Administration of Entonox®

This guidance does not override the individual responsibility of health professionals to make appropriate decision according to the circumstances of the individual patient in consultation with the patient and /or carer. Health care professionals must be prepared to justify any deviation from this guidance.

INTRODUCTION

Entonox® is a pre-prepared gaseous mixture of 50% Oxygen and 50% Nitrous Oxide (N2O), which may be supplied in blue cylinders with blue and white quarters on the neck. Nitrous oxide is a rapidly acting inhalation agent which is tasteless and colourless. Entonox® has a rapid onset and offset and is a powerful analgesic which is safe and simple to use. It is commonly known as and may be familiar to patients as “laughing gas” or “gas and air”. Entonox® is classed as a minimal sedation agent that may be administered by a single doctor, nurse or other suitably trained member of clinical staff who has demonstrated competence in administering Entonox®. Routine oxygen saturation recording is not required however if patients have known cardiac or respiratory problems then the location of an oxygen saturation monitor should be known.

The apparatus has a “demand valve”, that allows the Entonox® gas to flow when the patient exerts a negative pressure through inhalation. The patient applies the necessary suction via a mouthpiece. This demand system makes overdose virtually impossible, because once the patient’s conscious level falls the mask or mouthpiece will no longer be retained in position, causing room air to be inhaled.

Lead Clinician(s)

Dr. James France	Consultant Emergency Medicine WRH
Dr Shinwari	Consultant Paediatrician
Guideline reviewed and approved by Paediatric Quality Improvement meeting:	26th March 2021
Reviewed by Medicines Safety Committee:	16th May 2023
Review Date: This is the most current document and should be used until a revised version is in place	16th May 2026

Key Amendments made to this document:

Date	Amendment	By:
20/09/13	Minor amendments made	James France Mel Chippendale Alison Smith
23/11/2015	Document extended for 12 Months as per TMC paper approved on 22nd July 2015	
14/09/2016	Full review and amendments to include plaster technicians in guideline	Mel Chippendale/James France
05/09/2018	Removal of reference to registered professional requiring ILS / ALS / EPLS Clarification role of oxygen saturation monitoring.	James France
19th Nov 2020	Document extended for one year	Dr J West/ Paediatric QIM
26th March 2021	Document approved with no amendments	Paediatric Guideline Review Day Meeting
3rd May 2023	Document re-instated as a Trustwide document, reviewed by James France.	James France
16th May 2023	Minor amendments to the Contraindication section	Pharmacy/Medicines Team

Competencies required

- Qualified nurses, Doctors, and other member of clinic staff who have received training in the use of Entonox® and are competent in the administration of Entonox®, including its uses, contraindications and side effects. (Please see appendix 1 detailing training and competence.)
- This guideline is to be used in conjunction with Trust Protocol for Entonox® or prescribed by medical or non-medical prescriber. (Appendix 2)
- Basic life support

Patients covered

Patients with pain as a result of injury or illness and those undergoing short painful procedures where analgesia is required. Patients will be assessed as to the suitability of Entonox® as analgesic of choice (see indications and contraindications). Patient must be able to understand and comply with administration of Entonox® and be able to self-administer. Assessment of suitability for use on children must be assessed by a practitioner competent to assess children as the level of understanding and ability to self-administer will vary depending on age and physical condition, and mental ability.

This guideline does not cover the use of Entonox® in the delivery suite as this is subject to a separate guideline.

Aims of guideline

1. To ensure appropriate use of Entonox® after assessment of the patient and their analgesia requirements.
2. To ensure safe and appropriate administration of Entonox®.
3. To ensure all patients, including children and families / carers, receive information and explanation on the use of Entonox®.
4. To provide a framework for assessing competence in the administration of Entonox®.
5. To provide a framework for gaining competence to use the Trust Protocol for Entonox®.

Indications

General

- Entonox® should only be used to provide short term analgesia for the duration of the procedure being undertaken.
- Entonox® use **must not preclude definitive pain management** for ongoing pain related to a procedure or painful condition.
- Entonox® may be safely used during painful procedures in addition to other techniques (e.g. local / topical anaesthesia or opiate analgesia)
- Extreme anxiety / needle phobia

The uses are varied and many and may include the following:

Emergency Medicine, Trauma and Orthopaedics

- Traumatic injuries
- Simple manipulations or reduction of fractures
- Application and removal of traction
- Cleaning pin site
- Wound dressing
- Repair of lacerations

Paediatrics

- Lumbar puncture
- Accessing indwelling central venous catheter devices
- Venepuncture/cannulation when severe anxiety or needle phobia is likely - restraining children is not an acceptable alternative to adequate analgesia (see RCN guidelines on restraining children and young people).
- Dressing or plaster application or changes
- Traction
- Any short painful procedure

ENT

- Short outpatient procedures.

Endoscopy

Please note this guideline does not cover the use of Entonox® in the delivery suite as this is subject to a separate guideline.

Contraindications

Nitrous oxide diffuses into cavities so it should not be used if any of the following are suspected:

- pneumothorax
- bowel obstruction, if there is abdominal distension
- air embolism
- decompression sickness
- middle ear infections/surgery
- bullous lung disease
- intracranial air collection
- recent intraocular injection

Any cause of sedation (e.g. alcohol or drug intoxication) as level of consciousness is difficult to determine and compliance may be poor. The patient should remain co-operative throughout the procedure.

Miscellaneous:

- A woman in the first two trimesters of pregnancy should not be given Entonox® nor be in the vicinity when it is being administered to another person
- Immunosupression – prolonged use can cause anaemia and leukopenia.
- B_{12} or folate deficiency or unexplained neuropathies
- significant cardiac failure

Any patient unable to use the self-administration system eg.

- lack of comprehension due to age, infirmity or mental ability
- maxillo-facial injury
- alcohol or drug intoxication

Patients after head injury or with an impaired mental state.**Side effects**

General:

Dry mouth, disorientation, dizziness, euphoria, loss of inhibition, feeling floaty, blurring vision, tingling sensation lips, fingers, nose (harmless and will stop when inhalation of Entonox® is discontinued) and less commonly, nausea and vomiting, excessive sedation.

Vitamin B_{12}

N_2O oxidises cobalamin and thereby inactivates vitamin B_{12}. Prolonged exposure to N_2O can cause a myeloneuropathy similar to subacute combined degeneration of the cord. Acute exposure may precipitate a similar clinical syndrome in patients with pre-existing sub-clinical vitamin B_{12} deficiency and depression of white cell formation may also occur.

Cardiovascular effects

N_2O may cause mild increases in pulmonary vascular resistance which may be significant in patients with pulmonary hypertension, particularly mitral stenosis.

Other

Addiction to N_2O has been reported and misuse is well recognised and of considerable concern [1] especially amongst young people.

Precautions

At high concentration can cause sedation, unconsciousness and hypoxia.

If Entonox® is used over 4 or more consecutive days the blood count should be checked. (BOC datasheet)

Maximum exposure to Entonox® is 6 hours.

Definitive supplementary analgesia should be considered.

Entonox® should not be used daily for more than 4 days.

Please see Appendix 3 with regards to the environmental concerns surrounding the use of Entonox®

Please see Appendix 4 for example Patient Information Leaflet

Note

[1] Suspected_nitrous_oxide_toxicity_in_Emergency_Departments_v3.pdf (rcem.ac.uk)

Administration of Entonox®

Assessment

1. Assess nature of injury or procedure required.
2. Assess patient; ensure no contraindications for use of Entonox®.
3. Assess patient's level of understanding and ability to self-administer Entonox®.
4. Assess patient's level of understanding of the treatment to be carried out.
5. Assess patient's need for any concurrent local / topical anaesthesia or analgesia.

Plan

1. Explain procedure and use of analgesia to patient / family / carers as appropriate.
2. Answer questions, provide reassurance.
3. Gain consent (verbal or implied, see DH guidance on consent children young people, adults).
4. Collect and check equipment, ensure a new mouthpiece and filter is used for each patient.

Administration

1. Ensure patient comfort and safety.
2. Demonstrate to patient use of equipment (do not inhale Entonox® yourself !).
3. Ensure patient understands what to do and what to expect before procedure commences.
4. Allow patient to practice using equipment.
5. Encourage patient to inhale and exhale Entonox® for 2 minutes before commencing procedure to ensure effectiveness.
6. Encourage continued slow deep breathing throughout the procedure.
7. Observe patient during and after the procedure to monitor effects of Entonox® and assess when effects have worn off.
8. Dispose of mouth piece and filter in yellow bin.
9. Document patient's name, hospital number or date of birth and the date in the log book provided.

Evaluation

1. Evaluate effectiveness of Entonox®.

Health and Safety Issues

Entonox® is a mixture of two substances, therefore to ensure thorough mixing small cylinders (E or smaller) should be stored on their sides

Large cylinders (F or larger) are stored upright or in their trolleys and it is impractical for them to be stored on their sides.

To ensure mixing, the cylinder must be at 10^0C or more for 24 hours or if small above 10^0C for 2 hours and inverted three times.
Care must be taken when lifting and carrying smaller cylinders. Larger cylinders are transported using trolleys. Care must be taken when moving cylinders on and off trolleys and between store and clinical area.

Entonox® is excreted unaltered via the patient's breath so administration must take place in a well ventilated area** to prevent others inhaling the Entonox®. See Appendix 5.

** *The evidence base for what constitutes a well ventilated area is sparse but literature and anecdotal evidence from practitioners experienced in the use of Entonox® suggest areas with air conditioning or open windows are adequate for occasional to regular use. Salvage equipment is recommended for prolonged and continuous use and individual clinical areas will need to assess potential use and ventilation requirements.*

COSHH requirements must be adhered to i.e. an assessment of risk and implementation of methods to control the risk. The risk assessment should be carried out by the practitioner to ensure that ventilation is adequate and action should be taken to move the patient to a well ventilated area if necessary.

It is recommended that as a precaution, driving, use of machinery and signing of legal documents should be avoided for 30 minutes post administration. Staff must ensure that they have discussed this with the patient.

To provide an audit trail in the case of possible cross contamination or substance misuse, each patient's name, hospital number or date of birth and the date of use must be recorded in the log book. On receipt of a new cylinder this must also be recorded in the log book. Managers in each area should ensure a log book is provided.

Entonox® prescription and administration should be documented appropriately by individual departments.

Infection Control Issues

- Disposable lightweight tubing will be used.
- If the tubing has been used, it is changed weekly and recorded. If it is visibly contaminated it is changed immediately.
- A bacterial filter protects the tubing from internal contamination. The outside of the tubing that is held by the patient is socially cleaned in the same way as the rest of the equipment. Tubing should be cleaned between patient use e.g. wiped with a detergent and water and dried thoroughly.
- Each individual patient will have theirown mouthpiece and bacterial filter or facemask and filter.
- Administration devices, masks and mouthpieces are **single patient use only**.
- If a patient is known to be colonized or infected with an alert organism, or has an acute infection then the tubing remains with the patient**. (**See infection control policies.)

Use of the equipment

Practitioners check that the equipment is in good working order before use.

The following are checked:-

- The Bodock seal to see that it is present, complete, un-cracked or split.
- A suitable key to turn the cylinder on and off is attached to the equipment.
- That the regulator fits securely.
- Gas is blown through the system to check for leaks and ensure any grit is out of the system.
- The tubing between the patient and the equipment is clean and in date.
- The equipment is clean.
- There is a record of usage and changes of tubing.
- As Entonox® supports combustion cylinders must be turned off when not in use.
- Equipment needs to be well maintained and cleaned regularly. Cylinders are cleaned in between uses. Dust and debris should be removed using detergent and water or detergent wipes.

Entonox® cylinders must be stored in accordance with data sheet information from BOC

- No lubrication may be used on the Entonox® system.

- The pin index system ensures that the regulator cannot be connected to the incorrect gas so no alterations may be made to the pin index system.
- If the regulator has been damaged and will not fit snugly the system cannot be used and Medical engineering department should be informed immediately.
- Entonox® cylinders must be stored under cover, kept dry and clean and not subjected to extremes of temperature.
- The mixture supports combustion and must be stored away from combustible materials in the gas store, and away from sources of heat in the clinical areas. Notices must prohibit smoking and naked flames.
- In the gas store it is kept separately from other gases. Full and empty cylinders are stored apart and stocks should be rotated and kept at between 6 and 10^0C.
- Cylinders must not be repainted, have markings obscured or labels removed.
- Where cylinders are stored in clinical areas the above cautions should be adhered to.
- In addition used cylinders should be returned immediately to main stores.
- Numbers of cylinders stored should be kept to a minimum.
- Storage should be in a well ventilated room, which is clearly labelled saying the type of cylinder being stored.
- No combustible material should be stored with the cylinder. Large cylinders should be secured and small cylinders stored horizontal.

APPENDIX 1

Worcestershire Acute Hospitals NHS Trust
ASSESSMENT OF COMPETENCY FOR THE ADMINISTRATON OF ENTONOX®

ASSESSMENT SPECIFICATION: The candidate should be able to demonstrate competence in the administration of Entonox® using the following knowledge evidence and performance criteria

KNOWLEDGE EVIDENCE: The candidate should be able to:

a) Demonstrate knowledge of local guidelines for administration of Entonox®
b) Demonstrate a factual knowledge of indication/contraindications and adverse effects of Entonox® Discuss potential problems/contra indications that may be encountered and how to prevent/resolve them
c) Identify the correct equipment for administration of Entonox®
d) Demonstrate skill in the correct administration of Entonox®
e) Discuss responsibility and accountability with reference to use of Entonox®
f) Discuss safety aspects of the procedure and disposal of equipment
g) Discuss the environmental impact of the use of Entonox®

You need a supervisor who is professionally accountable and competent to administer Entonox® *Assessment in Clinical Practice. or equivalent*
Competencies may be assessed by individuals who have attended a training programme and are deemed competent by your supervisor

- Any problems, please contact Professional Development on 01905 760825 or Ext 33743

Clinical Supervisor *(please print)* …….. Signature …… Date: ……

Candidate *(please print)*…… Signature …… Date: ……

Ward/Department: ……Directorate/PCT …….. Location: ……..

Comments by Supervisor	**Comments by Candidate:**

When you have completed your competencies, please send a PHOTOCOPY of this form to: Professional Development Administrator, Charles Hastings Education Centre, WRH.

Worcestershire Acute Hospitals NHS Trust
Performance Criteria for Assessment of Competency for Administration of Entonox®

PERFORMANCE CRITERIA	COMPETENT- Mentor Initial & Date		
	Observation of practice	Supervised practice 1	Supervisor initials
1 **Patient identified correctly**			
2 Preparation of Equipment			
3 Procedure			
Assess Nature of injury or procedure to be carried out Assess patient, ensure no contraindications present Assess level of understanding and ability to self-administer Assess level of understanding of procedure to be carried out Assess need for any concurrent local, topical or systemic analgesia			
Plan Explain procedure and use of Entonox® as analgesia to patient/family/carers as appropriate Answer questions, provide reassurance Gain verbal consent (see DH guidance on consent children, young people, adults Gather equipment and ensure all complete and in working order			
Administration Ensure patient comfort and safety Demonstrate to patient use of equipment Ensure patient understands what to do and what to expect before procedure commences Allow patient to practice using equipment Encourage patient to inhale and exhale Entonox® for 2 minutes before commencing procedure to ensure effectiveness Encourage continued deep breathing throughout the procedure Observe patient during and after the procedure to monitor effects of Entonox® and assess when effects have worn off			
Correct Disposal of all equipment switch off equipment and dispose of single patient use components			
Evaluation Evaluate effectiveness of Entonox®			
5 Patient reassured and comfortable			
7 Correct Documentation of all relevant information			
Main Clinical Mentor *(please print)*……..……. **Signature** …… **Date:** ……	**Candidate** *(please print)* ……..…….. **Signature** ……..…… **Date:** ……..……..…		

APPENDIX 2

Administration PROTOCOL FOR Entonox®

YOU MUST BE AUTHORISED BY NAME, UNDER THE CURRENT VERSION OF THIS PROTOCOL BEFORE YOU ATTEMPT TO WORK ACCORDING TO IT

Clinical Condition	
Indication	Children, young people and adults requiring rapid analgesia for short painful procedures. This PROTOCOL is to be used in conjunction with **Trust Guideline for use of Entonox® (WAHT-TWI-002)**
Inclusion criteria	Entonox is designed for self-administration by the conscious patient, who may need to be assisted by a healthcare professional in order to do so Patients who can understand and consent to use of Entonox® and self-administer. The ability of patents to understand and self-administer will be assessed on an individual basis. Age, physical condition and mental capacity must be considered. For paediatric patients this must be assessed by a practitioner competent to assess children. Patients undergoing short painful procedures. Patients with trauma.
Exclusion criteria	• Any patient unable to self-administer due to age, physical condition, mental capacity, or for any other reason • Abdominal pain if bowel obstruction is suspected • Chest wall injury if pneumothorax is suspected • Pneumothorax • Bullous lung disease • Earache • Impaired level of consciousness • Early pregnancy • Heart Failure • Immunosuppression • B12 or folate deficiency or unexplained neuropathy • Decompression sickness • Maxillofacial injury • Sedated patients if decreased level of consciousness • Intoxication
Cautions/Seek further advice	Entonox® should be used with caution in patients with head injury and only by experienced medical practitioners such as consultants in emergency medicine.
Action if patient declines or is excluded	Refer to supervising doctor/receiving facility as appropriate. Document refusal or action taken in patient's records.

Drug Details	
Name, form & strength of medicine	Entonox® gas 50% oxygen and 50% nitrous oxide
Route/Method	Inhalation by self-administration, with assistance from a healthcare professional where needed
Dosage	As required by self-administration
Frequency	As required by self-administration
Duration of treatment	Short term pain relief
Maximum or minimum treatment period	Short term pain relief only
Quantity to administer	As required by self-administration
Side effects	Occasionally - nausea Tingling sensation (lips, fingers, nose) stops when inhalation stops Dry mouth, loss if inhibition, dizziness, euphoria, Blurred vision, excessive sedation with over dosage
Advice to patient/carer	Procedure to be explained as per trust guideline for administration of Entonox®, equipment demonstrated and patient allowed to practice. Advised to inhale gas for 2 minutes prior to procedure and for duration of procedure. Importance of self-administration discussed and rationale. Explain that if patient becomes drowsy they will release the mouth piece and inhalation will stop and over administration will be avoided.
Follow up	Short acting inhaled agent. Patient will be assessed for pain and return to normal state. Definitive further analgesia if indicated. Advise not to drive or operate machinery for 30 minutes. Entonox® not to be used more than 4 days in a row.

Staff Characteristics	
Professional qualifications	Registered Professional with a current registration. Medical or nursing practitioner with assessment skills able to monitor and assess level of consciousness, basic air way management and recognise signs of over sedation. Assisting the patient with self-administration of Entonox® may be delegated to a trained and competent plaster technician or but the registered professional remains accountable
Specialist competencies or qualifications	• Has undertaken appropriate training to carry out clinical assessment of patient leading to diagnosis that requires treatment according to the indications listed in this PROTOCOL • Has attended training on use of Entonox® and been assessed as competent to administer Entonox®
Continuing education & training	The practitioner should be aware of any change to the recommendations for the medicine listed. It is the responsibility of the individual to keep up-to-date with continued professional development.

Referral Arrangements and Audit Trail	
Referral arrangements	N/A
Records/audit trail	• Patient's name, address, date of birth and consent given • Contact details of GP (if registered) • Diagnosis • Advice given to patient (including side effects, PAL) • Signature/name of staff who administered or supplied the medication, and also, if relevant, signature/name of staff who removed/discontinued the treatment • Details of any adverse drug reaction and actions taken including documentation in the patient's medical record • Log book to be kept with Entonox® cylinder for audit purpose and monitoring use

References/Resources and comments	Notes: SPC – Summary of Product Characteristics BNF – British National Formulary Trust Guideline WAHT-TWI-002 Administration of Entonox® in children, young people and adults

This protocol must be agreed to and signed by all health care professionals involved in its use. The Trust Pharmacy Department will hold the original signed copy. The protocol must be easily accessible in the clinical setting	
Organisation	**Worcestershire Acute Hospitals NHS Trust**

Clinical Authorisation	
Lead Doctor	Name: Dr James France Position: Consultant in Emergency Medicine Signature: Date:
Lead Nurse/Allied Health Professional	Name: Melanie Chippendale Position: Advanced Nurse Practitioner Paediatrics Signature: Date:
Lead Pharmacist	Name: Alison Smith Position: Lead Pharmacist Medicines Safety Signature: Date:
Organisational Authorisation	
Director of Medicine	Name: Andrew Short Position: Signature: Date:
Director of Nursing	Name: Jan Stevens Position: Signature: Date:
Chair of Medicines Safety Committee	**Name:** Richard Cattell Position: Director of Pharmacy Signature: Date:

PROTOCOL Peer Reviewed by		
Name	***Position***	***Date***
James France	Consultant in Emergency Medicine	17.12.2012
James France Mel Chippendale	Consultant in Emergency Medicine Advanced Nurse Practitioner Paediatrics	14/09/2016

Individual Authorisation

PROTOCOLs DO NOT REMOVE INHERENT PROFESSIONAL OBLIGATIONS OR ACCOUNTABILITY.
It is the responsibility of each professional to practice only within the bounds of their own competence and in accordance with their own Code of Professional Conduct.
Note to Authorising Managers: authorised staff should be provided with an individual copy of the clinical content of the PROTOCOL and a photocopy of the document showing their authorisation.

I have read and understood the PROTOCOL and agree to supply/administer this medicine only in accordance with this PROTOCOL.

Name of Professional	Signature	Authorising Manager	Date

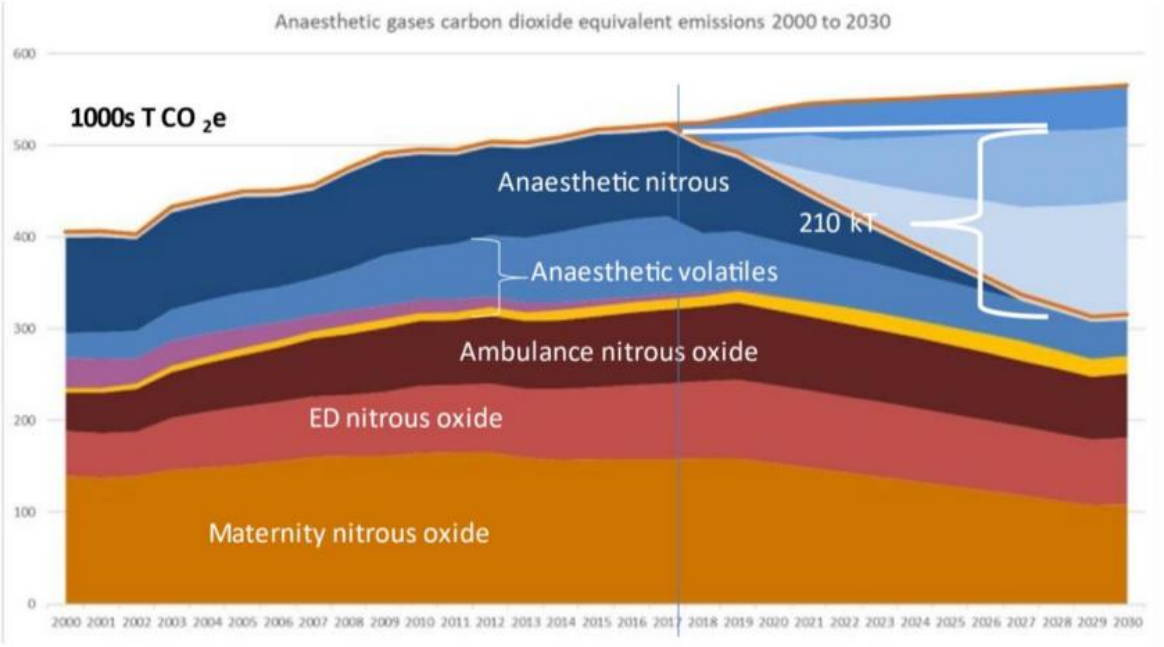
Appendix 3

Greenhouse Gas Effect of Entonox®

Used correctly, nitrous oxide can be a very safe and effective analgesic medicine. For some patients it may be the best option pain relief. However, we should also be aware of some of the broader implications of this drug:

1. The ability of nitrous oxide to trap heat in the atmosphere (known as the global warming potential or GWP) is approximately 298 times that of carbon dioxide.
2. Nitrous oxide is also an ozone depleting gas, and has been labelled as one of the most significant ozone depleting gases of the 21st century.
3. Nitrous oxide inactivates vitamin B12 and interferes with folate metabolism. Risks of occupational exposure in healthcare workers such as reduced fertility have been reported following repeated exposure in inadequately ventilated rooms and spaces.
4. Nitrous oxide can be used as a drug of abuse, with regular exposure leading to peripheral neuropathy, and subacute combined degeneration of the spinal cord

The NHS in England has pledged to be carbon net zero by 2040. The NHS is responsible for 4-5% of total UK carbon emissions, and anaesthetic gases have been identified as a 'carbon hotspot'. The 2019 NHS Long Term Plan highlights these gasses as an area for action. Nitrous oxide use in the acute sector leads to more greenhouse gas emissions than any other anaesthetic gas, accounting for 75% of all anaesthetic gas emissions.



Graph 1. ED and Ambulance Nitrous Oxide Use, as a proportion of total anaesthetic gas footprint. [8]

Graph 1. Nitrous Oxide Use, as a proportion of total anaesthetic gas footprint.
A significant proportion of these emissions originate from non-maternity nitrous oxide use (eg emergency departments). It is important to reduce nitrous oxide wastage, and consider the use of alternatives, where feasible and safe to do so.

- It is estimated that 30 minutes of Entonox® use produces the equivalent emissions of approximately 38 kg of CO2. This is the same as driving a medium sized petrol car over 120 miles.
- At present, partially empty and expired Entonox® cylinders are vented off directly to the atmosphere, further contributing to emissions.
- Some emergency departments may have piped Entonox® from a gas manifold. This has the potential to lead to leaks from pipework, and also wastage of large quantities of gas if the manifold is not correctly managed.

Alternatives to nitrous oxide, such as methoxyflurane (marketed as Penthrox®) are now available, and may be suitable for some, but not currently all, patients. Methoxyflurane has a much lower ability than nitrous oxide to trap heat in the atmosphere (GWP of 4 vs 298) although the data to compare the total environmental impact of nitrous oxide and methoxyflurane as a life cycle analysis (incorporating manufacture, use and disposal of each product) is not yet available.

Conclusion

Nitrous oxide is a potent greenhouse gas and ozone depletor. It has potential harms associated with long term and occupational exposure. Whilst there may be patients or providers for whom nitrous oxide containing products, such as Entonox®, are required, where clinically appropriate, other alternatives may provide longer lasting and more definitive analgesia. Environmental damage carries a human health cost, financial cost and ecological cost, in turn each affecting the ability for health services to provide care. There is a responsibility to individually and collectively understand and minimise the environmental consequences of our actions. Mitigating, eliminating or reducing wastage and unnecessary usage of Entonox® in our services is an important responsibility.

Reference:
Nitrous Oxide and Prehospital Emergency Medicine. Information Sheet for Emergency Care Providers. Royal College Emergency Medicine, College of Paramedics, Association of Ambulance Chief Executives, British Association for Immediate Care. May 2022.
Nitrous_Oxide_and_Prehospital_Emergency_Medicine_v3.pdf (cloudinary.com) Accessed 02.05.2023

Appendix 4

Example Patient Information Leaflet

Worcestershire Royal Hospital
Emergency Department
Patient Advice Sheet

NHS Worcestershire Acute Hospitals NHS Trust

Entonox®

What is Entonox®?

Entonox® is a well-established pain relieving gas mixture. It consists of two gases, 50% nitrous oxide and 50% oxygen and is more commonly known as 'gas and air'. Entonox® is used to control pain during some investigations and procedures.

How do I use Entonox?

Entonox® is self-administered; this means that you have control when using the gas. A clinician (nurse or doctor) who has undergone training will supervise you and remain with you during the procedure. Before the start of the procedure, the clinician will show you how to use the equipment correctly. The Entonox® is breathed in using a mouthpiece, which is held between your teeth with your lips closed. You will be asked to breathe normally using the mouthpiece; you should breathe in through your mouth only.

As you continue to use the Entonox® you may become light-headed or drowsy, the clinician will check if you are ready to start the procedure. The Entonox® gas only works when you breathe it in; you will need to continue breathing the Entonox® during the procedure. When you stop breathing the gas, the effects wear off very quickly.

When do I start using Entonox®?

The clinician will advise you when to start using the Entonox® and will supervise you during the procedure. The clinician will ask you to start using the Entonox® for approximately two minutes before the start of the procedure. You should continue to use the Entonox® throughout the procedure.

The Entonox® will help to relieve your pain but may not remove it completely. The normal breathing required to use the Entonox will also help you to keep relaxed during the procedure. If the use of Entonox® is unsatisfactory at any stage, alternative pain relief can be given; just ask the clinician who is supervising you.

The clinician will advise you to stop breathing the Entonox® when the procedure is completed. Any effects from the gas will wear off very quickly.

What are the benefits of using Entonox?

You are in control
The pain relieving effects are rapid
There are no long lasting side effects

Appendix 4, continued

Example Patient Information Leaflet

Are there any alternatives?

If you do not wish to use Entonox® you can discuss alternative pain relief with the clinician.

Are there any side effects?

Entonox® can make you feel drowsy and a little light-headed. Because Entonox® is self-administered, it is very safe. If you become drowsy, you will be unable to hold the mouthpiece to your mouth. This prevents you from breathing in too much of the gas and the effects of the Entonox® will wear off very quickly.

Other possible side effects include dizziness, nausea, disorientation and a dry mouth.

A tingling sensation, usually in the fingers can occur; this is often due to breathing too quickly. Your clinician will encourage you to slow your breathing to a normal rate if this happens.

All these sensations disappear rapidly after you stop using Entonox®.

Is it safe to use ENTONOX® while pregnant?

Yes, it is. However, it is best to avoid using it during the first and second trimesters of pregnancy. Your healthcare professional will answer any questions you may have.

How soon does the Entonox® wear off?

Entonox® works only when you breathe it in. Its effects wear off very quickly once you have stopped using it, normally within about a minute. However, you should rest for at least 15 minutes before you start to walk around again.

What should I expect after having Entonox®?

When the procedure is over, you will be asked to rest on a trolley for at least 15 minutes. You must not walk around as you may feel unsteady and dizzy.

As a safety precaution, it is advisable not to drive or operate machinery for at least 30 minutes after using Entonox®. Do not drive unless you feel you are safe to do so. You must not drive if any sedation or other intravenous pain relief has been administered to you in addition to the Entonox®.

Acknowledgements:
Hull University Hospital Teaching NHS Trust
Gloucestershire hospitals NHS foundation Trust Hospitals

Emergency Department,
Worcestershire Royal Hospital,
Tel: 01905 733065

Appendix 5

Extract from *Guidance on minimising time weighted exposure to nitrous oxide in healthcare settings in England*

This guidance outlines the mitigations that NHS trusts should consider to protect staff by limiting their occupational exposure to nitrous oxide (N2O) and recommended governance arrangements for board assurance of occupational exposure to N2O.

When Entonox® is used as an analgesic, the efficacy of closed-circuit breathing apparatus is reduced through imperfect patient usage – most commonly, taking the rebreather mask/rebreather tube away from their mouth when exhaling. If ventilation is insufficient, human factors are critical in reducing staff exposure, such as:

- providing clear instructions to patients on correct use of equipment being used, including exhaling into the rebreather mask or out through the mouthpiece
- staff positioning relative to exhaust Entonox® and the direction of ventilation flow
- turning gas and air off when not in use
- unplugging regulators from outlets when not in use
- monitoring the condition of equipment for leakages.

The function of the ventilation in this circumstance is to dilute the concentration of N_2O, such that it does not exceed the maximum time weighted exposure limits for staff. This is done through:

- minimum of 10 air changes per hour
- ensuring ventilation is turned on and unobstructed
- annual testing and validation of the ventilation

The following should be avoided, and if unavoidable there should be enhanced monitoring:

- environments with fewer than 10 air changes per hour
- staff located between the exhaling patient and the air outlet

Reference

Guidance on minimising time weighted exposure to nitrous oxide in healthcare settings in England. NHS England, March 2023. https://www.england.nhs.uk/long-read/guidance-on-minimising-time-weighted-exposure-to-nitrous-oxide-in-healthcare-settings-in-england/ Accessed 02.05.2023