

Local Guideline



John Hunter
Children's Hospital
CHILDREN, YOUNG PEOPLE AND FAMILIES



Health
Hunter New England
Local Health District

Intraosseous Needling in NICU

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| Sites where Local Guideline applies | Neonatal Intensive Care Unit. JHCH |
| Target audience: | NICU clinical staff, which provide care to neonatal patients. |
| Description | Guideline for procedure and equipment requirements for intraosseous needling of an infant in NICU when no other vascular access available |
| This Local Guideline applies to: | |
| 1. Adults | No |
| 2. Children up to 16 years | No |
| 3. Neonates – less than 29 days | Yes Approval gained from the Children Young People and Families Network on 26/03/2014 |
| Keywords | EZ-IO, hypo-perfusion, infusion, intraosseous, resuscitation |
| Replaces Existing Local Guideline and Procedure | Yes |
| Registration Number(s) and/or name and of Superseded Documents | 5-5.6.7 Intraosseous Needling, infusion and care |
| Related Legislation, Australian Standards, NSW Health Policy Directive, NSQHS Standard/EQuIP Criterion and/or other, HNE Health Documents, Professional Guidelines, Codes of Practice or Ethics: | |
| <ul style="list-style-type: none"> Australian Resuscitation Council Policy Statement 13.7 December 2010 http://www.resus.org.au/policy/guidelines/section_13/13_7.htm Hunter New England Health Clinical Guideline HNEH CG 10_11 Intraosseous needle Insertion in Children Hunter New England Health (2006) Kaleidoscope Paediatric Trauma Resource Manual http://www.kaleidoscope.org.au/docs/Man_PaedTrauma.pdf JHCH (2013)-Aseptic Technique in NICU JHCH_NICU_03.01 http://intranet.hne.health.nsw.gov.au/ NETS Victoria Neonatal Handbook, Intraosseous Needle Insertion. Uploaded Oct. 2013 http://www.netsvic.org.au/nets/handbook/index.cfm?doc_id=455 | |
| Prerequisites (if required) | |
| Local Guideline Note | This document reflects what is currently regarded as safe and appropriate practice. The guideline section does not replace the need for the application of clinical judgment in respect to each individual patient but the procedure/s require mandatory compliance . If staff believe that the procedure/s should not apply in a particular clinical situation they must seek advice from their unit manager/delegate and document the variance in the patients health record. |
| Position responsible for the Local Guideline and authorised by | Dr Paul Craven, Acting Director of Newborn Services, NICU. JHCH |
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| Date authorised | 26/03/ 2014 |
| This Local Guideline contains advice on therapeutics | Yes <i>Approved QUM 13/03/2014</i> |
| Date of Issue | 14/03/2014 |

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| Review due date | 14/03/2018 |
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RISK STATEMENT

This local guideline has been developed to provide guidance to clinical staff in NICU when intraosseous needling required and ensures that the risks of harm to infants and staff during the procedure are identified and managed.

Any unplanned event resulting in, or with the potential for injury, damage or other loss to infants/staff/family as a result of this procedure must be reported through the Incident Information management System and managed in accordance with the Ministry of Health Policy Directive: Incident management PD2007_061. This would include unintended injury that results in disability, death or prolonged hospital stay.

RISK CATEGORY: *Clinical Care & Patient Safety*

OUTCOMES

| | |
|---|---|
| 1 | Clinicians are aware of the indications for intraosseous needling |
| 2 | Provision of timely intraosseous needling as clinically indicated |
| 3 | Risk of injury/ morbidity to infants minimised |

ABBREVIATIONS & GLOSSARY

| Abbreviation/Word | Definition |
|-------------------|-------------------------------|
| EZ-IO | Intraosseous gun |
| FBC | Full blood count |
| HAPS | Hunter Area Pathology Service |
| IV | Intravenous |
| NICU | Neonatal Intensive Care |
| UVC | Umbilical Venous Catheter |

GUIDELINE

This Guideline does not replace the need for the application of clinical judgment in respect to each individual patient.

RATIONALE

Although not a common procedure in NICU intraosseous needling provides an alternative route for rapid vascular access in neonatal patients during resuscitation if peripheral or central venous access cannot be obtained, or until IV or UVC access is successful.

The medullary cavity does not collapse in the presence of hypovolaemia or circulatory failure and is in continuity with the venous circulation. It can therefore be used to infuse fluids and drugs, and collect blood samples if necessary (GOSH, 2013). It has been shown that the onset of action and drug levels during cardiopulmonary resuscitation using the intraosseous route are similar to those given intravenously (ARC2010, Ellemunter et.al, 99&VonHoff et.al, 2008).

INDICATIONS

1. Where vascular access is urgently required for resuscitation and has been unable to be achieved with IV or UVC access (ARC 2010)
2. Where there is significant hypotension, hypo-perfusion, hypoglycemia and there is a need to be corrected and attempts to obtain IV or UVC insertion have been unsuccessful (HNEH 2010_11)

KEY POINTS

1. Intraosseous needling can be used for neonates however not as common due to the fragility of small bones and the smaller intraosseous space, particularly in preterm infants (ARC,2010)
2. The insertion of intraosseous needles should only be performed by a Medical Officer. Clinicians involved in neonatal resuscitation should be aware of where to locate intraosseous equipment in NICU and how to set up according to this guideline (ARC, 2010).
3. It is considered a sterile aseptic procedure
4. Intraosseous insertion and infusions should be considered a temporary emergency access measure only and should not be used for longer than 24 hours
5. Removal of the intraosseous needle should be done as soon as the patient has been resuscitated and alternative intravenous assess has been established
6. It is possible to achieve high flow rates if using a syringe to infuse fluid
7. Drugs and fluid administered via an intraosseous needle are distributed as fast and attain similar plasma concentrations as those administered intravenously.
8. Bone marrow aspirate can be obtained before infusion for analysis of blood biochemistry as well as blood film for microscopy if sepsis suspected.
HAPS do not accept blood drawn from bone marrow for a full blood count (FBC) due to the risk of blocking machines. It is important for NICU medical staff to

communicate with registrar in lab if samples to be collected. **NB.** In the case of CARDIAC arrest do not waste time collecting bone marrow.

NEONATAL CONTRAINDICATIONS

1. Prior unsuccessful attempt in the same bone
2. Fracture of the bone used as an access site
3. Osteogenesis imperfecta
4. Osteomyelitis
5. Osteopetrosis
6. Infected skin lesions at proposed insertion site
7. Haemophilia or other known coagulopathies

COMPLICATIONS (Ellemunter et.al, 2007)

Though complications are low they can be significant if they occur.

1. Extravasation of fluid, drugs or air into skin or periosteum
2. Sub-periosteal infusion may occur when the needle fails to enter the bone marrow
3. Through and through puncture may occur if the needle is advanced too far
4. Blockage of the needle may occur if no inner stylet is used
5. Infection – cellulitis, abscess formation, skin necrosis or osteomyelitis
6. Tibial fracture
7. Fat and bone marrow micro emboli
8. Compartment syndrome – due to prolonged infusion

WHAT CAN AN INTRAOSSEOUS LINE BE USED FOR?

Any intravenous drug or routine resuscitation fluid can be administered safely by the intraosseous route:

- a) All drug doses and fluid rates are the same as for conventional intravenous routes
- b) All blood products can be given (GOSH 2013)
- c) Limited specimen collection-see point 9 on page 5

SELECTION OF NEEDLE

The EZ-IO “gun” has an 18G needle and is suitable for newborn infants up to 6 months (kept in the bottom draw of resuscitation trolley in NICU). If there is no designated intraosseous needle available an 18g spinal/bone marrow needle can be used as a substitute in the case of an emergency.



PREPARATION OF EQUIPMENT

1. Skin cleaning solution for gestational age
2. Intraosseous needle
3. Sterile gloves
4. 5ml and 20 ml syringe
5. Extension tubing and/or IV giving set - primed
6. 3-way tap
7. Large green drape
8. Dressing pack
9. Drugs and fluid to be infused
10. 5ml sterile normal saline 0.9%
11. Equipment for blood sample if required
12. Adhesive tape
13. Armboard/limb board
14. Medication and fluid chart

WHERE TO PLACE AN INTRAOSSEOUS NEEDLE?

The anatomical landmarks for insertion of the intraosseous cannula in a neonate are:

1. tibia – 2-3cm below the tibial tuberosity
2. femur – 3cm above the lateral condyle

These two sites specifically avoid the epiphyseal (growth) plates of the bone and the joint spaces, though many others may be chosen in particular circumstances

Fig. 3: The intermedullary sinusoids

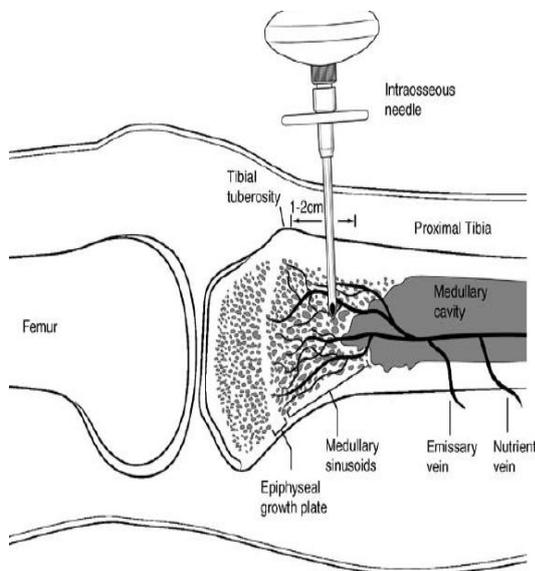


Fig 3. Lateral view of leg showing the angle of the intraosseous needle when using the placement shown in Fig. 3 It is important that if using the tibia you should avoid the growth plates of the bone and the joint spaces (HNEH CPG 10_11)



Fig. 4 The flat medial surface of the proximal shaft (tibial plateau 1-3cm below the tibial tuberosity). NB. a small rolled towel can be placed under the leg to help with stabilisations (HNEH CPG 10_11)



Fig 5. Femur site (www.emedicine.medscape.com)

PROCEDURE FOR NEEDLING (NOT BATTERY POWERED EZIO INSERTION 'GUNS')
(GOSH 2013)

1. Use universal precautions
2. If infant not moribund consider pain relief for procedure (refer to Management of Pain in the Newborn CPG)
3. Check expiry date and open intraosseous needle package
4. Remove device and check to ensure:
5. integrity – no cracks or bends in hub or cannula
6. Trocar can be unscrewed and easily withdrawn from cannula. Replace trocar by screwing into cannula and ensure it protrudes past the end of the cannula ready for insertion
7. Draw up 10ml sodium chloride 0.9% for injection in syringe and prime the 3-way tap with extension tubing. Turn the 3-way tap to the 'off' position
8. Clean the skin as per Aseptic Technique CPG
9. Immobilise the limb with the non-dominant hand to secure the limb and facilitate safe placement of needle
10. **DO NOT PLACE HAND DIRECTLY UNDER INSERTION SITE OF THE LIMB** in case needle is inserted totally through limb. If this occurs, remove and re-insert in opposite limb.

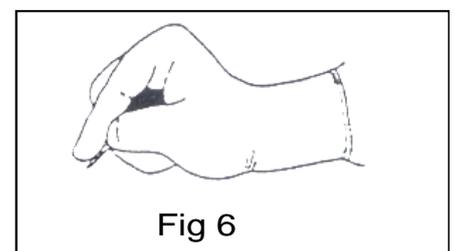


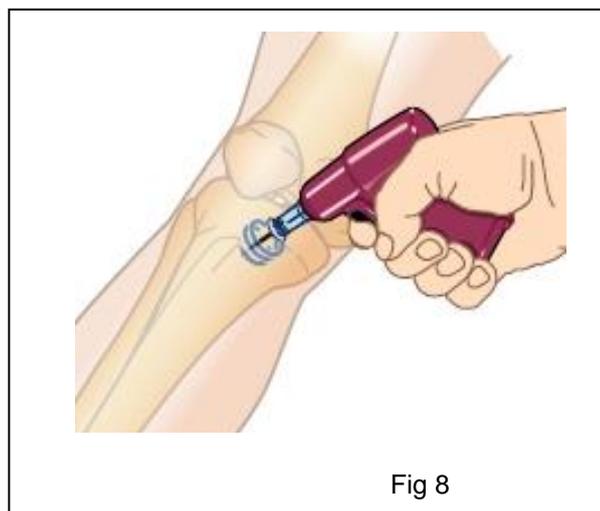
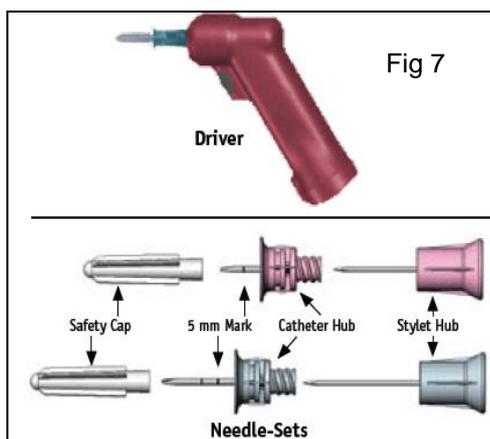
Fig 6

11. Hold intraosseous needle as shown (fig 6)
12. Puncture the skin 10mm distal (1 finger width) below the tibial tuberosity with the intraosseous needle at an angle of 60-90 degrees aimed slightly toward the foot.
13. A twisting/screwing motion of the needle tip provides the cutting mechanism that allows passage through the bone cortex. Only moderate pressure should be used and the needle tip must not be 'wobbled' as this will produce too large an insertion hole that will make the intraosseous needle unusable.
14. Continue the twisting motion even if there is no apparent forward motion of the needle until a sudden 'give' is felt (the intraosseous needle should now be through the cortex of the bone and into the marrow cavity). The needle should now stand firmly in the bone much like a nail stands in a piece of wood. This may not be the case in a neonate due to thin cortex **DO NOT ADVANCE ANY FURTHER**
15. Remove trocar and confirm correct position by aspirating blood – there is a risk that the needle may become blocked with marrow. Gently syringe in 10ml of saline and check the limb for swelling and observe that there is no increase in resistance. If this occurs remove the needle and try the other limb. **NEVER USE THE SAME LIMB TWICE.**
16. **CAUTION** – trocar should be disposed of immediately to ensure no needle stick injury occurs
17. Flush needle and connect extension tubing, 3-way tap and giving set
18. Secure the extension set further down or up the limb

PROCEDURE FOR USING EZ-IO "GUN" (EZ-IO 2006)

Follow procedure as above to point 8

1. Ensure that the driver and needle set are securely seated (Fig 7)
2. Remove and discard the needle safety cap from the intraosseous needle set install on the power driver
3. DO NOT touch needle
4. Position driver at insertion site with needle set at a 90 degree angle to the bone and GENTLY power or press needle set until needle set tip touches the bone.
5. Ensure at least 5mm of the catheter is visible



6. Penetrate bone cortex by squeezing the driver's trigger and applying **gentle, steady downward pressure**
7. Release the driver's trigger and stop insertion process when a sudden "give" or "pop" is felt upon entry into the medullary space
8. Only use gentle-steady pressure. If driver stalls and will not penetrate you may be applying **TOO MUCH** downward pressure
9. Remove power driver and stylet, confirm stability (fig 9), and attach extension set and flush with 5 mls of normal saline (Fig 10).
10. Secure and monitor

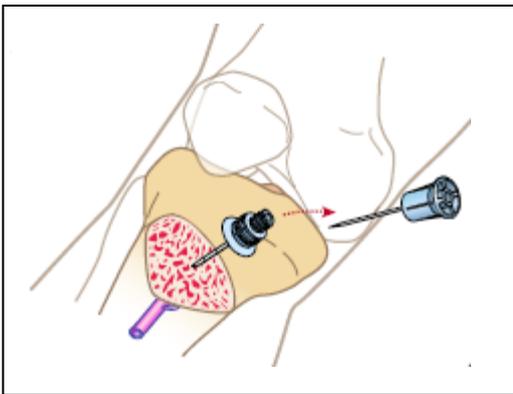


Fig 9

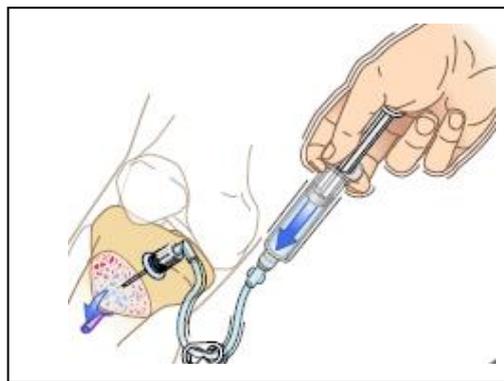
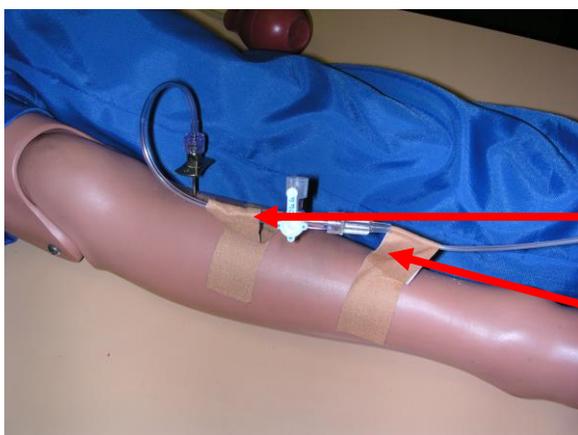


Fig 10

Figures 7 – 11 are sourced from Ez-IO Intraosseous Infusion system direction for use
<http://www.vidacare.com/reports/VDAA168EZ-IODFU051707.pdf>

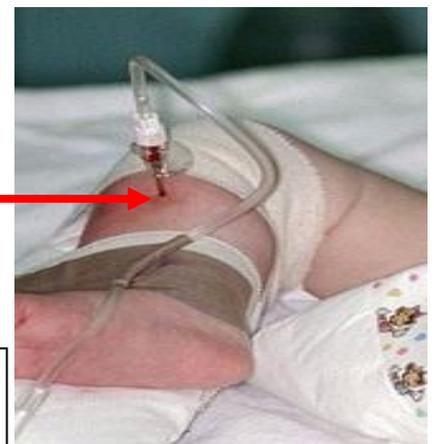
SECURING INTRAOSSEOUS NEEDLE AND GIVING SET



NB. Limb should be supported by immobilization device

Insertion site clear of dressings

Secure extension tubing
All connections are luer locked



(Photographs courtesy of NETS NSW clinical guideline Intraosseous Transfusion 2009 and Intraosseous Needle Insertion in Children HNEH CG 10_11)

1. Splint the limb securely
2. No dressing around site
3. Use adhesive tape to secure extension tube to limb

CARE AND OBSERVATIONS

1. Close observation of the insertion site must be undertaken to detect possible extravasation or sub-periosteal placement has occurred.
2. Observe for leaking around entry site or compartment syndrome (swelling, tightness or bruising).
3. Normal procedures relating to flushing between drugs etc. should occur
4. There is no restriction concerning the volume of fluid administered
5. If there are any signs of leaking etc. the intraosseous needle should be removed immediately
6. Intraosseous needle should be removed as soon as alternative access has been established
7. Document time of insertion, which limb, and related issues
8. Minimise movement of limb
9. Monitor limb circulation, skin integrity, and observe for swelling
10. Fully monitor the infant during intraosseous fluids
11. It is recommended not to use an intraosseous infusion site for more than 24 hours

FAMILY AND CHILD

1. Intraosseous needles are rarely used in patients who are not severely compromised /collapsed and therefore time for immediate explanations may not be appropriate. However, parents should be informed about the reasons for the use of the intraosseous needle, expected length of time it will be used for , expected outcome and the potential risks.
2. Warn the parents about the appearance prior to viewing the limb with the needle in it.
3. Inform them of the restraint and limitations that maybe required to ensure the needle does not fall out

REMOVAL OF INTRAOSSEOUS NEEDLE (De Boer et.al 2008)

1. Remove intraosseous needle using aseptic technique
2. Loosen and remove any devices used to secure needle and / or extension tubing to skin
3. Gently rotate the needle and withdraw smoothly
4. Cover the puncture site with a sterile gauze pad and apply direct pressure for 5 minutes (Revenis, 2007)
5. Remove pad and cover site with a sterile dry dressing
6. Dispose of items in sharps container
7. Record removal in patient notes
8. Observe limb for a further 24 hours to observe for adverse outcomes such as infection

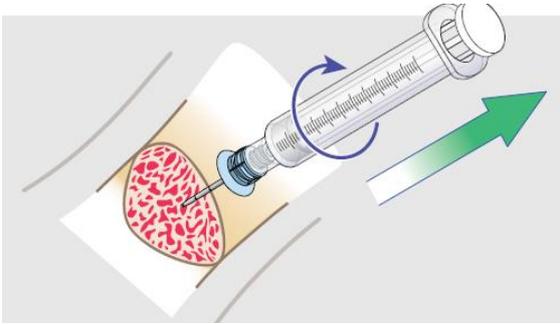


Fig 11 Removal of needle

LONG TERM OUTCOMES

Provided intraosseous needling performed following guidelines there is no reported effect on bone length or bone growth in later life (Vreede et.al 2000, Claudet et.al 2003)

REFERENCES

Australian Resuscitation Council (2010) Guideline 13.7 Medications or fluids for resuscitation of the Newborn infant <http://www.resus.org.au>

Brownstein Dr, Rivera FP. Emergency medical services for children. In: *Nelson Text Book of Pediatrics*, 17th Edn. Eds. Behrman RE, Kliegman RM, Jenson Hb. Philadelphia W.B. Saunders company 2004; 106 (3): E 29

Claudet,I., Baunin,C. & Laport-Turpin,E. Long term effects on tibial growth after intraosseous infusion: a prospective, radiographic analysis. *Paediatric Emergency Care*. 2003; 19: 397

DeBoer S, Russell T, Seaver M, Vardi A: Infant Intraosseous Infusion. *Neonatal Network* Vol. 27, No. 1, January/February 2008

Ellemunter, H, Simma B, Trawoger R, Maurer H. Intraosseous line in preterm and full term neonates. *Arch Dis Child Fetal Neonatal Ed* 1999; 80: 74-5

Engle, W (2006). Intraosseous access for administration of medications in neonates. *Clinics in Perinatology*, 33 161-168

EZ-IO (2006). Intraosseous Infusion system, Directions for use <http://www.vidacare.com/reports/VDAA168EZ-IODFU051707.pdf>

Great Ormond Street Hospital for Children (2007): Clinical Guideline Intraosseous Access.uploaded Oct 2013. <http://www.gosh.nhs.uk/health-professionals/clinical-guidelines/intraosseous-access/>

Great Ormond Street Hospital for Children. Clinical Guideline Intraosseous Access. www.ich.ucl.ac.uk/clinical_information/clinical_guidelines_2007

HNEH (2010) Intraosseous Needle Insertion in Children HNEH CG10-11

Hodge,D. Intraosseous Infusion, In: *Textbook of Pediatric Emergency Procedures*,2nd Edn. Eds. King,C & Henretig,F. Lippincott, Williams & Wilkins, USA (2008). Chap 21 pp.287

Hunter New England *Paediatric Trauma Resource Manual* 2006:

http://www.kaleidoscope.org.au/docs/Man_PaedTrauma.pdf

King Edward Memorial/Princess Margaret Hospital (2006) NCCU Clinical Guidelines section 5, Venous and Arterial Access and Line management.

www.kemh.health.wa.gov.au/services/nccu/guidelines/documents/7289.pdf

NETS NSW (2005) NETS Clinical Policy: Intraosseous Insertion C-6-15, (unpublished)

NETS Victoria Neonatal Handbook, Intraosseous Needle Insertion. Uploaded Oct. 2013

http://www.netsvic.org.au/nets/handbook/index.cfm?doc_id=455

Revenis,M. Intraosseous Infusions, In: *Atlas of Procedures in Neonatology*, 4th Edn. Eds. MacDonald,M & Ramasethu,J, USA. (2007). Chap47 pp.364

Von Hoff, D., Kuhn Pharm, J., Burris, H., & Miller, L,. Does Intraosseous equal intravenous? A pharmacokinetic study. *The American Journal of Emergency Medicine*. (2008) 26, 31-38.

Vreede,E. Bulatovic,A. & Rosseel,P. *Medecins Sans Frontieres* (2000): Practical Procedures, Intraosseous Infusion Issue 12 Article 10.

www.nda.ox.ac.uk/wfsa/html/u12/u1210_01.htm

FEEDBACK

Any feedback on this document should be sent to the Contact Officer listed on the front page.

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