NHS
Solent
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Medical Gas Policy

Please be aware that any printed version of this Policy may NOT be the latest version. Staff are reminded that they must always refer to the Intranet for the latest version

Purpose of Agreement	To put in place measures for Solent NHS Trust to ensure the safe use of medical gases and to reduce any risks associated with each gas.
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Contents:

1. INTRODUCTION AND PURPOSE

1.1 This policy sets out the standards which Solent NHS Trust expects its directly and indirectly employed staff to adhere to in relation to the care and control, safe use, prescribing, handling, supply and administration of medical gases.

1.2 The policy takes account of current legislation, official guidance and recommendations. These, however, change with time and all staff have a responsibility to identify where new guidance may conflict with this policy.

1.3 The policy lays out the key principles for the care and control of medical gases. Individual services may then develop local procedures within this framework in consultation with the Chief Pharmacist. Any local procedure must be approved by the relevant associate director, senior practitioner or other suitable professional and the Chief Pharmacist via the Solent NHS Trust Medicines Committee.

1.4 Medical gases are licensed medical products that are used for a variety of purposes in caring for patients. They are provided to the Trust's various settings by contracted suppliers in the form of small and medium sized cylinders, large cylinders that are used in a manifold room (a room used for holding cylinders) for piped gas systems, liquid containing cylinders (liquid oxygen) or a cryogenic gases in liquid form to freeze tissues. All personnel working with medical gases must be suitably trained before they can handle and/or administer these gases to patients.

2. SCOPE AND DEFINITIONS

2.1 This policy applies to all directly and indirectly employed staff within Solent NHS Trust and other persons working within the organisation in line with Solent NHS Trust's Equal Opportunities Document.

2.2 The policy covers all aspects of prescribing, supply, administration and storage of medical gases in community hospitals, community clinics and other departments and settings where Solent NHS Trust provides care. It is an important aspect in the treatment of clients receiving care provided by the organisation.

2.3 The policy also gives advice to Trust staff who are involved in the care of patients in their own home, on the safe use of medical gases.

2.4 The policy does not give detailed instructions on the use of administration equipment associated with use of medical gases.

2.5 **Definitions:**-

2.5.1 **Administration of Medical Gas**-To give to a patient a medical gas product by introduction of that gas into the body by inhalation or by external application (e.g. application of liquid nitrogen).

2.5.2 **BNF-** British National Formulary (latest addition available at http://www.evidence.nhs.uk/formulary/bnf/current

2.5.3 **Controlled Stationery -** Any stationery (e.g. drug prescription chart) which, in the wrong hands, could be open to abuse within the system.

2.5.4 **Cryogenic Liquid**-A medical gas which has been cooled to liquid form and which is then used to freeze tissues requiring treatment.

2.5.5 **Healthcare Professional-** A registered practitioner in an occupation which requires specialist education and training in practical skills in health care. The professions concerned are self-regulating and practitioners are expected to satisfy their profession's accepted standards of practice and conduct.

For the purposes of this policy, these practitioners are accepted to include:

- Registered nurses or midwives
- Doctors (medical practitioners)
- Dentists
- Dieticians
- Pharmacists
- Registered Pharmacy Technicians
- Podiatrists

2.5.6 **Medical Gas**- Any gas which is manufactured, sold and/or supplied for use wholly or mainly in being administered to one or more human beings for a medicinal purpose.

2.5.7 **MHRA-** Medicines and Healthcare products Regulatory Agency is an agency of the Department of Health.

2.5.8 **NMC-** Nursing and Midwifery Council (UK)

2.5.9 **NPSA-** National Patient Safety Agency, whose responsibilities passed to the NHS Commissioning Board Special Health Authority on 1st June 2012.

2.5.10 **Patient** - A person who receives a medical gas, although individual services may refer to them, for example, as service user, client or resident

2.5.11 **Patient Group Directions (PGD)-**A specific written instruction for the supply or administration of medicines to clinical groups of patients who may not be individually identified before presentation for treatment

2.5.12 **Prescribe-** To order in writing (or electronically) the supply of a medical gas for a named patient (see "Prescription")

2.5.13 **Prescriber-**A healthcare professional that is legally authorised to prescribe a medical gas, including medical and non-medical prescribers

2.5.14 **Prescription -** An order for the dispensing or administration of a medical gas. The order is presented to a professional who is legally authorised to dispense or administer. The order must be either:

a) in writing in a legally prescribed format and signed by the person authorised by law to prescribe, or
b) made, using a Trust-agreed electronic prescribing system, by the person authorised in law to prescribe medical gases, and who has been provided with a secure, individual computer access password.

2.5.15 **Prescription Record Chart-**Authorised drug chart for recording patient prescriptions and administration.

2.5.16 **Supply-** To lawfully provide a medical gas directly to a patient or to a carer for administration to patient(s).

2.5.17 **Treatment-** The management and care (including use of medicines and procedures) of a patient to prevent or cure disease or to ameliorate suffering and disability.

2.6 Other procedures or policies relating to ordering, storage, prescription, supply and administration of medical gases must be referred to where appropriate. These will include:

Medicines Policy
Resuscitation Policy
Specific Patient Group Directions
Non-medical Prescribing Policy
Relevant Health and Safety policies, e.g. COSHH
Arrangements for dealing with Drug Alerts and Medicines Recall Procedures
The Palliative Care Handbook, latest edition
Medicines Purchasing for Safety Procedure

3. Medical Gas Cylinders

3.1 For most settings in Solent NHS Trust, medical gases are provided in cylinders that are stored on site and transported to the area of use when required, for example, oxygen cylinders used in an emergency situation. Cylinders are labelled according to their size; size A being the smallest and size J the largest. The largest cylinders are designed to be attached to gas manifolds to serve piped medical gas systems (at Royal South Hants Hospital only). Small and medium size cylinders (commonly CD and HX) are used for individual patient care and are provided with an integral valve and flow meter.

3.2 Medium and large sizes of medical gas cylinders are very heavy and can cause harm to patients. An alert was issued in July 2010 informing organisations of the risks - EFA/2010/008 (Unsecured medical gas cylinders, including cylinders on trolleys). In response to this, all F, HX and G size cylinders must only be used at the bedside of those patients requiring continuous oxygen, and must be firmly secured in a suitable trolley. Secured cylinders must be placed to ensure that a patient cannot use the cylinder as a support when moving or rising from bed.

3.3 Large size cylinders (size G and above) must only ever be moved (whether full or empty) with the aid of a suitable trolley and/or hoist.

3.4 Each setting (ward, clinic or manifold room) within the Trust must have a set stock holding of medical gas cylinders. This can range from an agreed small number of portable oxygen cylinders for emergency use, through to larger set numbers of large cylinders as back up for a manifold. Service managers, in conjunction with the Chief Pharmacist, must regularly review stock levels of cylinders to ensure that sufficient are being kept for patient care.

4. ORDERING MEDICAL GAS CYLINDERS AND INVENTORY CONTROL

4.1 The service lead for each setting that uses medical gases (ward, clinic, manifold room) must designate a suitably trained person with the responsibility for monitoring medical gas cylinders and ordering replacement cylinders to maintain stock levels.

4.2 The most common requirement for medical gas stock within Solent NHS Trust is oxygen for emergency use. Oxygen cylinders are checked as part of the regular check of emergency drugs and it is essential that medical gas cylinders are replaced before they are empty and are in place ready for the next potential emergency situation.

4.3 Medical gas cylinders remain the property of the contracted supplier and are rented by the Trust. So while it is essential that adequate supplies are kept as stock, it is also important that settings do not maintain excess stock.

4.4 Reordering of medical gas cylinders must be on an empty (or part used cylinder) replaced with a full cylinder basis. This will ensure that set stock levels are maintained.

4.5 For settings that have a medical gas cylinder store on site (Royal South Hants, St James's, Western Community Hospital and St Mary's Hospitals) replacement for empty, part used or out of date cylinders is arranged by contacting the porters/facilities staff. They will arrange delivery of a full cylinder and pick up of the used cylinder direct to/from the ward or clinic. Facilities staff will maintain a record of cylinders delivered to each setting. Facilities staff will arrange collection of used cylinders from the medical gas store and delivery of full cylinders to the store with the medical gas contractor on a regular (usually weekly) basis.

4.6 For settings remote from the three hospital sites listed in 4.5 above, replacement for empty or part used or out of date cylinders is arranged by contacting the medical gas contractor direct who will deliver replacements at the next available opportunity. Medical gas cylinders must not be supplied between sites using Trust transport or staff cars.

4.7 Urgent orders for replacement of medical gas cylinders may be placed with the medical gas contractor. However, if a shortage of a medical gas might compromise the treatment of a patient, treatment must either cease or consideration be given to transferring the patient to Emergency Dept. by ambulance.

4.8 Community based nurses may carry a single portable oxygen cylinder for emergency treatment in their cars. All cylinders must be fixed securely during transportation. There is no requirement

to display a HAZChem Notice. Transport of any other medical gases or other sizes of oxygen cylinder must be done in a specifically designated vehicle and is restricted to medical gas delivery companies and Trust contracted transport.

4.9 It is important that medical gas cylinders are not supplied from the Trust to any setting outside of the Trust or to patients at home. Likewise there must be strict adherence to full for empty ordering from the medical gas contractor. The Trust will be liable for on-going rental of all cylinders supplied to it, regardless of where they are used, and will be liable for a cylinder charge for lost cylinders.

4.10 Periodically (usually annually) an inventory check of all cylinders present and being charged for rental to the Trust must be arranged between the service lead for Facilities and the Chief Pharmacist.

5. STORAGE OF MEDICAL GAS CYLINDERS

5.1 When stored in a medical gas store on the four hospital sites, cylinders must be stored separately from any non-medical gases in a dedicated area which must be designed to the requirements of HTM 02-01. Cylinders must be under cover in a secure lockable area away from any stocks of combustible materials and sources of heat. Warning notices prohibiting smoking and naked lights must be posted on the cylinder store clearly visible to all. A Medical Gas Compound Assessment tool is included at Appendix 4. Regular (annual) checks against the assessment must be made to ensure medical gas cylinder storage complies with the appropriate standards.

5.2 The store must provide adequate space to allow segregation of cylinders of different gases as well as full and empty cylinders. It must also be large enough to allow easy access for stock examination and cylinder rotation. Full cylinders must be used in strict rotation according to expiry dates and expired cylinders must be stored with empty cylinders awaiting collection by contractor. F size cylinders and larger must be stored upright and held by safety chains. E size cylinders and smaller must be stored horizontally on racks.

5.3 Cylinders in all clinical areas (wards or clinics), when not in use, must be stored on a secure trolley or suitable rack in a well ventilated “parking” area that will not block doorways or fire exits. A Storage Facilities Assessment Form is included at Appendix 5. Regular (annual) checks against the Assessment Form must be made to ensure medical gas storage complies with the appropriate guidance. Checks will be made by the Medical Devices Safety Officer or nominated deputy and will be reported to the Medicines Committee.

5.4 In the event of a fire the Emergency Services must be advised of the location of the cylinder store and/or cylinders in clinical settings by the responsible person for fire safety at the site.

5.5 In the case of clinics and settings outside of the three main hospital sites, the most senior clinical manager must consider the type of intervention being carried out and have emergency oxygen available if deemed necessary. The expiry date and quantity of gas in each cylinder must be checked weekly by the senior clinical manager, though they may delegate this task to another suitably trained member of staff if required.

6. HANDLING OF MEDICAL GAS CYLINDERS

6.1 All personnel handling medical gas cylinders must receive regular manual handling training in line with the statutory and mandatory training matrix and if porters are transporting cylinders they must complete the transportation of medical gas cylinders asection only via the online training provided by BOC

6.2 Cylinders must be handled with care, never knocked violently or allowed to fall over.

6.3 Large and medium sized cylinders must only be moved with the appropriate size and type of trolley. The cylinder valve must always be closed when moved.

6.4 When in use cylinders must be firmly secured to a suitable cylinder support or trolley.

6.5 Never roll cylinders along the ground as this may cause the valve to open accidently. It may also damage the integrity of the cylinder and cylinder label and paintwork.

7. Use of Medical Gas Cylinders

7.1 If a cylinder is found to be faulty (e.g. faulty valve operation, damaged valve outlet or minor leaks from valve) the cylinder must be isolated in the cylinder store and marked faulty and the supplier contacted for advice.

7.2 When using medical gas cylinders it is most important that no part of the cylinder valve or equipment is either lubricated or contaminated with oil or grease.

7.3 Before use ensure that:

- the correct cylinder is selected for the gas required and administration of the gas.
- the cylinder contents are checked to ensure that sufficient gas is available for the required use.
- the cylinder is in date.

7.4 The cylinder must be prepared for use as follows:

- if present, remove the disposable seal by pulling the tear tag and discard.
- check for signs of oil or grease on the cylinder valve. If present clean the cylinder valve and head gear before use.
- attach appropriate required tubing and/or administration equipment
- open the cylinder valve slowly by the handwheel.

7.5 Cylinders must be checked while in use to ensure that leaks of gas are not occurring, by listening for hissing sounds of escaping gas from any connections within the system. If leaks are suspected, tighten any connections and check for leaks again. If a leak persists, obtain a replacement cylinder and return the faulty cylinder to the medical gas contractor.

7.6 After use ensure that:

- the cylinder valve is closed immediately.
- equipment used to administer the gas is removed from the cylinder.
- cylinders are returned to the ward/clinic parking area designated for medical gas cylinders.

- a full for empty replacement of used or part used cylinders (with insufficient for further use) is arranged immediately.

8. PIPED MEDICAL GASES – MEDICAL OXYGEN ONLY

8.1 Medical Gas Pipeline Systems (MGPS) deliver medical gases directly to the patient's bedside from either a liquid gas container or from large medical gas cylinders attached to a manifold in a remote part of the site. Where a liquid gas container is used the container is known as a vacuum insulated evaporator (VIE) and uses the gradual warming and evaporating of the liquid gas to pressurise the MGPS and deliver the medical gas to the patient.

8.2 Guidance from the NPSA recommends that medical gas cylinder usage should be minimised in a ward environment and wherever possible MGPS should be used to deliver medical gases to patient's bedsides. However, comparatively low usage of medical gases within the Trust makes extension of MGPS unnecessary and unviable, though this must be kept under review by the Chief Pharmacist and Director of Estates.

8.3 MGPS is only available at the Royal South Hants Hospital to deliver oxygen from a liquid gas VIE.

8.4 The management and maintenance of MGPS can only be undertaken by designated staff that have undertaken specific training and hold the relevant qualifications. For the MGPS at the Royal South Hants Hospital, all duties, responsibilities relating to management and maintenance are delegated to the landlord (NHS Property Service)who have a duty to appoint an accredited Authorised Person (AP) and, therefore, outside of the remit of any Solent NHS Trust staff. The appropriate maintenance of the MGPS and delivery of medical oxygen of the correct quality to Solent NHS Trust patients on the Royal South Hants Hospital site must be included in the contract for the MGPS servicing

8.5 When either planned maintenance or emergency repair work is arranged on the MGPS, the Authorised Person the Approve for the work will contact the Designated Officer for Solent NHS Trust or their deputy for permission to an interruption to the MGPS supply. The Designated Officer will be the senior nurse on duty on the Royal South Hants Hospital site. The Designated Officer will be required to sign the permit to work on the MGPS, and will need to make alternative arrangements for administration of oxygen to patients (i.e. sufficient supply of medical gas cylinders). The Designated Officer will also be required to take certain actions in the event of an emergency, for example isolation of oxygen supply in the event of fire.

8.6 Specific regulations govern the siting of the VIE and the warming of the gas before it reaches the patients. Observance of these regulations falls within the remit of the accredited Authorised Person (AP) .

8.7 If for any reason the piped medical gas system is not working:
- Contact the Designated Officer (senior nurse) at the hospital who must then contact the Authorised Person for the MGPS or their nominated deputy.
- Use medical gas cylinders as described above until instructed to recommence using the piped medical gas system.

8.8 Even if piped oxygen is available at the patient's bedside, it is important that each ward has emergency cylinders of oxygen available for transporting patients and/or for use in areas where piped oxygen is not provided (e.g. treatment rooms).

8.9 Failure of the VIE will cause oxygen delivery to automatically switch to delivery from the manifold to which are attached large size oxygen cylinders. Repair or replacement of the VIE can then be arranged by staff of NHS Property Services.

9. Use of Medical Oxygen from the MGPS

9.1 To use medical oxygen for a patient in a bed served by the MGPS:
- insert the correct valve into the wall port.
- attach appropriate required tubing and/or administration equipment
- open the valve slowly by the handwheel.

9.2 The system of delivery of oxygen to the patient must be checked for leaks while in use, by listening for hissing sounds of escaping gas from any connections within the system. If leaks are suspected, tighten any connections and check for leaks again.

9.3 After use ensure that:
- the valve is closed immediately. It is important that delivery of oxygen ceases when no longer needed because to leave it running will be wasteful and present an increased fire risk.
- equipment used to administer the gas is removed from the wall port.

10. ORDERING OF MEDICAL OXYGEN FOR THE MGPS

10.1 Liquid oxygen is delivered to the VIE by the medical gas contractor according to an agreed timetable. Urgent additional supplies can be arranged if necessary. All arrangements for ordering are made by NHS Property Services.

11. PRESCRIBING AND ADMINISTERING MEDICAL GASES

11.1 Medical Oxygen

11.1.1 Oxygen is one of the most common medicines used in patient care. It is administered to patients across a range of specialties to provide oxygen to the lungs and thereby increase the availability of oxygen to the body tissues. If used appropriately, oxygen is life-saving and part of first-line treatment in many critical conditions. However, if used incorrectly it may cause serious harm or even death. The most common reasons for oxygen therapy include:
- Acute hypoxaemia (e.g. pneumonia, shock, asthma, heart failure, pulmonary embolus).
- Ischaemia (e.g. myocardial infarction, but only if associated with hypoxaemia).
- Abnormalities in quality or type of haemoglobin (e.g. acute gastrointestinal blood loss).
- Pneumothorax.

- Post operative state (general anaesthesia can lead to decrease in functional residual capacity with in the lungs resulting in hypoxaemia).
- Long term conditions

11.1.2 Oxygen must be prescribed in accordance with current British Thoracic Society guidelines. For the purposes of saving life, in an emergency, oxygen must always be given immediately and documented later.

11.1.3 **Oxygen Used in Emergency Situations**

a. When not prescribed but required in an emergency, practitioners who have undergone appropriate training in basic life support, may administer oxygen in accordance with the Solent NHS Trust Patient Group Direction (PGD) for Administration of Oxygen.
b. Oxygen administered in an emergency must be documented in the patient's notes alongside any other emergency treatment provided.
c. All patients who have had a cardiac or respiratory arrest should have 100% oxygen provided along with basic/advanced life support.
d. All peri-arrest and critically ill patients should be given 100% oxygen (15 l/min reservoir mask) whilst awaiting immediate medical review. Patients with COPD and other risk factors for hypercapnia who develop critical illness should have the same initial target saturations as other critically ill patients.

11.1.4 **Prescribing and Administering Oxygen**

a. Prescriptions for oxygen must be clearly written on the prescription chart indicating the target saturation required rather than the specific dose to be administered. The method of delivery must be specified and therapy will be given to achieve the saturation required.
b. A target saturation of 94-98% is used for most acutely unwell patients (>94% if aged 70 years old or more) or 88 –92% for those at risk of hypercapnic respiratory failure. Note that for patients of all ages, there may be transient dips in saturation levels during sleep to 84%. Patient's oxygen saturation must be recorded in the patient's notes. Guidance on identifying appropriate saturations for patients as provided by the British Thoracic Society is in Appendix 2.
c. Only appropriately trained practitioners can administer oxygen to patients.
d. Advice on the most appropriate delivery method for oxygen to patients is given at Appendix 3.
e. Before administering oxygen to a patient, the practitioner must confirm the identity of the gas by connecting to the correct wall port, or identifying the gas cylinder. If medical gas cylinders are used, the practitioner must also check the expiry date of the gas and ensure that adequate supplies of oxygen are available to maintain the flow rate prescribed.
f. Appropriate monitoring devices, including pulse oximetry, must be used to achieve the target saturation prescribed. All patients must have their oxygen saturation observed for at least 5 minutes after starting oxygen therapy and at regular intervals thereafter. Oxygen flow rate must be adjusted to keep within the target saturation range. Oxygen flow rates and saturation rates must be recorded on the bedside observation chart.
g. Any sudden change in oxygen saturation rates must be referred to a doctor, as must any deterioration in the patient's condition.
h. When oxygen is no longer required by a patient, it must be crossed off the prescription chart by the prescriber along with the date of discontinuation.

i. Accurate documentation of flow rates and target saturations achieved must be recorded in the patient's notes.

11.1.5 Precautions/Hazards/Complications of Oxygen Therapy

a. In patients with chronic carbon dioxide (CO_2) retention, oxygen administration may cause further increases in carbon dioxide and respiratory acidosis. This may occur in patients with COPD, neuromuscular disorders, morbid obesity or musculoskeletal disorders. There are several factors, which lead to the rise in CO_2 with oxygen therapy in patients with hypercapnic respiratory failure, and details are in the BTS guideline available at: http://www.brit-thoracic.org.uk/ClinicalInformation/EmergencyOxygen
b. Drying of nasal and pharyngeal mucosa
c. Oxygen toxicity
d. Absorption atelectasis
e. Skin irritation
f. Fire hazard (NB. Medical oxygen is highly dangerous in the presence of oils, greases, tarry substances and many plastics due to the risk of spontaneous combustion with high pressure gases. Therefore patients on medical oxygen who require an emollient should not use any paraffin based product

11.2 Medical Oxygen in the Patient's Own Home

11.2.1 Oxygen must not be supplied to patients for use in their own home from any of the Solent NHS Trust Hospital or community settings. If required for home treatment, medical oxygen is prescribed via the patient's GP and delivery is arranged directly via the community oxygen gas contractor.

11.2.2 Solent NHS Trust staff attending patients at home may provide advice on the safe and secure use of oxygen, if required, in line with information given within this policy. Further information can be obtained from the Trust's Medicines Management Team.

11.3 Entonox (Mixture of 50% Nitrous Oxide and 50% Oxygen)

11.3.1 Entonox is used exclusively for the relief of pain.

11.3.2 Nitrous Oxide begins to separate out from the gas mixture if the temperature falls below about -6°C. A homogenous mixture is again obtained when the temperature is raised to above 10°C and the cylinder is agitated. Therefore, before use, to ensure it is properly mixed, cylinders must be stored horizontally for 24 hours at a temperature above 10°C. If this is not practicable, before use the cylinders must be maintained at a temperature above 10°C for at least 2 hours and then completely inverted 3 times.

11.3.3 Entonox is highly dangerous when in contact with oils, greases, tarry substances and many plastics due to the risk of spontaneous combustion with high pressure gases.

11.3.4 While Entonox can be prescribed for patients, it is generally used in clinic areas where treatment causes short term moderate to severe pain. In such cases, suitably trained and authorised

practitioners administer Entenox under PGD. Administration of Entenox must be documented in the patient's notes.

11.3.5 Before a patient undergoes a procedure that might necessitate use of Entenox, it is important that the trained practitioner responsible for administration checks that there is a sufficient amount of gas in the cylinder to provide analgesia throughout.

11.3.6 Entonox is self-administered by the patient and so it is important to ensure the patient understands how the apparatus works to produce analgesia. The dose required for analgesia depends on the amount of gas inhaled. Its effects are apparent within four to five breaths reaching maximum effect within about two to three minutes of inhaling the gas.

11.3.7 The gas flow stops when the patient removes the mouthpiece or mask. Overdosing does not occur since continued administration leads to light anaesthesia, causing the mask or mouthpiece to drop away as the patient relaxes.

11.3.8 Administration of Entonox must be documented in patient's notes.

11.4 **Medical Air**

11.4.1 Like atmospheric air, Medical Air contains 21% oxygen. It is used:
- in anaesthesia as a carrier gas for volatile anaesthetic agents.
- as a power source for pneumatic equipment.

11.4.2 While it is medical product, medical air does not require a prescription for it to be used. However, only practitioners trained to give volatile anaesthesia or trained to use equipment powered by medical air (e.g. nebulisers) may use medical air. Its use must be documented in the patient's notes.

11.4.3 Medical air is usually administered from medical gas cylinders via self-contained or compressed air line breathing apparatus ending in a face mask for delivery to the patient.

11.4.4 Medical air is contra-indicated when oxygen or other gaseous combinations are required. Utmost care must be taken to avoid using medical air when oxygen has been prescribed.

11.5 **Cryogenic Liquids**

11.5.1 Cryogenic liquids used within the Trust are:-
- Liquid Nitrogen – nitrogen gas from the atmosphere cooled to below its boiling point of -196°C. Liquid nitrogen can only be kept in specially designed vacuum insulated containers (dewars) for it to remain in liquid form.
- Nitrous oxide – nitrous oxide within the CryOmega II device which, when activated, provides a small amount of liquid nitrous oxide at -89°C in a pen device ready for administration.

11.5.2 Liquid nitrogen is available from the contracted cryogenic liquid supplier delivered according to a pre-agreed schedule. Delivery will require access of the liquid nitrogen dewar at the roadside in

order to allow direct topping up from the vacuum insulated container on the delivery vehicle. Nitrous oxide pens are available pre-loaded directly from the suppliers.

11.5.3 Nitrous oxide devices may be stored with no particular constraints in their pre-activated state. The liquid nitrogen dewar must be stored in a well-ventilated secure area and must only be accessed by persons trained in handling and using cryogenic gases.

11.5.4 Extreme care must be taken when handling cryogenic liquids. There are two main hazards with their use:-

a. Cold burns or frostbite when they come into contact with skin or mucous membranes.

b. Asphyxiation due to high concentrations and the displacement of oxygen in the atmosphere.

In the event of exposure of anyone to either of these effects, prompt medical attention is required. Personal Protective Equipment (PPE – loose fitting cryogenic gloves, eye goggles or full face shield, appropriate closed shoes) must be worn when handling or transferring liquid nitrogen.

11.5.5 Nitrous oxide devices come ready to use (other than for activation) and no transfer of liquid is required prior to use. Liquid nitrogen will require transfer from its storage dewar into an administration device, which is similarly insulated, prior to use. Transfer must only be performed by staff trained in handling liquid nitrogen and who have the appropriate personal protective equipment.

11.5.6 There is no requirement for cryogenic liquids to be prescribed, but their use must be in accordance with the Solent Trust Patient Group Direction for the appropriate product and must be fully documented in the patient's notes. Patient assessment and administration of the cryogenic liquid must only be undertaken by practitioners trained in the use of these liquids and who are fully aware of the risks.

11.5.7 Liquid nitrogen remaining in the vessel at the end of the clinic must be allowed to evaporate from the container. It must never be poured out of the container.

11.5.8 Requests to supply cryogenic liquids from outside the Trust (e.g. by GP surgeries) must be declined, but information on suppliers can be provided.

12. MEDICAL GAS COMMITTEE

12.1 NPSA Alert (NPSA/2009/RRR006 Oxygen Safety in Hospitals) recommended that all NHS Trusts must constitute a multidisciplinary group (such as a Medical Gas Committee) to be responsible for reviewing oxygen related incidents, developing a local oxygen policy and a training programme. The administration of oxygen covers many different disciplines and it is vital that action plans are jointly developed.

12.2 As a community and mental health based Trust, the use of oxygen therapy is of a different scale to that of an acute trust, and is largely only used in the rare emergency situation. It has been agreed, therefore, that the multi-disciplinary group for the Trust will be the Medicines Committee, who will have a standing item on their agenda for any matters relating to medical gases.

12.3 Via the Medicines Committee, incidents relating to medical gas use will be monitored and assessed and if necessary action plans drawn up.

13. ROLES AND RESPONSIBILITIES

13.1 The Chief Executive has overall responsibility for the strategic and operational management of the organisation, including ensuring all policies are adhered to.

13.2 The Chief Operating Officers, Chief Medical Officer and Chief Nurse and the Operational Directors, on behalf of the Chief Executive, will ensure that clinicians and their practice comply with this policy.

13.3 The Assurance Committee (Board Committee) is responsible for ratifying this policy and ensuring it represents best practice and is based on current evidenced based information.

13.4 Service managers and modern matrons will ensure that:

- The policy is available to all employees for whom they are responsible, who handle medical gases.
- Employees are supported in the identification of training and development needs and have access to training on medical gases if required.
- Staff involved in any aspect of medical gas use understand their responsibilities and are competent to undertake those responsibilities.
- Facilities and equipment are available to promote safe use of medical gases and are maintained to the required standards.
- Risk assessments are undertaken for using medical gases.
- Systems for reporting incidents and accidents involving medical gases, routine audit, review of adverse events and patient complaints are in place.

13.5 The responsibility for monitoring this policy and advising on best and current evidenced-base practice is primarily vested in the Chief Pharmacist.

13.6 All staff who handle or use medical gases must:

- Comply with this policy.
- Follow all information, instruction and training provided.
- Use equipment safely and appropriately.
- Take an active role in promoting safety both to the recipients of gas therapy and other members of staff.
- Report all incidents, accidents or “near misses” in accordance with the Incident Reporting Policy.

13.7 It must be recognised that compliance with this policy does not override any individual responsibility of healthcare workers to ensure that:

- Their practice complies with current legislation.
- They follow guidance issued by the Department of Health, professional bodies (e.g. Nursing and Midwifery Council, General Pharmaceutical Council) or other government departments such as the Home Office.
- They manage the risks to patients.

14. TRAINING

14.1 Under the Health and Safety at Work Act 1974 it is the responsibility of employers to train their employees on the recommended safeguards relating to products and equipment used at work. With regards to medical gases training must be provided in the following areas:

- Explanation of medical gases, their properties and their clinical uses
- Administration of medical gases
- Medical gas cylinders identification and labelling
- Cylinder storage and handling
- Dealing with faulty cylinders and other equipment
- Fire and explosion risk associated with medical gases
- Practical use of cylinders
- MGPS and associated equipment, including flow meters
- Training in the handling of cryogenic liquids (if appropriate for role)

14.2 Training on the use and transportation of medical gas cylinders is provided by access to online training provided by BOC (medical gas contractor) which is arranged through and supported by the Trusts Learning and Development Department. The two modules for this training meet National criteria and can be accessed via the e-learning catalogue on individual's e-learning home page. Other training on specific elements on the safe use of medical gases is arranged by service managers via the Learning and Development Department and the usual application process. Attendance of staff at training must be recorded and monitored by service managers.

14.3 Though the responsibility for training staff to act as Authorised Person for the MGPS remains with their employer), Solent NHS Trust must ensure that the MGPS is being maintained by competent and suitably trained and qualified staff via suitable clauses within the contract between the two Trusts.

14.4 Staff require to be explicitly authorised by their line manager to carry out specific roles with medical gases and this must be reflected in the job description of the individual.

14.5 All supervisory staff shall be vigilant for signs that may indicate abuse or diversion of medical gases or equipment and take appropriate action or discuss with their manager. Additional advice can be sought from the Chief Pharmacist in the first instance.

14.6 All medical gas training must be recorded on the Organisational Learning Module database against individual staff records.

15. EQUALITY & DIVERSITY AND MENTAL CAPACITY ACT

15.1 For the Equality & Impact and Mental Health Assessment conducted in relation to this policy refer to the Equality Impact Assessment Form (Appendix 1). There is no negative impact on any patient group or staff group as this policy is to ensure equality of practice across the organisation.

16. SUCCESS CRITERIA AND MONITORING POLICY EFFECTIVENESS

16.1 The responsibility for monitoring this policy will be vested in the Chief Pharmacist.

16.2 The effectiveness of this policy will be reviewed by the Medicines Committee under the agenda item of Medical Gases and will be discussed prior to the stipulated review timeframe at the Medicines Committee meeting. Details of these discussions will be documented in the minutes.

16.3 The policy will also be monitored through various other methods including adverse incident reporting, significant event review and other medicines management audits.

16.4 The Assurance Committee will be responsible for overseeing risk management and clinical or corporate governance issues.

16.5 The annual assessment of the internal and external gas storage compounds, areas will be collated and reviewed at appropriate groups, committees

16.6 Regular (annual) checks against the Assessment Form must be made to ensure medical gas storage complies with the appropriate guidance. Checks will be made by the Medical Devices Safety Officer or nominated deputy and will be reported to the Medicines Committee.

17. REVIEW

17.1 This document may be reviewed at any time at the request of either at staff side or management, but will automatically be reviewed 3 years from initial approval and thereafter on a triennial basis unless organisational changes, legislation, guidance or non-compliance prompt an earlier review.

18. REFERENCES AND LINKS TO OTHER DOCUMENTS

NPSA Rapid Response Report NSSA/2009/RRR006 Oxygen Safety in Hospitals
DH Estates and Facilities Division (2006) Health Technical Memorandum 02-01 Medical Gas Pipeline Systems Part A and B
BOC Medical booklet - Gas Safe - with Medical Gases
BOC Medical Gas Data Sheet for Medical Oxygen
BOC Entonox Data Sheet
BOC Medical Air Data Sheet
Health and Safety Executive leaflet – Take Care with Oxygen HSE8 Reprinted 2/08
British Thoracic Society Guidelines for Emergency Oxygen Use in Adult Patients, 2008, reviewed 2011
BOC Care with Cryogenics Leaflet
BOC Liquid Nitrogen Safety Data Sheet
BOC Liquid Oxygen Safety Data Sheet
Health and Safety at Work Act 1974
Unsecured medical gas cylinders, including cylinders on trolleys EFA/2010/008 July 2010
Medicines Amendment Orders relating to Patient Group Directions (2000) Medicines Policy
Resuscitation Policy
Specific Patient Group Directions
Non-medical Prescribing Policy
Relevant Health and Safety policies, e.g. COSHH
Arrangements for dealing with Drug Alerts and Medicines Recall Procedures
The Palliative Care Handbook, latest edition
Medicines Purchasing for Safety Procedure

APPENDIX 1 – Equality Impact Assessment Form

Step 1 – Scoping, identify the policy's aims	Answer
1. What are the main aims and objectives of the policy?	To put in place measures for Solent NHS Trust to ensure the safe use of medical gases and to reduce any risks associated with each gas. It thereby provides direction on ensuring access to medical gas treatment to all patients when required.
2. Who will be affected by it?	All staff employed directly and indirectly by the organisation whose work involves them in any way with ordering, prescribing, dispensing, supplying, transporting and administering medical gases.
3. What are the existing performance indicators / measures for this? What are the outcomes you want to achieve?	That all staff refer to the policy and follow all the principles it contains with regard to the use and handling of medical gases. Furthermore, that the policy is used as a framework for more detailed local service standard operating procedures that relate to medical gases.
4. What information do you already have on the equality impact of this policy?	None
5. Are there demographic changes or trends locally to be considered?	No
6. What other information do you need?	None

Step 2 – Assessing the impact, consider the data and research	Yes	No	Answer (Evidence)
1. Could the policy be used unlawfully against any group?		X	This policy is to ensure equality of access to medical gases when needed across the organisation in a safe and effective manner. It applies equally to all groups.
2. Can any group benefit or be excluded?		X	This policy specifies the safe and effective use of medical gases equally to all groups, albeit that some requirements are specific to certain care settings, e.g. in community nursing, sexual health.
3. Can any group be denied fair and equal access to treatment as a result of this policy?		X	This policy specifies the safe and effective use of medical gases equally to all groups, albeit that some requirements are specific to certain care

			settings, e.g. in community nursing, sexual health.
4. Can this policy actively promote good relations with and between different groups?	X		All groups are treated equally within the policy and gives opportunity for shared training and learning.
5. Have you carried out any consultation internally / externally with relevant individual groups?		X	Not necessary.
6. Have you used a variety of different methods of consultation / involvement?		X	Not necessary.
7. Mental Capacity Act implications?		X	Does not involve individual patients directly.
8. Will this policy require a decision to be made by or about a service user? (Refer to the Mental Capacity Act policy for further information)		X	Does not involve individual patients directly.

If there is no negative impact – end Impact Assessment here.

APPENDIX 2 – Guidance on Giving Oxygen and Oxygen Saturation Levels

Emergency Oxygen Use in Adult Patients:

Table 1 Critical illnesses requiring high levels of supplemental oxygen

Table 1 Critical illnesses requiring high levels of supplemental oxygen (see section 8.10)

- The initial oxygen therapy is a reservoir mask at 15 l/min.
- Once stable, reduce the oxygen dose and aim for target saturation range of 94–98%
- If oximetry is unavailable, continue to use a reservoir mask until definitive treatment is available.
- Patients with COPD and other risk factors for hypercapnia who develop critical illness should have the same initial target saturations as other critically ill patients pending the results of blood gas measurements, after which these patients may need controlled oxygen therapy or supported ventilation if there is severe hypoxaemia and/or hypercapnia with respiratory acidosis.

	Additional comments	Grade of recommendation
Cardiac arrest or resuscitation	Use bag-valve mask during active resuscitation Aim for maximum possible oxygen saturation until the patient is stable	Grade D
Shock, sepsis, major trauma, near-drowning, anaphylaxis, major pulmonary haemorrhage	Also give specific treatment for the underlying condition	Grade D
Major head injury	Early intubation and ventilation if comatose	Grade D
Carbon monoxide poisoning	Give as much oxygen as possible using a bag-valve mask or reservoir mask. Check carboxyhaemoglobin levels A normal or high oximetry reading should be disregarded because saturation monitors cannot differentiate between carboxyhaemoglobin and oxyhaemoglobin owing to their similar absorbances. The blood gas Pa_{O_2} will also be normal in these cases (despite the presence of tissue hypoxia)	Grade C

COPD, chronic obstructive pulmonary disease; Pa_{O_2}, arterial oxygen tension.

Emergency Oxygen Use in Adult Patients:

Table 2 Serious illnesses requiring moderate levels of supplemental oxygen if the patient is hypoxaemic

Table 2 Serious illnesses requiring moderate levels of supplemental oxygen if the patient is hypoxaemic (section 8.11)

- The initial oxygen therapy is nasal cannulae at 2–6 l/min (preferably) or simple face mask at 5–10 l/min unless stated otherwise.
- For patients not at risk of hypercapnic respiratory failure who have saturation <85%, treatment should be commenced with a reservoir mask at 10–15 l/min.
- The recommended initial oxygen saturation target range is 94–98%.
- If oximetry is not available, give oxygen as above until oximetry or blood gas results are available.
- Change to reservoir mask if the desired saturation range cannot be maintained with nasal cannulae or simple face mask (and ensure that the patient is assessed by senior medical staff).
- If these patients have co-existing COPD or other risk factors for hypercapnic respiratory failure, aim at a saturation of 88–92% pending blood gas results but adjust to 94–98% if the $Paco_2$ is normal (unless there is a history of previous hypercapnic respiratory failure requiring NIV or IPPV) and recheck blood gases after 30–60 min.

	Additional comments	Grade of recommendation
Acute hypoxaemia (cause not yet diagnosed)	Reservoir mask at 10–15 l/min if initial Spo_2 <85%, otherwise nasal cannulae or simple face mask Patients requiring reservoir mask therapy need urgent clinical assessment by senior staff	Grade D
Acute asthma		Grade C
Pneumonia		Grade C
Lung cancer		Grade C
Postoperative breathlessness	Management depends on underlying cause	Grade D
Acute heart failure	Consider CPAP or NIV in cases of pulmonary oedema	Grade D
Pulmonary embolism	Most patients with minor pulmonary embolism are not hypoxaemic and do not require oxygen therapy	Grade D
Pleural effusions	Most patients with pleural effusions are not hypoxaemic. If hypoxaemic, treat by draining the effusion as well as giving oxygen therapy	Grade D
Pneumothorax	Needs aspiration or drainage if the patient is hypoxaemic. Most patients with pneumothorax are not hypoxaemic and do not require oxygen therapy Use a reservoir mask at 10–15 l/min if admitted for observation. Aim at 100% saturation (oxygen accelerates clearance of pneumothorax if drainage is not required)	Grades C and D
Deterioration of lung fibrosis or other interstitial lung disease	Reservoir mask at 10–15 l/min if initial Spo_2 <85%, otherwise nasal cannulae or simple face mask	Grade D
Severe anaemia	The main issue is to correct the anaemia Most anaemic patients do not require oxygen therapy	Grades B and D
Sickle cell crisis	Requires oxygen only if hypoxaemic (below the above target ranges or below what is known to be normal for the individual patient) Low oxygen tension will aggravate sickling	Grade B

COPD, chronic obstructive pulmonary disease; CPAP, continuous positive airway pressure; IPPV, intermittent positive pressure ventilation; NIV, non-invasive ventilation; $Paco_2$, arterial carbon dioxide tension; Spo_2, arterial oxygen saturation measured by pulse oximetry.

Emergency Oxygen Use in Adult Patients:

Table 3 Patients requiring controlled or low-dose oxygen therapy

Table 3 COPD and other conditions requiring controlled or low-dose oxygen therapy (section 8.12)

- Prior to availability of blood gases, use a 28% Venturi mask at 4 l/min and aim for an oxygen saturation of 88–92% for patients with risk factors for hypercapnia but no prior history of respiratory acidosis. **[Grade D]**
- Adjust target range to 94–98% if the $Paco_2$ is normal (unless there is a history of previous NIV or IPPV) and recheck blood gases after 30–60 min **[Grade D]**
- Aim at a prespecified saturation range (from alert card) in patients with a history of previous respiratory acidosis. These patients may have their own Venturi mask. In the absence of an oxygen alert card but with a history of previous respiratory failure (use of NIV or IPPV), treatment should be commenced using a 28% oxygen mask at 4 l/min in prehospital care or a 24% Venturi mask at 2–4 l/min in hospital settings with an initial target saturation of 88–92% pending urgent blood gas results. **[Grade D]**
- If the saturation remains below 88% in prehospital care despite a 28% Venturi mask, change to nasal cannulae at 2–6 l/min or a simple mask at 5 l/min with target saturation of 88–92%. All at-risk patients with alert cards, previous NIV or IPPV or with saturation <88% in the ambulance should be treated as a high priority. Alert the A&E department that the patient requires immediate senior assessment on arrival at the hospital. **[Grade D]**
- If the diagnosis is unknown, patients aged >50 years who are long-term smokers with a history of chronic breathlessness on minor exertion such as walking on level ground and no other known cause of breathlessness should be treated as if having COPD for the purposes of this guideline. Patients with COPD may also use terms such as chronic bronchitis and emphysema to describe their condition but may sometimes mistakenly use "asthma". FEV_1 should be measured on arrival in hospital if possible and should be measured at least once before discharge from hospital in all cases of suspected COPD. **[Grade D]**
- Patients with a significant likelihood of severe COPD or other illness that may cause hypercapnic respiratory failure should be triaged as very urgent and blood gases should be measured on arrival in hospital. **[Grade D]**
- Blood gases should be rechecked after 30–60 min (or if there is clinical deterioration) even if the initial $Paco_2$ measurement was normal. **[Grade D]**
- If the $Paco_2$ is raised but pH is ⩾7.35 ($[H^+]$ ⩽45 nmol/l), the patient has probably got long-standing hypercapnia; maintain target range of 88–92% for these patients. Blood gases should be repeated at 30–60 min to check for rising $Paco_2$ or falling pH. **[Grade D]**
- If the patient is hypercapnic ($Paco_2$ >6 kPa or 45 mm Hg) and acidotic (pH <7.35 or $[H^+]$ >45 nmol/l) consider non-invasive ventilation, especially if acidosis has persisted for more than 30 min despite appropriate therapy. **[Grade A]**

	Additional comments	Grade of recommendation
COPD	May need lower range if acidotic or if known to be very sensitive to oxygen therapy. Ideally use alert cards to guide treatment based on previous blood gas results. Increase flow by 50% if respiratory rate is >30 (see recommendation 32)	Grade C
Exacerbation of CF	Admit to regional CF centre if possible; if not, discuss with regional centre or manage according to protocol agreed with regional CF centre	Grade D
	Ideally use alert cards to guide therapy. Increase flow by 50% if respiratory rate is >30 (see recommendation 32)	
Chronic neuromuscular disorders	May require ventilatory support. Risk of hypercapnic respiratory failure	Grade D
Chest wall disorders	For acute neuromuscular disorders and subacute conditions such as Guillain-Barré syndrome (see table 4)	Grade D
Morbid obesity		Grade D

CF, cystic fibrosis; COPD, chronic obstructive pulmonary disease; CPAP, continuous positive airway pressure; IPPV, intermittent positive pressure ventilation; NIV, non-invasive ventilation; $Paco_2$, arterial carbon dioxide tension; Spo_2, arterial oxygen saturation measured by pulse oximetry.

Emergency Oxygen Use in Adult Patients:

Table 4 Conditions for which oxygen is not required unless the patient is hypoxaemic

Table 4 Conditions for which patients should be monitored closely but oxygen therapy is not required unless the patient is hypoxaemic (section 8.13)

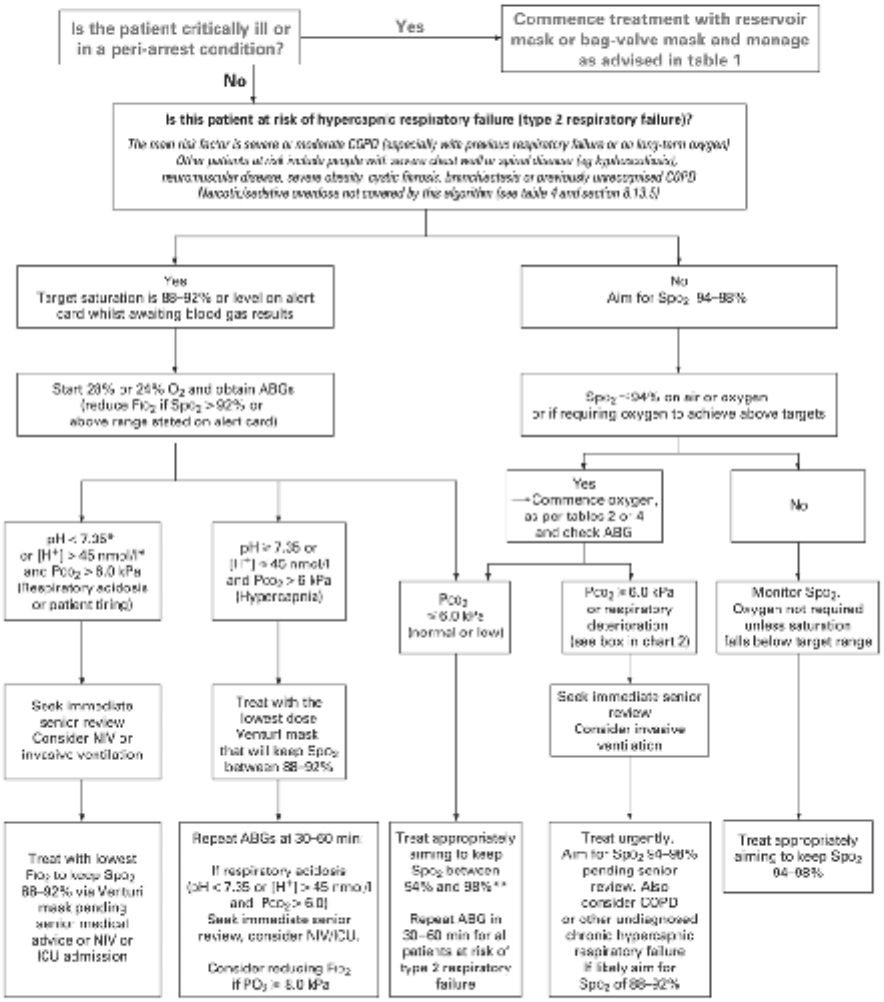
- If hypoxaemic, the initial oxygen therapy is nasal cannulae at 2–6 l/min or simple face mask at 5–10 l/min unless saturation is <85% (use reservoir mask) or if at risk from hypercapnia (see below).
- The recommended initial target saturation range, unless stated otherwise, is 94–98%
- If oximetry is not available, give oxygen as above until oximetry or blood gas results are available
- If patients have COPD or other risk factors for hypercapnic respiratory failure, aim at a saturation of 88–92% pending blood gas results but adjust to 94–98% if the $Paco_2$ is normal (unless there is a history of respiratory failure requiring NIV or IPPV) and recheck blood gases after 30–60 min

	Additional comments	Grade of recommendation
Myocardial infarction and acute coronary syndromes	Most patients with acute coronary artery syndromes are not hypoxaemic and the benefits/harms of oxygen therapy are unknown in such cases	Grade D
Stroke	Most stroke patients are not hypoxaemic. Oxygen therapy may be harmful for non-hypoxaemic patients with mild to moderate strokes.	Grade B
Pregnancy and obstetric emergencies	Oxygen therapy may be harmful to the fetus if the mother is not hypoxaemic (see recommendations 14–17)	Grades A–D
Hyperventilation or dysfunctional breathing	Exclude organic illness. Patients with pure hyperventilation due to anxiety or panic attacks are unlikely to require oxygen therapy	Grade C
	Rebreathing from a paper bag may cause hypoxaemia and is not recommended	
Most poisonings and drug overdoses (see table 1 for carbon monoxide poisoning)	Hypoxaemia is more likely with respiratory depressant drugs, give antidote if available (eg, naloxone for opiate poisoning)	Grade D
	Check blood gases to exclude hypercapnia if a respiratory depressant drug has been taken. Avoid high blood oxygen levels in cases of acid aspiration as there is theoretical evidence that oxygen may be harmful in this condition	
	Monitor all potentially serious cases of poisoning in a level 2 or level 3 environment (high dependency unit or ICU)	
Poisoning with paraquat or bleomycin	Patients with paraquat poisoning or bleomycin lung injury may be harmed by supplemental oxygen	Grade C
	Avoid oxygen unless the patient is hypoxaemic	
	Target saturation is 88–92%	
Metabolic and renal disorders	Most do not need oxygen (tachypnoea may be due to acidosis in these patients)	Grade D
Acute and subacute neurological and muscular conditions producing muscle weakness	These patients may require ventilatory support and they need careful monitoring which includes spirometry. If the patient's oxygen level falls below the target saturation, they need urgent blood gas measurements and are likely to need ventilatory support	Grade C

COPD, chronic obstructive pulmonary disease; ICU, intensive care unit; IPPV, intermittent positive pressure ventilation; NIV, non-invasive ventilation; $Paco_2$, arterial carbon dioxide tension; Spo_2, arterial oxygen saturation measured by pulse oximetry.

Emergency Oxygen Use in Adult Patients:

Chart 1 Oxygen prescription for acutely hypoxaemic patients in hospital



Any increase in Fio_2 must be followed by repeat ABGs in 1 h (or sooner if conscious level deteriorates)
*If pH is < 7.35 ([H+] > 45 nmol/l) with normal or low $Pacc_2$, investigate and treat for metabolic acidosis and keep Spo_2 94–98%
**Patients previously requiring NIV or IPPV should have a target range of 88–92%, even if the initial $Pacc_2$ is normal.

Figure 1 Chart 1: Oxygen prescription for acutely hypoxaemic patients in hospital. ABG, arterial blood gas; COPD, chronic obstructive pulmonary disease; Fio_2, fraction of inspired oxygen; ICU, intensive care unit; NIV, non-invasive ventilation; Pco_2, carbon dioxide tension; Spo_2, arterial oxygen saturation measured by pulse oximetry.

Emergency Oxygen Use in Adult Patients:

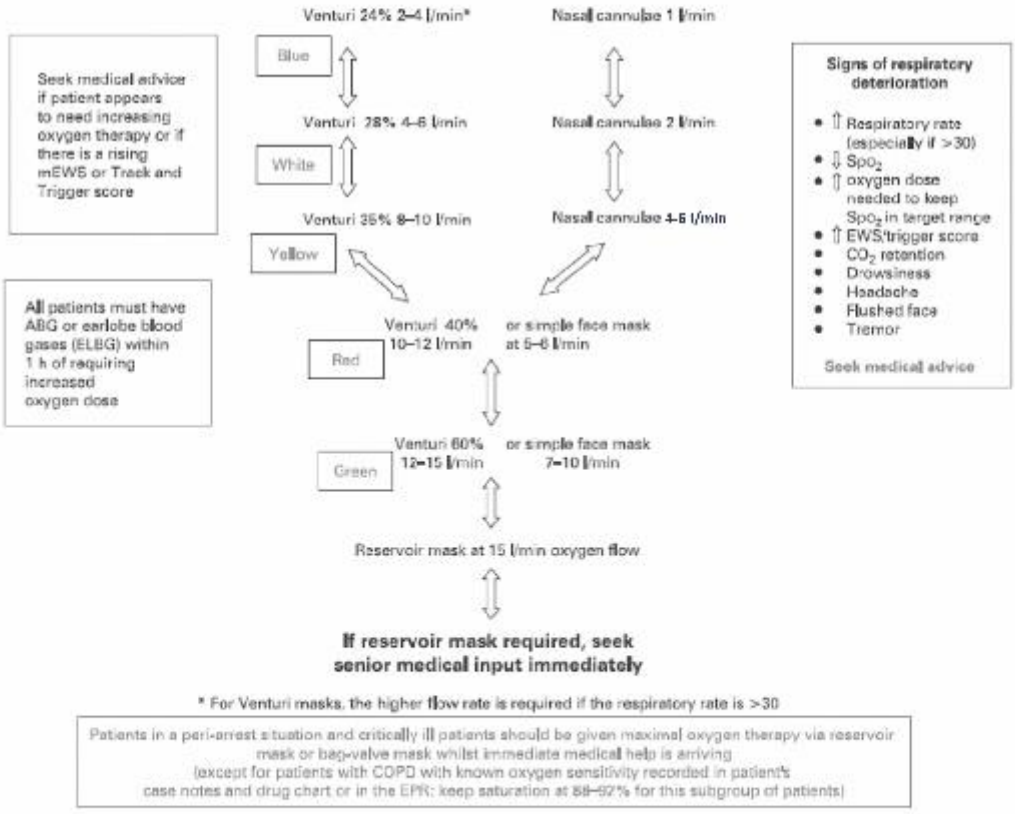
Chart 2 Flow chart for oxygen administration on general wards in hospitals

See patient's drug chart and chart 1 and tables 1–4 for starting dose and target saturation

Choose the most suitable delivery system and flow rate

Titrate oxygen up or down to maintain the target oxygen saturation.

The table below shows available options for stepping dosage up or down. The chart does not imply any equivalence of dose between Venturi masks and nasal cannulae.
Allow at least 5 minutes at each dose before adjusting further upwards or downwards (except with major and sudden fall in saturation).
Once your patient has adequate and stable saturation on minimal oxygen dose, consider discontinuation of oxygen therapy.



* For Venturi masks, the higher flow rate is required if the respiratory rate is >30

Patients in a peri-arrest situation and critically ill patients should be given maximal oxygen therapy via reservoir mask or bag-valve mask whilst immediate medical help is arriving
(except for patients with COPD with known oxygen sensitivity recorded in patient's case notes and drug chart or in the EPR: keep saturation at 88–92% for this subgroup of patients)

Figure 2 Chart 2: Flow chart for oxygen administration on general wards in hospitals. ABG, arterial blood gas; EPR, electronic patient record; EWS, Early Warning Score; Spo_2, arterial oxygen saturation measured by pulse oximetry.

APPENDIX 3 – Oxygen Administration Systems

a. Nasal Cannulae

DEVICE	DESCRIPTION	PURPOSE
Nasal Cannulae 	Nasal cannulae consist of pair of tubes about 2cm long, each projecting into the nostril and stemming from a tube which passes over the ears and which is thus self-retaining. **Uncontrolled oxygen therapy** 	Cannulae are preferred to masks by most patients. They have the advantage of not interfering with feeding and are not as inconvenient as masks during coughing and sneezing. It is not advisable to assume what percent oxygen (FI02) the patient is receiving according to the Litres delivered but this is not important if the patient is in the correct target range.

ACTION	RATIONALE
1. (When using nasal cannula). Position the tips of the cannula in the patient's nose so that the tips do not extend more than 1.5cm into the nose.	Overlong tubing is uncomfortable, which may make the patient reject the procedure. Sore nasal mucosa can result from pressure or friction of tubing that is too long.
2. Place tubing over the ears and under the chin as shown above. Educate patient re prevention of pressure areas on the back of the ear.	To allow optimum comfort for the patient. To prevent pressure sores.
3. Adjust flow rate, usually 2-4 l/min but may vary from 1-6 l/min in some circumstances.	Set the flow rate to achieve the desired target oxygen saturation.

b. Fixed Performance Mask (Venturi Mask and Valve)

DEVICE	DESCRIPTION	PURPOSE
Venturi mask 	A mask incorporating a device to enable a fixed concentration of oxygen to be delivered independent of patient factors or fit to the face or flow rate. Oxygen is forced out through a small hole causing a Venturi effect which enables air to mix with oxygen. **Controlled oxygen therapy**	This is a high performance oxygen mask designed to deliver a specified oxygen concentration regardless of breathing rate or tidal volume. **Venturi devices come in different colours for %** Blue = 24% White = 28% Yellow = 35% Red = 40% Green = 60%

ACTION	RATIONALE
1. (When using Venturi mask) Connect the mask to the appropriate Venturi barrel attached firmly into the mask inlet.	To ensure that patient receives the correct concentration of oxygen
2. Fasten oxygen tubing securely.	Correctly secured tubing is comfortable and prevents displacement of mask/cannulae.
3. Assess the patient's condition and functioning of equipment at regular intervals according to care plan.	To ensure patient's safety and that oxygen is being administered as prescribed.
4. Adjust flow rate. The minimum flow rate is indicated on the mask or packet. The flow should be doubled if the patient has a respiratory rate above 30 per minute.	Higher flows are required for patients with rapid respiration and high inspiratory flow rates. This does not affect the concentration of oxygen but allows the gas flow rate to match the patient's breathing pattern.

c. Simple Facemask (variable flow)

DEVICE	DESCRIPTION	PURPOSE
	Mask has a soft plastic face piece, vent holes are provided to allow air to escape. Maximum 50%-60% at 15ltrs/minute flow.	This is a variable performance device. The oxygen concentration delivered will be influenced by**:** **a.** the oxygen flow rate (litres per minute) used, leakage between the mask and face. **b.** the patient's tidal volume and breathing rate.
Simple face mask Variable Percentage (Delivers unpredictable concentrations that vary with flow rate) *Nasal cannulae should be used for most patients who require medium dose oxygen but a simple face mask may be used due to patient preference or if the nose is blocked*	**Uncontrolled Oxygen therapy**	**NOT to be used for CO_2 retaining patients.**

ACTION	RATIONALE
1. (If using simple face mask) Gently place mask over the patient's face, position the strap behind the head or the loops over the ears then carefully pull both ends through the front of the mask until secure.	Ensure a comfortable fit and delivery of prescribed oxygen is maintained.
2. Check that strap is not across ears and if necessary insert padding between the strap and head.	To prevent irritation.
Adjust the oxygen flow rate. Must never be below 5L/min	Flows below 5L/m do not give enough oxygen and may cause increased resistance to breathing and may also cause CO2 re-breathing due to the small mask size.

d. Reservoir Mask (non-rebreathe mask)

DEVICE	DESCRIPTION	PURPOSE
Reservoir Mask **(Non-rebreathe Mask)** 	Mask has a soft plastic face piece with flap-valve exhalation ports which may be removed for emergency air-intake. There is also a one-way valve between the face mask and reservoir bag. **Uncontrolled oxygen therapy**	In non re-breathing systems the oxygen may be stored in the reservoir bag during exhalation by means of a one-way valve. High concentrations of oxygen 80-90% can be achieved at relatively low flow rates. **NOT to be used for C02 retaining patients except in life-threatening emergencies such as cardiac arrest or major trauma.**

ACTION	RATIONALE
1. (Non Rebreathe Reservoir Mask) Ensure the reservoir bag is inflated before placing mask on patient, this can be maintained by using 10-15 litres of oxygen per min.	To ensure the optimal flow of oxygen to the patient.
2. Adjust the oxygen flow to the prescribed rate.	Inadequate flow rates may result in administration of inadequate oxygen concentration to the patient.

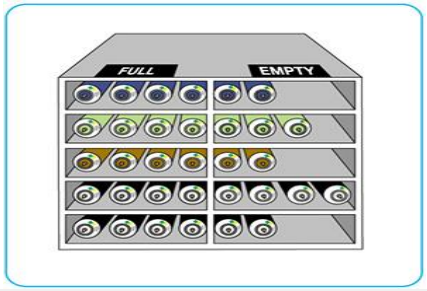
Appendix 4 - Storage and handling of medical gas cylinders survey 2014

Solent NHS Trust Estates Medical Gas Compound Assessment

Location :	**Date :**	**Name :** **Signature :**
Main Storage construction		**Comments**
under cover	**Yes / No**	
stand alone building	**Yes / No**	
inside / attached to building	**Yes / No**	
hard standing	**Yes / No**	
floor should be essentially level	**Yes / No**	
ventilated (high and/ or low level vents)	**Yes / No**	
adequate lighting	**Yes / No**	
warning notices posted prohibiting smoking and naked lights within the vicinity of the store	**Yes / No**	
lockable	**Yes / No**	

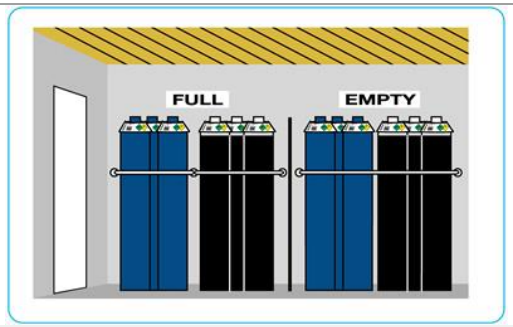
Storage and handling of medical gas cylinders survey 2014

Solent NHS Trust Estates Medical Gas Compound Assessment

Fire extinguisher provided either within the store or at a convenient place nearby	**Yes / No**	
Fire detection within the store	**Yes / No**	
Means of raising an alarm (Fire call points) either within the store or at a convenient place nearby	**Yes / No**	
Inside storage compound area		**Comments**
allow for F, HX, G and J size cylinders to be stored vertically (chained)	**Yes / No**	
allow for C, CD, D and E size cylinders to be stored horizontally on shelves (made of a material that will not damage the surface of the cylinders) 	**Yes / No**	
allow for segregation of full and empty cylinders and permit separation of different gases within the store	**Yes / No**	

Storage and handling of medical gas cylinders survey 2014

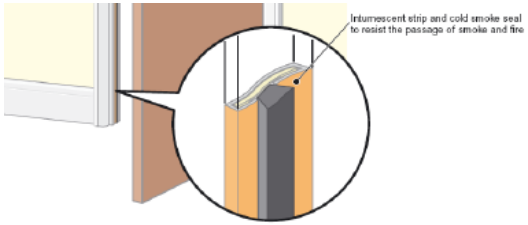
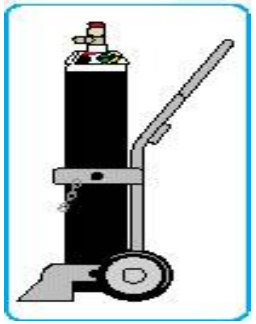
Solent NHS Trust Estates Medical Gas Compound Assessment

		
is the store free from clutter (I.e. equipment etc) and other combustible materials	**Yes / No**	
should be No non medical gases, flammable liquids, combustible materials or sources of ignition	**Yes / No**	

Appendix 5 - Storage and handling of medical gas cylinders survey 2014

Solent NHS Trust Internal ready to use storage facilities assessment

Location :	**Date :**	**Name :** **Signature :**
Ready to use stores/ Local storage (wards etc) Handling/ storage inside buildings		
Signage denoting the gases within displayed on the store door	**Yes / No**	
Housekeeping “clean and tidy ease of access/ egress”	**Yes / No**	
Sufficient space to manoeuvre onto and of trolleys	**Yes / No**	
Door Locked	**Yes / No**	
Cylinders secured to the wall either by hook/chain, braced or secured onto trolley	**Yes / No**	
Full cylinders only (No empty)	**Yes / No**	

FD 30 Fire Door 	**Yes / No**	
Fire detection within storage area	**Yes / No**	
Local storage (non specific storage area i.e. Corridors etc) **Is a cylinders support system used?**		**Comments**
Trolley with chained cylinders 	**Yes / No** **N/A**	
Hooks attached to wall and cylinders chained	**Yes / No** **N/A**	
If answered No to the above two questions then please write in the comment box how they are stored		

Appendix 6. – Glossary

BNF- British National Formulary (latest addition available at http://www.evidence.nhs.uk/formulary/bnf/current

MHRA- Medicines and Healthcare products Regulatory Agency is an agency of the Department of Health.

NMC- Nursing and Midwifery Council (UK)

NPSA- National Patient Safety Agency, whose responsibilities passed to the NHS Commissioning Board Special Health Authority on 1st June 2012.