1. **PURPOSE**

To endure the safe and compliant use of medical gases across Southern Health NHS Foundation Trust (the Trust) this document sets out how this will be achieved so the Trust can meet the compliance standards. It describe the measures necessary to ensure the safe use of medical gases and reduce risk associated with each Gas. To ensure all staff understand their responsibilities when handling Medical Gases and as a response to NPSA Alert (NPSA/2009/RRR006 Oxygen Safety in Hospitals).

This document should be read in conjunction with policy

SH NCP 65 Medical Gas and Medical Gas Pipeline Systems (MGPS)

SH CP 30 Medical Emergencies and Resuscitation

SH CP 1 Medicines Control, Administration and Prescribing (MCAPP)

SH NCP 22 Security Management Procedure

2. **INTRODUCTION**

The Trust currently uses medical gases as an adjunct to the provision of care in all areas of the Trust. This incorporates Emergency, inpatient and community settings.

3. **SCOPE**

This is for the use of any Contracted or trust staff in a clinical area using medical gases. To include Allied Health professional Porters and Nurses.
This procedure is to be used in conjunction with essential training accessible via LEaD when identified by a Training Needs Assessment. This includes the safe use of medical gases in hospitals and community clinical and other areas where staff are delivering care. The procedure does not cover the storage or delivery of the medical gases prior to delivery to the clinical area. This procedure does not cover actions required in the event of a cylinder being damaged or a leak being suspected.

4. DEFINITIONS

The Trust (Southern Health NHS Foundation Trust) classifies a medical Gas as:

‘A gas in any form intended for administration to a patient by any route’.

5. TRAINING

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 should be provided in the following areas:

- Explanation of medical gases, their delivery to patients, properties and their clinical uses
- Medical gas cylinders identification and labelling
- Cylinder storage and handling
- Fire and explosion risk associated with medical gases
- Practical use of cylinders
- Medical gas pipeline outlet systems

E Learning will be provided Via the LMS in association with E assessment. This training will be logged centrally so managers can manage compliance.
6. RESPONSIBILITIES

Quality Innovation and Development forum (QID)
Has the responsibility to ensure the Trust meets all statutory requirements and ensures the safe usage of medical gases. And receive reports on compliance and assurance from the Medical Gas Committee.

Medical Gases Committee
Provide a multiple disciplinary group to oversee the safe use of medical gases, their management and use and provide assurance to the Quality innovation and Development form and direction for the Trust staff.

The Authorised Person for medical gases
Report to the Medical Gases Committee on External Quality Assurance Compliance. Monitor quality assurance in their divisions, hold responsibility for ensuring External Quality Assurance are contemporaneous.

Staff Managers
Inform staff when they need to undertake training to use gases and support this ensuring that e learning and competence is undertaken. Maintain records of training and user manuals for audit.

LEaD
Provide E Learning and ensure the Training Needs Analysis (TNA) is appropriate and the competence required is clear.

Clinical and Ancillary Staff
Under take Learning and competence when required by their manager. To undertake internal and external Quality Assurance as per the requirements of the policy. Report concerns appropriately regarding the equipment.

7. SPECIFIC PROCEDURE
Please see your local guidelines for information on storage, ordering, transportation and clinical delivery
Pulmonary function medical gases have local management guidelines and advice on these can be obtained from the Authorised Person.
MEDICAL GASES IN CYLINDERS

For many settings in the Trust, medical gases are provided in cylinders that are stored and transported to the area of use when required, for example oxygen cylinders used in emergency situations.

The larger sizes of medical gas cylinders are very heavy and have been reported to cause patient entrapment by falling. An alert was issued in July 2010 informing organisations of these risks - EFA/2010/008 (Unsecured medical gas cylinders, including cylinders on trolleys). If it is necessary to use a large gas cylinder at the bedside then extra care must be taken to ensure that the patient cannot use the cylinder as a support when moving or rising from the bed e.g. by placing the trolley handle away from the patient.

It is acceptable to use G-size and above gas cylinders in manifold rooms.

Situations where larger cylinders are required should be risk assessed with regards the situation.

ORDERING MEDICAL GASES AND INVENTORY CONTROL

Inventory control and management of medical gases will be managed at a local level and over seen by the Authorised Person

Medical gas cylinders belong to the contracted supplier and are rented by the Trust.

The frequency of ordering depends on the amount used but should be frequent enough to ensure adequate supplies are always available.

Management of the cylinders must be maintained to ensure the segregation of empty and full cylinders and the expiry dates.
STORAGE OF MEDICAL GAS CYLINDERS

Medical gas 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. Advice can be sought from the Authorised person (AP).

Cylinders should be stored under cover, preferably inside, in a dry, clean secure lockable area not subjected to extremes of heat or cold.

Cylinders must not be stored near stocks of combustible materials or near sources of heat.

Warning notices prohibiting smoking and naked lights must be posted at the cylinder store that is clearly visible to all.

The storage area 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 should be used in strict rotation according to expiry dates.

Cylinders with less than 3 months expiry should be returned to the supplier along with empty containers.

F size cylinders and larger should be stored in an upright manner by the use of safety chains.

E size cylinders and smaller should be stored horizontally on racks designated cylinder holders.

Gas cylinders must always be firmly secured and never left unsupported.

Cylinders in a clinical area (ward or unit) must be stored on a secure trolley or suitable rack in a well ventilated “parking” area that will not block doorways or fire exits.

In the event of an emergency the Emergency services should be advised of the location of the cylinder store by the responsible person for fire safety at the site.
HANDLING MEDICAL GAS CYLINDERS

All personnel handling medical gas cylinder must receive regular manual handling training in line with the statutory and mandatory training matrix.

Personnel moving cylinders should be aware of the hazards of moving cylinders and wear appropriate Personal Protective Equipment (PPE).

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

Cylinders should only be moved with the appropriate size and type of trolley.

When cylinders are moved with apparatus attached, the cylinder valve should always be closed.

When in use cylinders should be firmly secured to a suitable cylinder support.

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

USE OF CYLINDERS

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.

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.

Special care is needed with the use of hand creams as these could provide sufficient contamination to the medical cylinder valve surface when handling the cylinder to cause an ignition when the valve is turned on.

- Before use ensure that:
- the correct cylinder is selected for the application and where a regulator is required, check that the cylinder product and filling pressure are compatible with the selected regulator
- only correctly designed valve spindle keys are used to open the cylinder valve
• the cylinder contents are checked to ensure that sufficient gas is available for the required use (contents may be determined by reading the gas regulator pressure gauge) the cylinder is in date

The cylinder should be prepared for use as follows:

• Remove the disposable seal by pulling the tear tag and discard
• For cylinder fitted with bullnose outlet valves, remove the cap from the valve outlet by pulling forward and leaving to one side
• For cylinders fitted with pin-index valves, remove the disposable seal and outlet clip and discard
• Check for signs of oil or grease on the cylinder valve. If either is discovered do not use
• Check that the regulator or equipment to be attached to the cylinder is appropriate for the cylinder to be used
• Ensure that the regulator or equipment to be attached to the cylinder is also free of oil or grease
• Check that the ‘o’ ring or sealing washer is in good condition. Replace it if shows any signs of wear or damage
• Only reasonable force should be used to attach a regulator to the cylinder. Never use excessive force as this may damage the valve outlet threads
• Open the cylinder valve slowly with a standard valve key or handwheel. Fully open the valve and then close a quarter turn to enable subsequent users to distinguish between and open and closed valve
• Leave the spindle key in the valve so that it may be closed in an emergency
• Ensure that the equipment operating instructions are available. Cylinders should be checked regularly whilst in use to ensure that they have sufficient content and that leaks do not occur

Checks must be made to avoid leaks of gas while using gas cylinders. The procedure for checking is as follows:

• Listen for hissing sound from cylinder connections
• Close the cylinder valve and verify the leak by noting any fall in the regulator pressure gauge reading
• Tighten connections and check for leaks again
• If a leak is still present, do not attempt to use sealing or jointing compounds to stop leak but notify the supplier as soon as possible to obtain advice. Do not use the cylinder
After use ensure that:

- the cylinder valve is closed immediately, using a correctly designed cylinder valve key with moderate force only
- that excess gas from the equipment regulator and connecting hoses are vented by opening the equipment flow control valves for a few seconds
- after venting, the control valves are closed
- the equipment connectors are removed from the cylinder using the correct tool or manually
- on cylinders fitted with bullnose valves, the valve outlet protection is replaced to protect the valve outlet from contamination
- the cylinder valve is closed
- all empty cylinders are returned to the appropriate place in the cylinder store

PIPED MEDICAL GASES

Recent guidance from NHS National Patient Safety Agency has stated that the use of oxygen cylinders in a ward environment should be minimised and wherever possible piped oxygen should be provided. Guidance for planning piped oxygen must be in accordance with HTM 02-01 Part A and B.

All personnel handling or responsible for medical gas manifold equipment must ensure they are familiar with the operating and safety procedures laid down in the manufacturer’s user manual. They must have undertaken the training outlined in Section 2.

The procedures for handling and storage of medical gas cylinders used with manifold equipment for piped gases is the same as listed above for medical gas cylinders.

Only personnel trained in the use of cylinders in the manifold room are allowed to enter the room and replace the large cylinders used for supplying piped medical gases.

When supplying cylinders to the manifold room, ensure that:

- the pipeline connections are leak tested when connecting to cylinders, using an approved leak test solution
any separate emergency cylinders are full and available for use and that they are checked and stock rotated on a regular basis

- the manifold room is not used as a general cylinder store
- all empty cylinders are removed immediately from the manifold room and returned to the empty cylinder storage area of the main cylinder store

Where cylinder manifolds are used it is important to ensure that:

- adequate training is given to all personnel involved in pipeline operations
- written procedures are readily available giving details of operating instructions and actions to be taken in the event of a gas supply failure or maintenance shutdown
- at maintenance shutdown, written warnings are given to all persons responsible for gas supplies in line with the “Permit to Work” system and this must be done with the Estates Department
- in the event of an emergency failure, all hospital departments are advised verbally as an immediate priority

For automatic changeover manifolds ensure that:

- all cylinder valves on both banks are open at all times (with the exception of the emergency standby cylinders)
- as soon as the running bank cylinders are empty and the manifold changeover has taken place, close the cylinder valves and replace with full cylinders
- open the cylinder valves on the reserve bank and complete leak checks

For manual changeover manifolds ensure that:

- the cylinder valves on the running bank are open
- the cylinder valves on the reserved bank are closed
- as soon as the running bank cylinders are empty, open the valves on the reserve bank and manually changeover the manifold
- the empty cylinders on the now empty bank are replaced
- the connections are leak tested and the cylinder valves then left closed

Liquid Oxygen (Cryogenic liquid)

- Piped oxygen can be supplied from a stainless steel vessel containing liquid oxygen
This source of oxygen is connected to the piped line system and has its dedicated control panel for monitoring purposes.

Liquid oxygen vessels are refilled by the gas provider at frequent intervals to ensure a constant supply of oxygen.

Caution must be taken to avoid the following possible health hazards associated with liquid oxygen:

- **Effects of cold on lungs**
  Transient exposure to very cold gas can provoke an attack of asthma in susceptible subjects. Prolonged breathing of extremely cold gas may damage lung tissue.

- **Cold burns and frostbite**
  Because of the low temperature of liquid gases, the liquid, cold vapour or gas can produce damage to the skin. Unprotected parts of the skin coming in contact with uninsulated items of cold equipment may also stick fast to them and the flesh may be torn on removal.

- **If for any reason hospital personnel are involved in handling or connecting liquid oxygen to the pipe line system personal protective equipment must be available.**

- **Should a spill or splash of liquid oxygen occur prompt medical attention must be obtained.**

If for any reason work needs to be undertaken that affects the piped medical gas system, a “Permit to Work” systems must be used and this must be done with the Estates Department.

If for any reason the piped medical gas system is not working:

- **Contact the Designated Officer (Medical or Nursing) at the hospital or unit responsible for piped medical gases**

- **Use medical gas cylinders as described above until instructed to recommence using the piped medical gas system.**

**TYPES OF MEDICAL GASES USED IN THE TRUST SETTINGS**

**Medical Oxygen**

Oxygen is one of the most common medicines used in hospital settings. 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.

**Care and Handling of Oxygen Cylinders and their Regulators**
- All staff involved with medical oxygen should be fully trained in the use of cylinders and the attachment of regulators as well as the fire risks associated with oxygen
- Ensure hands are clean before handling oxygen cylinders due to the risk of combustion from oils and grease. In particularly, make sure that hands are adequately dried after the use of alcohol gels
- Clean clothing, free from oil and easily combustible contaminants should be worn when handling oxygen cylinders
- Make sure that the oxygen cylinder outlet and oxygen regulator inlet are clean before attaching a regulator. Always open the cylinder slowly and check for leaks. Close cylinder valves when not in use
- When using medical oxygen cylinders ensure adequate ventilation. If clothing becomes impregnated with oxygen (due to leak) keep away from sources of ignition or open flames. Clothing impregnated with oxygen should be ventilated in fresh air for a minimum of 15 minutes
- Although the risks are small, there is a potential for burns to hands and face if hand creams or other petroleum based lotions are used on patients receiving oxygen therapy

**Prescribing Oxygen**
- Oxygen should be prescribed in accordance with current British Thoracic Society guidelines. For the purposes of saving life, in an emergency, oxygen should always be given immediately and documented later. Prescriptions for oxygen must be clearly written on the prescription chart indicating the dose to be administered, the method of delivery and the target saturation required
- 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

**Administering Oxygen to Patients**
- Only appropriately trained practitioners should administer oxygen to patients
Before administering oxygen to a patient, the practitioner must confirm the identity of the gas, check the expiry date of the gas and ensure adequate supplies of oxygen are available to maintain the flow rate prescribed.

Care must be taken to avoid confusing oxygen with medical compressed air.

Air flowmeters should be removed from wall outlets when not in regular use.

Appropriate monitoring and flow rate devices including pulse oximetry must be used to achieve the target saturation prescribed.

Practitioners must regularly monitor saturation levels and adjust flow rates to keep within the target saturation range.

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

**Emergency Oxygen Cylinders**

- Even if piped oxygen is available at the patient’s bedside, it is important that each hospital has emergency cylinders of oxygen available for transporting patients and/or for use in areas where piped oxygen is not provided.

- Community Clinics should consider the type of intervention being carried out and following a risk assessment have emergency oxygen available if necessary. If emergency oxygen is required the service should have written guidelines for its use in place.

- The expiry date and quantity of gas in each cylinder must be checked daily and always immediately before the start of clinics. Within community hospitals this is the responsibility of the Clinical Lead who may delegate it to a suitably trained person. Within community clinics and other units this is the responsibility of the service lead who may delegate it to a suitably trained person.

**Oxygen in Patient’s Own Home**

- Oxygen may be supplied to patients for use in their own home.

- This can be prescribed by specialist qualified staff. All patients should then be referred to the local HOSAR team.

- THE TRUST nurses who attend patients at home should provide advice on the safe use of oxygen if required and will carry out a patient risk assessment.

- Safety guidelines for patients in their own homes are available from the Medicines Management Team.
Entonox (Mixture of 50% Nitrous Oxide and 50% Oxygen)

Entonox is used exclusively for the relief of pain.

Care and Handling of Entonox Cylinders

- Nitrous Oxide begins to separate out from Entonox 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.
- Before use, to ensure it is properly mixed, cylinders should 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 or placed in warm water at body temperature for 5 minutes and then completely inverted 3 times.
- Entonox is non-flammable but strongly supports combustion (including some materials which do not normally burn in air).
- 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.

Prescribing Entonox

- Legally Entonox is a medical product but unlike oxygen, it does not require a prescription by a medical practitioner before it can be used.
- Only trained practitioners may use Entonox and its use must be documented in the patient’s notes.

Dosage and Administration of Entonox

- Before a patient uses Entonox, it is important that the trained practitioner responsible for administration checks that there is an appropriate amount of gas in the cylinder to provide analgesia throughout the proposed procedure.
- Since Entonox is self-administered it is important to ensure the patient understand 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.
- 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.
• Administration of Entonox must be documented in patient’s notes

9.3 Medical Air

Like atmospheric air, Medical Air contains 21% oxygen. It is used:
• as a replacement for atmospheric air when the atmosphere is contaminated by noxious fumes, vapours or gases
• in anaesthesia as a carrier gas for volatile anaesthetic agents
• as a power source for pneumatic equipment
• in ventilators and incubators to provide uncontaminated and controlled air flows

Prescribing Medical Air
• Legally Medical Air is a medical product but unlike oxygen, it does not require a prescription by a medical practitioner before it can be used
• Only trained practitioners may use Medical Air and its use must be documented in the patient’s notes

Care and Handling of Medical Air Cylinders
• The guidance in section 6.0 regarding the handling of medical gases should be followed when handling Medical Air cylinders

Dosage and Administration of Medical Air
• For breathing purposes, medical air is administered by various means, commonly by self-contained or compressed air line breathing apparatus
• In anaesthesia, medical air is administered from a cylinder and valve assembly or pipeline through a face mask or endotracheal tube
• 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
• To protect against medical air being used instead of oxygen, medical air flow meters should be removed from the wall outlet when not in regular use

Liquid Nitrogen
Nitrogen is a normal constituent of the atmosphere making up about 80% of the air we breathe. When cooled to below its boiling point (-196°C) gaseous nitrogen can be condensed to a liquid. It will remain in this form provided it remains below this temperature. On rapid warming the vapour may be briefly visible as a white mist.
Ordering Liquid Nitrogen
Liquid nitrogen is ordered from a supplier of cryogenic gases. The liquid gas is delivered by the supplier and transferred to a special storage cylinder which maintains the temperature required to keep the gas in the liquid form.

Storage of Liquid Nitrogen
Liquid nitrogen must only be stored in containers designed for storing cryogenic liquids. It must be stored in a well-ventilated secure area that is only accessible by persons trained in the proper handling of liquid nitrogen.

Care and Handling Liquid Nitrogen
There are two main hazards associated with liquid nitrogen:
- Cold burns or frostbite when in contact with the skin or respiratory tract
- Asphyxiation due to high concentrations, and the displacement of oxygen in the atmosphere. Breathing a pure nitrogen atmosphere will produce immediate loss of consciousness and almost immediate death
Therefore, when handling liquid nitrogen, utmost care must be taken to reduce the risk of these two hazards. Personal Protective Equipment (PPE) must always be used when handling or using liquid nitrogen.

Types of PPE:
- Loose fitting non-absorbent leather gloves must be worn when transferring liquid nitrogen from one container to another
- Eye goggles or a full face-shield must be used to protect the eyes and face
- Splash resistant aprons must be worn to protect from spillage onto clothing
- Appropriate shoes must be worn to protect feet

Should a spill or splash of liquid nitrogen occur prompt medical attention must be obtained.

Transfer of Liquid Nitrogen into Containers for Use in Clinics
Only personnel trained in the safe handling of liquid nitrogen may be involved in the transfer of the product from the main storage vessel into special Dewar containers that are used in clinical areas. To preserve the liquid state of the gas, liquid nitrogen should only be decanted into these specially designed vessels. These containers must be visually inspected each time they are refilled.
and any defects must be reported to the appropriate manager. When transported to the clinical area, the dewar container of liquid nitrogen must be placed in a safe place until required.

**Use of Liquid Nitrogen in Clinics**

Liquid nitrogen must only be used by healthcare professionals trained in the appropriate use of the product and who are fully aware of the hazards associated with the product.

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.

**Offsite Use of Liquid Nitrogen**

When liquid nitrogen is required for use in GP surgeries, arrangements must be made by the surgery with a commercial supplier. It must not be provided by the Trust unit or hospital.

**MONITORING ARRANGEMENTS**

Monitoring arrangements should be managed locally.

**INTERNAL AND EXTERNAL REFERENCES**

**Internal References**

- Medicines policy
- Incident reporting policy
- Infection control policy
- Medical Gas and medical gas pipeline policy.

**External References**

- BTS Oxygen Guidelines for emergency, adult, Domiciliary.
- The Resuscitation council
- Marsden
### CHANGE HISTORY

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