambulant: standing use	5.0	1	5.0	

A1

ADB code	Room name/function	Unit area allowance (sqm)	Quantity	Net internal area (sqm)	Notes
Y1510	Cleaners' room	8.0	1	8.0	May not be required if all relatives' rooms are within or adjacent to the main department.
W1585-01	Storage: linen	3.0	1	3.0	
	Storage: equipment and consumables	4.0	1	4.0	
	Bereavement suite				
	Bereavement interview room	8.0	1	8.0	These rooms should be located away from any relatives' overnight stay; they could be co-located with the birthing suite of the maternity unit, but separate access points would need to be provided.
	Bereavement viewing room	12.0	1	12.0	
	Clinical support				
	Room for expressing milk	6.0	1	6.0	1 required for small unit.
	Kitchen: milk feeds preparation	12.0	1	12.0	Large units (with 36 cots plus) only would require separate refrigerated store.
L1308	Near patient testing room	8.0	1	8.0	
T0535	Clean utility room	16.0	1	16.0	
Y0431	Dirty utility room	8.0	1	8.0	
Y0646	Disposal hold: 3000 litres	12.0	1	12.0	Separate dirty linen store has not been included. If local policy requires dirty linen disposal it is assumed that it could be dealt with in this area.

A1

W1585-01	Storage: clinical equipment	1.0	12	12.0	Allowance of 1 sqm per cot based on project evaluations. Bulky equipment eg ventilators, incubators etc. Assumed to include 1 spare cot for every 4 cots. Actual requirements subject to local policy.
	Storage: ready to use medical gas cylinders	4.0	1	4.0	
W1594	Storage: linen	3.0	1	3.0	Local policy permitting.
	Parking bay for large equipment	4.0	2	8.0	1 per 12 cots. Minimum 2. Includes mobile X-ray and transport incubator.
Y1510	Cleaners' room	8.0	1	8.0	1 per unit (excluding cleaners' room for relatives' overnight stay).
	Staff spaces				
	Staff support				
	Changing area: staff (size based on number of lockers)	1.4	15	21.0	1 locker per cot for ITU, 0.5 per cot HDU and 0.25 per cot SC, plus between 2 and 5 to allow for all staff. Multiply by 2 to allow for shift changeover. Multiply by 1.1 to allow for variation in male/female split. Includes uniform exchange, showers and a number of individual changing rooms.
	Shower room: ambulant	2.5	1	2.5	Additional shower rooms to allow for male and female segregation.
	Changing room: semi-ambulant	2.0	1	2.0	Additional individual changing rooms to allow for male and female segregation.
V1010	WC: ambulant	2.0	2	4.0	1 WC per 25 staff including wheelchair accessible. Minimum 2 scheduled to allow for separate male and female provision.
	Admin area: shared use	6.6	5	33.0	2 desk spaces for every 1000 births.
	Seminar room: 2 places (incl. 1 wheelchair place)	10.0	1	10.0	To be sized up and shared with other department(s).
W1585-02	Storage: general	8.0	0.1	0.8	En suite to seminar room, for flexibility in use of room. Part-time access required in small unit.

A1

ADB code	Room name/function	Unit area allowance (sqm)	Quantity	Net internal area (sqm)	Notes
D0434-03	Rest room with mini kitchen (size based on number of seats)	1.8	10	18.0	Provision for 50% of staff on duty at any one time, with a minimum of 6. Overall staff requirements will vary by cot allocation and quantity of other staff. Total staff numbers have been estimated at twice the number of staff directly required for the number and type of cots.
M0251	Office: 1-person	8.0	1	8.0	Attending consultant and ward manager within unit only.
	Net Total Planning – 5% Sub-Total Engineering zone -3% Circulation - 22% Gross Total **DEPARTMENTAL TOTAL**			**526.8** 26.3 553.1 16.6 121.7 **691.4** **691.0**	
	Optional accommodation				
	Play area: outside				Area subject to local decision.
P0808	Vending machine	3.0	1	3.0	
J1414	Children's play area	4.5	1	4.5	
	Information/resource centre: 3 persons	12.0	1	12.0	Shared facility that could be co-located with maternity.
	Examination room	12.0	1	12.0	May be located near the entrance for outpatient examination.
	Parking bay	2.0	1	2.0	

A1

H1304-02	Skills lab	28.0	1	28.0	For flexibility this is assumed to be a generic seminar room.
D1311	On-call overnight stay room	13.0	1	13.0	
V1323	Shower room: semi-ambulant: standing use	5.0	1	5.0	
W1585-02	Storage: general	8.0	1	8.0	En suite to skills lab, for flexibility in use of room.
M0251	Office: 1-person	8.0	1	8.0	Option provision to replace area allowance for open plan office space, but not generally recommended.
M0252	Office: 2-person	12.0	1	12.0	Option provision to replace area allowance for open plan office space, but not generally recommended.
M0254	Office: 4-person	24.0	1	24.0	Option provision to replace area allowance for open plan office space, but not generally recommended.
	Net Total Planning – 5% Sub-Total Engineering zone -3% Circulation - 22% Gross Total **DEPARTMENTAL TOTAL**			**131.5** 6.6 138.1 4.1 30.4 **172.6** **173.0**	

A1

Relationship of schedule to ADB room names The ADB room codes listed may not carry a title, in ADB, identical to the room function in the schedules. Use of the appropriate ADB room code will, however, result in the correct room being accessed.
Relationship of schedule to ADB for scalable rooms (ie those for which a recommended room size does not exist) ADB room code relates to one example size of this space and does not reflect space requirements of these schedules. Projects will scale up/down according to schedule.
Rounding of scalable rooms The number of waiting spaces and lockers (in the communal changing areas) has been rounded to the nearest multiple of 5. The number of seats in the staff rest rooms has been rounded to the nearest multiple of 10. The number of workstations in the open plan offices has been rounded to the nearest even number.
Optional accommodation Accommodation which is not expected in all departments, but, dependent on local policy, may be needed in addition to or instead of rooms listed in the schedule.

R

References

British Standards Institution

The latest version of any standard should be used, provided that it continues to address the relevant requirements of these recommendations. **http://shop.bsigroup.com/en/**

BS EN 1176-3:2008 *Playground equipment and surfacing. Additional specific safety requirements and test methods for slides*

BS EN 1176-4:2008 *Playground equipment and surfacing. Additional specific safety requirements and test methods for cableways*

BS EN 1177:2008 *Impact attenuating playground surfacing. Determination of critical fall height*

BS EN ISO 11197:2009 *Medical supply units*

NHS Wales Shared Services Partnership - Specialist Estates Services

Health Technical Memoranda (HTMs) and Health Building Notes (HBNs) issued by the Department of Health in England are being superseded by specific Welsh editions which will be titled Welsh Health Technical Memoranda (WHTMs) and Welsh Health Building Notes (WHBNs) and which will use the same numerical coding. The guidelines referenced below were the most recent at time of publication; however, the latest version should always be used, provided that it continues to address the relevant requirements of these recommendations. All are available from the NHS Wales Shared Services Partnership – Specialist Estates Services websites:

Intranet: http://howis.wales.nhs.uk/sites3/page.cfm?orgid=254&pid=39106
Internet: http://www.wales.nhs.uk/sites3/page.cfm?orgid=254&pid=6142

Welsh Health Building Notes (HBN & WHBN)

HBN 21:1996 *Maternity department*

WHBN 09-02:2013 *Maternity facilities*

WHBN 00-02:2013 *Sanitary spaces*

WHBN 00-03:2013 *Clinical and clinical support spaces*

WHBN 00-04:2014 *Circulation and communication spaces.*

R

Welsh Health Estates Notification (WHEN)

WHEN 10/14 *Measures to update 2002/2003 DCAG's for changes in specification (ie changes not covered by MIPS), to 8th July 2010*

Welsh Health Technical Memorandum (HTM)

HTM 02-01Parts A & B:2006 *Medical gas pipeline systems*

HTM 03-01Parts A & B:2007 *Specialised ventilation for healthcare premises* (Please note: at the time of press, a new WHTM is in production, please check the link above to the publications page of Specialist Estates Services website for latest guidance)

HTM 04-01 Parts A & B:2006 *The control of Legionella, hygiene, "safe" hot water, cold water and drinking water systems*

HTM 06-01Parts A & B: 2007 *Electrical services supply and distribution*

HTM 08-03:2011 *Bedhead services*

Other publications

BAPM (2010). *Service standards for hospitals providing neonatal care. 3rd ed*
www.bapm.org/publications/documents/guidelines/BAPM_Standards_Final_Aug2010.pdf

Chartered Institution of Building Services Engineers (2008). Lighting guide 2: *Hospitals and healthcare buildings* (SLL LG2). London:CIBSE

DH (2009). *Toolkit for high quality neonatal services.* [Archived]
http://webarchive.nationalarchives.gov.uk/20130107105354/http:/www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_107845

Graven SN, Bowen Jr FW, Brooten D et al (1992). The high-risk infant environment. Part 1. The role of the neonatal intensive care unit in the outcome of high-risk infants. *Journal of Perinatology* 12(2):164–172.

Graven SN (1997). Clinical research data illuminating the relationship between the physical environment and patient medical outcomes. *Journal of Healthcare Design* 9:15-29.

Graven SN, Browne JV (2008). Sensory development in the fetus, neonate, and infant: introduction and overview. *Newborn and Infant Nursing Reviews 8*(4):169-72.

R

HSE (2013). L8 (4th ed) *Legionnaires' disease: The control of legionella bacteria in water systems. Approved code of practice and guidance on regulations.* London: Health and Safety Executive. **http://www.hse.gov.uk/pubns/priced/l8.pdf**

HSE (2014). HSG 274 Part 2. *Legionnaires' disease. Part 2: The control of legionella bacteria in hot and cold water systems.* London: Health and Safety Executive. **http://www.hse.gov.uk/pUbns/priced/hsg274part2.pdf**

Hignett S, Lu J, Fray M (2010). Two case studies using mock-ups for planning adult and neonatal intensive care facilities. *Journal of Healthcare Engineering* 1(3):399-414. **http://multi-science.atypon.com/doi/pdf/10.1260/2040-2295.1.3.399**

Laing I, Ducker T, Leaf A et al (2004). *Designing a neonatal unit. Report for the British Association of Perinatal Medicine*. London:BAPM. **www.bapm.org/publications/documents/guidelines/DesigningNNU_May2004b.pdf**

NHS Wales (2013). *All Wales Neonatal Standards, 2nd ed*. **http://www.wales.nhs.uk/sitesplus/documents/862All%20Wales%20Neonatal%20Standards%202nd%20Edition%20v2%2005%2008%2013.pdf**

NICE (2010). *Donor milk banks: service operation*, CG93. **http://guidance.nice.org.uk/CG93**

RCOG, RCM, RCA *et al (2007). Safer childbirth: Minimum standards for the organisation and delivery of care in labour* **www.rcoa.ac.uk/document-store/safer-childbirth-minimum-standards-the-organisation-and-delivery-of-care-labour**