Medical Gas and Medical Gas Pipeline Systems (MGPS) Policy

Version 3

Summary: This document covers the use of medical gas and medical gas pipeline systems (MGPS) in Southern Health NHS Foundation Trust and associated buildings.

Keywords (minimum of 5): (To assist policy search engine) Medical Gas, Medical Gas Pipeline System (MGPS), Oxygen, Entonox, Gas Cylinders.

Target Audience: All staff that use medical gas and/or medical gas pipeline systems (MGPS).

Next Review Date: October 2022

Approved & Ratified by: Medicines Management Committee

Date of meeting: 7 September 2016

Date issued: October 2016

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Accountable Executive Lead: Paula Anderson, Finance Director
# Version Control

## Change Record

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## Reviewers/contributors

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Medical Gas and Medical Gas Pipeline Systems (MGPS)

1. Introduction

Southern Health NHS Foundation Trust recognises that it has a responsibility to provide a safe environment for all patients, staff and visitors.

This policy is to ensure the effective management of medical gas systems within Southern Health Foundation Trust. This includes the provision of a safe, secure and reliable system, including cylinders and associated equipment.

This policy is intended to be used by all staff involved in the use, handling and maintenance of medical gas systems and cylinders.

The policy addresses the provision of a piped medical gas pipeline system (MGPS) at the following locations:

- Lymington Hospital (AP and AE provided by landlord)
- Petersfield Community Hospital
- Romsey Community Hospital

The MGPS provides safe, convenient and cost effective supply of medical gases to points where these gases can be used by clinical and nursing staff for patient care.

Southern Health NHS Foundation Trust recognises its commitment to maintaining the MGPS to required standards and the training of all personnel associated with its operation.

Safe operation of a MGPS relies on competent staff who understand the system and who can liaise with clinical users to ensure continued patient safety.

Pipeline systems contain gas under pressure, which can present a hazard to patients, staff and visitors.

The key to safe operational management is the availability of comprehensive installation drawings and maintenance manuals.

Engineering Health technical Memorandum (HTM’s) give comprehensive advice and guidance on the design, installation and operation of specialised building and engineering technology used in the delivery to healthcare. In the case of MGPS this guidance is found in:

Health Technical Memorandum 02-01: Medical Gas Pipeline Systems.

Part A: Design, Installation. Validation and Verification
Part B: Operational Management
2. Aims

Key personnel have a functional responsibility to ensure that the MGPS is managed and operated safely and efficiently. In this document the job function is referred to rather than the name of staff carrying out the function. Lists of staff and their functional responsibilities are provided in Appendix 1 of this document.

With the exception of The Authorising Engineer and Competent Person (MGPS), the titles and roles listed refer in the main to directly employed hospital staff. In all cases a defined responsibility in connection with MGPS forms only part of their normal duties.

Due to the specialist requirements associated with MGPS, actual work on the systems is carried out by contractors who are trained and licensed to work on the systems as Competent Persons (MGPS).

Identified Authorised Persons (MGPS) are responsible for the day to day management of the MGPS and it is the Authorised Person (MGPS) alone who can decide whether the MGPS can be taken into or out of use, after written permission (permit to work) by the Designated Medical/Nursing Officer in cases where the effect has a direct impact on the patient.

The Authorised Person(s) (MGPS) will hold and maintain the Medical Gas Permit to work books.

3. Scope

The Policy is intended for use by all staff and contractors involved with medical gas and medical gas pipeline systems in Southern Health NHS Foundation Trust.

It applies throughout the premises to all fixed medical gas pipeline systems, associated plant, portable cylinders and suction units.

Compressed gas and vacuum supplies to general engineering workshops and dental department, pathology department equipment are separate from the general MGPS, and are not included in this policy, although the general principles in this document should be followed for these departments.

MGPS terminal units define the limits of Estates’ responsibility in this policy. Equipment connected to the terminal units is not covered by this policy other that where its mode of use may affect system operation or safety.

Medical equipment is the responsibility of the Estates Department through the BCAS Biomed Contract.

Medical gases should be not used for non-medical purposes other than as a test gas for medical equipment.

Medical air should be used as the power source for ventilators; the routine use of oxygen as a driving gas is to be avoided.

Management responsibility for all Trust premises containing MGPS resides with the estates department.

It is the trusts policy that, before work on the MGPS can commence; a permit-to-work form arranged by an Authorised Person (MGPG) must be completed. The Authorised
Person must have specific site knowledge of the MGPS on which they take responsibility and liaise with other permit signatories Competent Person (CP); Quality Controller (QC); Designed Medical Officer (DMO) or Designated Nursing Officer (DNO).

The Trust will co-operate and assist co-ordination of its medical gas activities with the Facilities Service provider (Intersperse) at Lymington Hospital PFI. It is the responsibility of the Trust to provide an Authorised person (MGPS) support to the Facilities Service Provider.

4. Definitions

The following abbreviations are found in the text of the document:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tbody>
<tr>
<td>AE</td>
<td>Authorising Engineer</td>
</tr>
<tr>
<td>AGSS</td>
<td>Anaesthetic Gas Scavenging System</td>
</tr>
<tr>
<td>AP</td>
<td>Authorised Person</td>
</tr>
<tr>
<td>AVSU</td>
<td>Area Valve Service Unit</td>
</tr>
<tr>
<td>CP</td>
<td>Competent Person</td>
</tr>
<tr>
<td>CPAP</td>
<td>Continuous Positive Airway Pressure</td>
</tr>
<tr>
<td>DMO</td>
<td>Designated Medical Officer</td>
</tr>
<tr>
<td>DNO</td>
<td>Designated Nursing Officer</td>
</tr>
<tr>
<td>HTM</td>
<td>Health Technical Memorandum</td>
</tr>
<tr>
<td>IHEEM</td>
<td>Institute of Healthcare Engineering and Estates Management</td>
</tr>
<tr>
<td>LVA</td>
<td>Line Valve Assembly</td>
</tr>
<tr>
<td>MGPS</td>
<td>Medical Gas Pipeline System</td>
</tr>
<tr>
<td>QC</td>
<td>Quality Controller</td>
</tr>
<tr>
<td>TU</td>
<td>Terminal Unit</td>
</tr>
<tr>
<td>VIE</td>
<td>Vacuum-insulated cryogenic storage vessel</td>
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**MGPS System Management**

The Medical Gas Pipeline System (MGPS) for Southern Health Foundation Trust compromises of the source of supply, pipeline distribution system, terminal units and warning/alarm systems installed to ensure cost effective and convenient distribution of medical gases to European Pharmacopoeia (Ph Eur) quality, for the use of clinical and nursing staff in the provision of patient care.

The Medical Gases provided in this way comprise: Anaesthetic Gas Scavenger System (AGSS), Carbon Dioxide (CO₂), Entonox (50%/50% O₂/N₂O), Medical Air (MA), Medical Vacuum (Med Vac), Nitrous Oxide (N₂O), Oxygen(O₂) and Surgical Air (SA).

This policy does not include any equipment attached to the Terminal Units for clinical use.

System drawings and plant schedules are maintained by the AP’s and retained in the estates department.

It is essential that staff with a day to day operational responsibility of MGPS have site specific knowledge of plant, systems and procedures.

The Authorised Person (MGPS) and Pharmacy hold the responsibility of maintaining record drawings and documentation.

5. Duties / Responsibilities

The following are the key personnel who have specific responsibilities within the operational policy.
• Chef Executive
• Head of Estates and Facilities
• Authorised Engineer (MGPS)
• Authorised Person (MGPS)
• Competent Person (CP)
• Designated Porter (MGPS)
• Quality Controller (QC(MGPS))
• Designated Medical or Nursing Officer (DMO/DNO (MGPS))
• All staff who use medical gases and medical gas pipeline systems

Chief Executive
The Chief Executive holds ultimate management responsibility, including allocation of resources and the appointment of personnel, for the Organisation in which the MGPS are installed.

The formal responsibility for the MGPS rests with the Chief Executive, although the Authorised Person (MGPS) retains effective responsibility for day-to-day management of the MGPS.

Head of Estates and Facilities/Maintenance Manager
The Director of Estates and Facilities delegates the day-to-day operational aspects of the MGPS to the Authorised Person.

Authorising Engineer (MGPS)
An Authorising Engineer (MGPS) is appointed by the Trust from the national IHEEM database of registered Authorising Engineers (MGPS).

The role of the Authorising Engineer (MGPS) includes the following:
• To recommend to the Chief Executive those persons who, through individual assessment, are suitable to be Authorised Persons (MGPS);
• To ensure that all Authorised Persons (MGPS) have satisfactorily completed an appropriate training course and that all training is documented;
• To ensure that all Authorised Persons (MGPS) are re-assessed every three years and have attended a refresher or other training course prior to such re-assessment;
• To conduct an annual audit and review of the management systems of the MGPS including Permit to Work;
• To assist the Authorised Person (MGPS), Operational Policy and Procedures.

Authorised Person (MGPS)
The Authorised Person (MGPS) is defined as that person(s) designated by the Chief Executive to be responsible for the day-to-day management of the MGPS at a particular site or sites. This includes the issue of permits, the operation of the Permit to Work procedure, management of the system documentation and security and safe and effective maintenance and operation of the MGPS in accordance with Statutory requirements and other guidelines listed in section 12 of this document.

The Authorised Persons (MGPS) are appointed in writing by the Chief Executive on recommendation of the Authorising Engineer (MGPS), who has specialist knowledge of MGPS and is on national IHEEM register of Authorising Engineers (MGPS).

An individual assessment of the Authorised Persons (MGPS) will be carried out to ensure that the Officer is suitably qualified and experienced to fulfil the necessary
requirements. Re-assessment will be carried out every three years to ensure continuation of appointment.

Operating the Permits for the authorisation of work requires that fullest compliance of all staff and their acceptance and understanding of the individual responsibilities involved. The Authorised Persons (MGPS):

- Takes the lead on in co-ordinating the work, explaining fully the extent and duration of any disruption to the service.
- Ensures that all contractors’ "Competent Persons(MGPS)" follow the procedures set out in the Permit and carry out the work in accordance with Trust Estates policies. This will involve provision and updating of ‘As-fitted’ drawings, assessments of risk, preparation and assessment of method statements and checks on compliance of Contractors’ Health and Safety policies, training records, test, equipment etc.

The Authorised Person (MGPS) is responsible for ensuring that:
- All Designated Medical/Nursing Officers involved are advised of the estimated duration of the work and the interruption to the MGPA;
- All terminal units affected (out of service) will be identified on the permit to work and the relevant staff informed.

Due to the size of the Trust, a number of Authorised Persons may be appointed to ensure that all required duties are co-ordinated efficiently.

Authorised Persons (MGPS) are required to liaise closely with other professionals in various disciplines. Consequently the appointment will be made known in writing to all interested parties. The Authorised Person (MGPS) will have direct contact with the Quality Controller (QC(MGPS)), Users and other key personnel.

The Authorised Persons (MGPS) are responsible for ensuring that work is carried out only by approved specialist contractors, registered under ISO 9001 or ISO 13485, with scope of registration defined as design, installation, commissioning and maintenance of MGPS as appropriate.

**Competent Person (MGPS)**

The Competent Person (MGPS) is the specialist contractor/ contractor’s employee who carries out the work on the MGPS as directed by the Authorised Person (MGPS) in accordance with the MGPS Permit to Work procedures and appropriate Method Statements and Health and Safety policies submitted by the Contractor.

The Competent Person (MGPS) must have received appropriate training, by their employees, and must be on a list of Competent Persons (MGPS) held by the contractor and the Trust.

The specialist contractor is responsible for assessing the competence of his directly employed competent staff and maintaining a register of Competent Persons (MGPS). The register must be made available to an Authorised Person (MGPS) on request.

**Quality Controller (MGPS)**

It is the responsibility of the Chief Executive to appoint, in writing, on the recommendation of the Chief Pharmacist, a Quality Controller with MGPS responsibilities.

The persons designated as Quality Controllers (MGPS) are responsible for the quality control of the medical gases in accordance with the latest European Pharmacopoeia
and Manufacturers’ Product Licences. Companies supplying medical gases have their own product licences and Qualified Person who ensures the quality of gas delivered to site meets the specified criteria.

The Authorised Person (MGPS) will be responsible for liaising with the Quality Controller (MGPS) and organising attendance as required.

The Quality Controller (MGPS) must have received training on the verification and validation of MGPS and be familiar with the requirements of this operational policy. He/she must be on the national register of MGPS Quality Controllers.

**Designated Medical or Nursing Officer (MGPS)**
The Designated Medical/Nursing Officer (MGPS) is the person in each department (or covering a range of departments) with whom the Authorised Person (MGPS) liaises on any matters affecting the MGP. It is the Designated Medical or Nursing Officer (MGPS) who has ultimate responsibility to give authorising permission for a planned interruption to the supply.

It is essential that there is liaison between the Medical and Nursing staff that use the MGPS and the Authorised Person (MGPS) in order to ensure that the MGPS is appropriate to the needs of patient care.

The Designated Medical or Nursing Officer (MGPS) must give permission for any interruption to the MGPS that takes place and they must sign the appropriate parts of the Permit.

The Designated Medical or Nursing Officer (MGPS) is responsible for ensuring that all relevant staff are aware of the interruption to the MGPS and which terminal units cannot be used.

All Designated Medical or Nursing Officers (MGPS) must have received adequate training on the MGPS relevant to their departments and on the action to be taken in the event of an emergency.

**Designated Porter (MGPS)**
Portering staff trained in the handling of medical gas cylinders will be known as Designated Porters and will be responsible for delivery of cylinders to wards, plant rooms etc. No other persons should be involved in cylinder handling unless properly trained or supervised.

Connection of cylinders to manifold systems will be undertaken by the Designated Porter.

Exceptions include the use of a Competent Person to change cylinders, set up temporary cylinders stations, etc. during commissioning works, planned or emergency shutdowns and plant maintenance.

Connection of cylinders to patient-connected medical equipment will be carried out by appropriately trained nursing/theatre staff.

**All Staff**
Involved directly and indirectly in health care provision are responsible for ensuring the following:

- Decline to use or operate any medical gas system which they have not been adequately trained to use and/or do not feel competent and confident to operate.
- Use medical gases in a safe and effective manner in accordance with their intended use.
• Maintain ongoing records of their training in relation to medical gas and medical gas pipeline systems (MGPS) within their personal development portfolio
• Report any concerns relating to the safe usage of medical gas to their line manager.

6. Training Requirements

It is essential that personnel at all levels have a sound general knowledge of the principles, functions and safety of medical gas systems.

No person should operate medical gas systems or equipment unless they are properly trained or supervised.

All staff required to work with or carry out activities relating to the storage, use or transportation of medical gases will have undertaken and achieved competencies required as designated through their training needs analysis (TNA).

Southern Health NHS Foundation Trust must ensure that all estates/medical/nursing staff have received this training before using the medical gas systems and that refresher courses are arranged.

Induction training for any personnel who will be working with medical gases should include the essential elements of medical gas safety and emergency actions.

It is essential for the safety of patients that no person should operate, or work on, any part of the MGPS unless adequate trained or supervised.

Essential training and refresher training is specific to the functional responsibilities of the key personnel involved in the day to day operation, maintenance and use of the MGPS, all training must be documented.

It is the duty of departmental managers to ensure that all staff working with the MGPS are appropriately trained.

Guidance on training course content and learning outcomes is detailed in Health Technical Memorandum 02-01 Medical Gas Pipeline Systems Part B. Operational Management Section 7.

On completion of the initial training course the following table outlines intervals for further updated training requirements.

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<td>Every 3 Years</td>
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<tr>
<td>Competent Person</td>
<td>Every 3 Years</td>
<td>Every 3 Years</td>
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<td>Designated Medical Officer</td>
<td>Every 3 Years</td>
<td>Every 3 Years</td>
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<td>Designated Nursing Officer</td>
<td>Every 3 Years</td>
<td>Every 3 Years</td>
</tr>
<tr>
<td>Quality Controller</td>
<td>Every 5 Years</td>
<td>Every 5 Years</td>
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<td>Designated Porter</td>
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<td>Medicine Management Committee</td>
<td>Annually</td>
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<td>Training as per requirements</td>
<td>Compliance relevant to individual responsibilities</td>
<td>Departmental Managers Individuals to maintain own records</td>
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<td>Changes to Guidance</td>
<td>Report changes relevant to individual</td>
<td>Committee chairperson to collate</td>
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<td>Report on Incidents</td>
<td>Report from the Ulysses risk management system</td>
<td>Liaison Officer</td>
<td>Medicine Management Committee</td>
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<td>Audit report</td>
<td>Internal Audit</td>
<td>Medicine Management Committee</td>
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<tr>
<td>Documentation</td>
<td>Audit report</td>
<td>Authorising Engineer</td>
<td>Medicine Management Committee</td>
<td>Annually</td>
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8. Policy Review

The Medicine Management Committee reviews the content and monitors the application of the MGPS Operational Policy in line with recommendations given in Health Technical Memorandum (HTM) 02-01 Part B, the Health and Safety at Work Act, the Pressure System Safety Regulations and Regulations 5 of both the Workplace (health, safety and welfare) Regulations 1992, and The Provision & Use of Work Equipment Regulations 1998 (PUWER). The Committee will also consider requirements of the NHS Spec C11 for new design requirements.

9. Associated Documents

- SH CP 1 Medicines Control, Administration and Prescribing Policy (MCAPP)
- SH CP 22 Security Management Policy
- SH CP 30 Medical Emergencies and Resuscitation Policy

10. Supporting References

- Control of Substances Hazardous to Health (COSHH) Regulations 2002
- Electricity at Work Regulations 1989
- Electromagnetic Capability Regulations 2005
- European Pharmacopoeia
- Health and Safety at Work etc. Act 1974
- Health Technical Memorandum (HTM) 02-001 “Medical Gas Pipeline Systems”. Part A, Design, Installation, Validation and Verification
- Highly Flammable Liquid and Liquid Petroleum Gas Regulations Medicines Act 1968
- Management of Health and Safety at Work Regulations 1999
- National Health Service Model Engineering Specification, C11, “Medical Gases”
- Part B, Operational Management
- Personal Protective Equipment at Work Regulations 2002
- Pressure Systems Safety Regulations 2000
- Provision and Use of Work Equipment Regulations 1998
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 1995
- Statutory and other requirements relevant to Medical Gas Pipeline Systems
- Work Place (Health, Safety and Welfare) Regulations 1992
Appendix 1

Designated Trust Personnel

<table>
<thead>
<tr>
<th>Title and Location</th>
<th>Name</th>
<th>Medical Gas Role</th>
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<tbody>
<tr>
<td>Chief Executive</td>
<td>Nick Broughton</td>
<td>Executive Director</td>
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<tr>
<td>Head of Estates and Facilities</td>
<td>Andy Mosley</td>
<td>Senior Estates Manager</td>
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<tr>
<td>Authorising Engineer</td>
<td>Steve Goddard</td>
<td>*Authorising Engineer</td>
<td>0845 652 4901</td>
</tr>
<tr>
<td>Estates Officer</td>
<td>Karl Beanland</td>
<td>*Authorised Person (MGPS)</td>
<td>07769 710920</td>
</tr>
<tr>
<td>Estates Operative</td>
<td>Kevan Eames</td>
<td>*Authorised Person (MGPS)</td>
<td>07900 682957</td>
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<tr>
<td>Quality Controller</td>
<td>TBC</td>
<td>*Quality Controller (MGPS)</td>
<td></td>
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<tr>
<td>Clinical Director Anaesthesia/Theatres</td>
<td></td>
<td>*Designated Medical Officer</td>
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<tr>
<td>Director of Nursing</td>
<td></td>
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<tr>
<td>Health and Safety Manager</td>
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<td></td>
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<tr>
<td>Clinical Risk Manager</td>
<td></td>
<td></td>
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<tr>
<td>Head Porter</td>
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<td>Designated Person (MGPS)</td>
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</tr>
<tr>
<td>Patient Services</td>
<td>Available 24 hours</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Persons nominated under the Permit to Work System.*
Site Specific Form

MGPS Key Holders

Keys associated with medical gas system are kept at Estates Department for each site.

Keys for cylinder storage areas are available via portering services.

Important contract details:

<table>
<thead>
<tr>
<th>Estates Department</th>
<th>0300 300 3636</th>
<th>24HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Portering</td>
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<tr>
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<tr>
<td>Risk Management</td>
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<tr>
<td>Risk Management</td>
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</tr>
<tr>
<td>Specialist MGPS Contractor Beacon-MED/ES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical Gas Cylinder Orders, BOC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid Oxygen BOC Gases</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 2  Operating Procedures Wards and Departments

All ward-based equipment is serviced and maintained by the Estates or Clinical Engineering Department and nominated contractors for ease of use by nursing staff, however no person should operate medical gas systems or equipment unless they are adequately trained or supervised.

The equipment at ward and department level is diverse, of varying age and manufacture, it is therefore not possible within the scope of this document to advise on the operational aspects of every piece of equipment.

With regard to medical gas systems, the ward equipment covered by this document falls into two main categories.

Normal Operating Equipment: Medical gas outlets and connections, cylinders and regulators.
Emergency Equipment: Alarms and Area Valve Service Units (AVSUs).

Medical Gas Outlets (Medical Gas Outlets)

Although there are a number of different types of Medical gas outlets used within the Trust, the operation is generally the same.

Medical gas outlets are designed to be gas specific and matched to a probe of the same type; in this way, gases are not able to be cross-connected. As Medical gas outlets cannot accept any probe for which they have not been designed, however it does not prevent the wrong gas from being given to the patient as care should be applied when connecting the mask and hose to the regulator (Christmas Tree) Attempting to force a wrong connection, could cause damage to the equipment and result in malfunction or leakage, this should never be attempted.

Medical gas outlets are either horizontally (wall or trunking) mounted, where the probe enters from the front, or vertically (pendant) mounted where the probe enters from below. At the top of the terminal unit, when it is horizontally mounted, is allocating pin that ensures that probe, which has a mating cut-out, enters the terminal unit in an upright position, ensuring that any equipment is located correctly. Where a terminal unit is mounted in a pendant assembly, it is used with remote (hose) equipment only and therefore the locating pin is not required.

In both cases a probe is engaged in the terminal unit by squarely pushing it into position unit the probe is felt to “click” into position. As this happens, an automatic valve is opened in the rear of the terminal unit allowing gas to pass into the probe and associated equipment or directly for patient use.

Once a probe has been connected to a terminal unit, ensure that the connected equipment is turned off and listen for leaks. If a leak is suspected, change the probe for another, and listen for leaks again. If a leak can still be heard this would indicate that the leak is on the terminal unit itself and should be reported to the Estates Service Desk.
If no leak can be detected with the new probe engaged, then it would indicate that the probe or equipment connection is leaking which should be reported to the medical engineering department for repair or replacement.

To remove the probe from a terminal unit, the probe should be cupped in the palm of the hand and pressure exerted on the outer ring on the terminal unit with the thumb and forefinger; this will unlock the probe and close the automatic valve. You might hear a slight hiss of gas at this time but it is nothing to worry about. As the ring depresses, the probe will be released from the front of the terminal unit into the hand at the same time the automatic valve is closed preventing any further escape of gas.

This is the same operation for all gases (with the exception of the AGSS, which is a screwed connection).

Medical gases should not be used for non-medical purposes other than as a test gas for medical equipment. Medical air should be used as the power source for ventilators; the routine use of oxygen as a driving gas is to be avoided.

**Flowmeter and Regulators**

Flowmeter and regulators should be connected to the corresponding, medical gas Outlet as detailed above and adjusted in accordance with manufacturer’s instructions.

For oxygen and medical air flowmeter with rotometer tubes, there is a ball or bobbin inside the tube, which will rise and fall to indicate the level of gas being delivered, as the control knob on the front of the unit is turned anti-clockwise or clockwise respectively. It is important to understand where on the ball or bobbin, the reading should be taken from, as can differ from manufacturer to manufacturer.

Some flowmeter are operated with a click stop arrangement, where a dial up reading on the front of the flowmeter determines the flow rate of the gas. Again there are a number of different manufacturers this type of equipment, and care should be taken on the operation. Some units will not pass gas when the reading is in-between flow rate indications.

It is important to select the correct flowmeter for the application. Paediatric oxygen flowmeters are very sensitive and control the amount of oxygen to very fine limits within the range 0-5 l/m, whereas adult flowmeters normally have a range of up to 15 l/m.

**Note:**

Ensure you are connecting the correct Gases at the base of the flowmeter Medical Air or Oxygen via the Plastic Tubing this is an area where cross-connections can occur.
Prevention of waste and risk of Fire

Where patients are being administered oxygen, it is normally for extended periods. Some patients have the ability and option to apply and remove oxygen devices when needed. Care should be taken to ensure that devices that are not being used are not left on the bed, armchairs, etc. passing high oxygen concentrations into the bedding and mattress, or into surrounding atmosphere. Not only is this an extremely dangerous practice from fire risk point of view, it is wasteful and will mean that oxygen supplies will need replenishing more frequently than they would otherwise.

All patients should be advised if they take the oxygen off it needs switching off at the wall unit, by a member of nursing staff.

It is the Nursing staffs’ responsibility to ensure the Patient is receiving the correct flowrate via the correct device to correlate with the patients oxygen saturations. This should be routinely checked and recorded on the patient’s notes.

Suction regulators

Suction regulator sets are made up of a number of components that need to be assembled at the bedside, comprising:

1) The regulator itself, which can either be directly connected and plugged into a terminal unit or connected by a remote hose and rail mounted.

2) A bacterial trap, which is designed to guard the equipment from internal contamination and protect any maintenance workers.

3) A collection jar to receive any fluids extracted from patients, and Connection hoses to connect the regulator to the collection jar and the collection jar to the patient. Some collection jars are also fitted with a disposable liner.

It is essential that all staff are familiar with the operation and assembly of these components and that all manufacturer’s products are catered for in this familiarisation.

If the components are not assembled correctly, the float traps and bacterial traps could be compromised allowing contamination or even blockage of the medical vacuum pipeline system.

Once correctly assembled, the normal method of operation is to turn the regulator on or off with the lever type switch, and adjust the level of vacuum to the desired level by operating the round suction control dial.

Suction regulators can be very specific for the clinical application and a variety exist for high or low vacuum, paediatric, thoracic or intermittent use, it is important that the correct suction regulator is used for the specific application.
Portable suctions shall be available in each ward or department for emergency use; it is the responsibility of each ward/department to undertake a risk assessment to ensure the correct numbers of ports/ suction units within their area are available.

**Hoses, connection and inspection**

Sometimes, especially in theatre environments, medical gas outlets are connected to items of equipment by means of flexible connection hoses. These hoses can carry relatively high pressure and care should be taken to ensure that the hoses are sound and clean before inserting the probe into the outlet.

Where hoses are in environments where they could be damaged, for example by having heavy equipment wheeled over them, a full examination of the hose should be made routinely. Any cuts or abrasions would necessitate the hose being replaced.

Because of the amount of pressure contained in the length of a hose, their removal from Medical gas outlets should be a two-handed operation to prevent the hose causing damage. This is especially important on 7 bar surgical air hoses in theatres.

**Cylinder use in wards and departments**

When using cylinders the nursing staff concerned should be aware of the individual requirements of the patient, the contents of the cylinder and the time available within the cylinder. It is the responsibility of nursing staff to ensure that the medical gases are administered correctly.

**Ordering and delivery of medical gas**

The nurse in charge of the ward or department should contact the pharmacy stores to request cylinder replacement.

Where a cylinder is not a direct replacement, i.e. an addition to ward stock levels the requisition must be made by the ward sister in charge or senior nurse manager. All requests for cylinders should detail

- The gas required
- The size of cylinder
- If a replacement or extra regulator is required
- If a cylinder trolley or support is required
- The number of cylinders needed

To ensure patient and staff safety, it is essential that all users ensure a high standard of cleanliness when storing, transporting or connecting medical gas cylinders to regulators or other medical devices, particularly with respect to oil and / or grease (E.g. barrier creams) and alcohol gel products. **If hand creams or gels have been used, wash hands before connecting regulator or flowmeters.**
Users should ensure that they open medical gas cylinder valves slowly; If resistance to opening of the cylinder is excessive, the cylinder should not be used and should be returned to the supplier labelled to indicate the problem as either a faulty or incident cylinder. (Follow supplier’s procedure)

Cylinders should be transported in a purpose made trolley suitable for the size of cylinder. Small cylinders can be carried, although no more than one at a time.

A manual handling risk assessment should be carried out on each cylinder size, specific to the task to be completed and the person involved. This is even more important where the cylinder position itself is confined, e.g. positioning cylinders in manifold racks or under A&E patient trolleys.

Portering staff will deliver cylinders to the wards / departments in accordance with the order of request or priority, change regulators as required and return the empty cylinders to store.

The porter will leave the cylinder:
- Secured in a suitable trolley or restraint
- With the regulator and flowmeter connected where required
- Having tested the regulator connections for leaks
- With the cylinder valve and flowmeter turned off
- At the nominated cylinder storage area

The use of medical gas cylinders

Medical gases in cylinders have a number of hazards that staff, patients and public need to be aware of. In ward areas these relate primarily to the risks associated with oxidizing substances, pressure and manual handling although in other areas (theatres) asphyxiant and cryogenic properties also need to be considered, all of which should be covered during training.

In every department cylinders should be stored in specific and signed areas. Regulators should be turned off when cylinders are left in a ward or department.

Any damaged, faulty or out of date regulators should not be used and returned to Medical Engineering Department by the portering staff.

Before administering a medical gas the nurse responsible shall:

1) Check to ensure for the correct gas and matching regulator.
2) Check to ensure the gas is in date
3) Connect the face mask and low pressure tubing between the flowmeter and patient.
4) Advise the patient of the particular dangers
5) Turn on the cylinder valve and adjust the regulator to give the correct flowrate according to the % required and prescription.
6) Cylinders should be replaced when level is in the red sector of the contents gauge and treatment should not start if the cylinder is less that quarter full.
7) However, cylinders should never be emptied deliberately to reach these levels.

After the administration of a medical gas
Ensure that the cylinder valve and flowmeter are turned off. Where cylinders are used that they are returned to the cylinder storage area or if empty taken off the w/d and returned to the Pharmacy Store.

Only competent staff should attempt to handle and operate medical gas cylinders.

Cleaning Routines

Cleaning of all equipment should follow the guidelines in the infection control policy. With the exception that medical gas equipment including cylinders, should only ever be wiped down with a damp cloth with warm water containing no solvents.

All patient connected administration sets and facemasks are designed to be single use only and should be disposed of appropriately after use.

Closed disposable suction jar liners are normally used, which when full should be sealed, double bagged and disposed of as clinical waste in the normal manner. Suction tubing and catheters should be classified as single use and changed between each patient or daily when in constant use and disposed of as clinical waste.

Where glass or multi use jars are used on the MGPS in plant rooms and risers, wear protective clothing (aprons, visor/spectacles and gloves). Empty contents down sluice, wash with detergent and warm water, dry thoroughly and return to CSSD for reprocessing.
Appendix 3

Medical Gas Alarm Systems

There are two types of alarm system across the Trust: The plant or central alarm system that monitors the supply units for failure or imminent failure of supply, and the local alarm systems that monitor the condition (Pressure) of gas at the point of use. Both local area and main plant alarm panels are designed for the use of the staff within the department. Staff should be aware of their location and the senior nurse in the department should ensure that the systems display “Normal” on a daily basis.

If an alarm occurs, pressing the “Mute” button on the front of the panel can silence the condition. If the alarm panel has been muted, it will reset itself after 15 minutes.

Main Plant Alarms

These alarm panels are designed to relay any faults occurring on the supply units (manifolds, compressors etc.) to the alarm system, and then transmit that information to all areas where a panel is situated. It is essential that a daily check be made to ensure that the alarm panel is displaying an illuminated “Normal” legend at the top of the each gas column.

If any of the gas alarms are activated the alarm panel will display a flashing light accompanied by a two-tone audible signal, corresponding to the problem. Please refer to “Alarm System Indications” section for indications and actions of alarm displays.

Pressing the “Mute” button on the front of the panel will silence the alarm. If the supply plant problem is not rectified within 15 minutes, the alarm panel will reset itself and the audible signal will be re-instated.

Local Area Alarm Panels

Local Alarm panels are situated in most wards, departments and theatres areas, either at the nurse base or adjacent to the AVSUs. Staff should be aware of the exact location of these items. They are provided for nursing staff, who need to be aware of what is happening to the medical gas systems, and the condition of the gas being delivered to the patient.

These units work by monitoring the gas supply inside each ward or department, so that if an alarm occurs, the fault has already happened. There is no time allowance, and no forewarning, you will need to act immediately as this could be an emergency, to the Estates Department Service Desk 0300 300 3636

The first condition, as with the main alarm panels, is the most important and indicated by a green “Normal” light at the top of each column. This advises you that everything is OK and safe to use. Nursing staff should make a point of checking this every day.
Area Valve Service Units (AVSUs)

AVSUs are primarily intended for use in times of emergency, the emergency operation of these units are covered in the appendix 10 “Emergency procedures – Wards and Departments”.

Any routine use of the AVSU not constituting an emergency, including maintenance, needs to have a permit signed by the DNO responsible for that area.
Appendix 4

Emergency Procedures – Wards & Departments

It is impossible to list here all possibilities or scenarios where an emergency might occur. The following is a selection of emergencies that might arise and the relevant actions to be taken as a result.

Medical Gas alarms

There are two separate types of medical gas alarm and staff should be aware of the differences and the meanings of each. Where there are both types within one department, additional care should be taken over the meaning and interpretation of the signals. The panels are relatively easy to identify.

Main Plant Alarm Panels

These panels constitute an array of gas legends with, in each column, a “Normal” condition followed by 4 alarm conditions. They are normally only installed in high acuity areas such as theatres, ICU, HDU etc. as well as the telephone exchange, and are designed to monitor the condition of the supply units feeding the medical gas pipeline systems, they provide forewarning of imminent failure and under normal circumstances will display a first level alarm when things start to require attention (such as oxygen requiring refilling on the VIE).

The first legend is the most important and advises staff that everything is OK and safe to use. Nursing staff should make a point of checking this every day. Additionally, an individual alarm condition might occur at position 3 on the panel and this would indicate that the second source of supply, the reserve system, was only 50% full. These would not normally constitute an emergency.

However if any other alarm indication arises or if two or more alarm indication are displaying within the same column, then follow procedures as detailed in “Alarm System Indications”.

Local Area Alarm Panels

These panels constitute an array of gas legends with, in each column, a “Normal” condition followed by only 2 alarm conditions that indicate “High Pressure” and “Low Pressure”. The first legend, as with the main alarm panels, is the most important and advises you that everything is OK and safe to use. Nursing staff should make a point of checking this every day. The panel could be located at or near the nurse station or the entrance to the area.

It should be noted that if a local area alarm panel is activated, then the condition has already occurred and emergency procedures should be instigated immediately.

The first real alarm condition on this panel indicates that the pressure in the pipeline is high. This could mean that the flow rate to patients has increased. Check to ensure what is being delivered. It may need to be adjusted to compensate,
additionally, the alarm system reverts back to normal, then the individual flowrates to patients will need to be checked and adjusted again.

The second (final) alarm condition refers to a low pressure condition, this could be just below the recommended pressure (normally 4 bar) or it could actually mean that the gas has been exhausted completely, you must immediately check which patients are being supplied with the relevant gas and make alternative provisions (cylinders) then follow emergency procedures.

**Failure of mains electricity supply**

In the event of an electricity failure, medical gas supplies should be maintained by the emergency generator system (The “Essential” supply).

The vacuum plant and medical gas alarm systems are connected to the “essential” electricity supply and will continue to provide and monitor gas supplies as normal.

In the event of failure of both mains and generator supplies:

- The oxygen system will continue to supply gas from the primary or reserve VIEs.
- The Vacuum plant will not operate and central vacuum service will be lost.
- Normal” portable vacuum units can be used only if local electricity supplies are available.
- Ejector or battery driven units will have to be used where available and where vacuum
- Provision is essential for critical care.
- Alarm panels will display a “System Failure” red warning light and give an audible alarm.
- If the electricity supply failure is local and power to an alarm panel only is interrupted the panel will display a “System Failure” red warning light and emit an audible alarm; gas supplies will not be affected.

In any of these circumstances:

- The Authorised Person (MGPS) will be informed of the situation, via the Estates Service Desk / Switchboard.
- Portering and Estates will arrange for staff to monitor gas consumption, replacing empty cylinders as necessary, until the electricity supply is restored.
- The Authorised Person (MGPS), Pharmacy, Portering and Clinical Engineering will arrange emergency cylinder / regulator supplies as necessary.

- The Authorised Person (MGPS) will monitor the situation and confirm resetting of the (MGPS) plant and system alarms following restoration of supply.

**Serious leak of Medical Gases**

In these circumstances:

- The Duty Porter and the Duty Engineer should be contacted by the Estates Service Desk / Switchboard.

- If there is likely to be a requirement for large numbers of cylinders, the Patient Services Co-ordinator should also be contacted.

- Details of the leak should be confirmed: i.e. the floor level, department, room number, the gas or gases involved and if patient ventilators are in use. During out of hours working – the On-call Engineer should notify the Authorised Person (MGPS)

It is the responsibility of the DNO to authorise isolation of medical gases to the area, after ascertaining that no patients will be put at risk in any area(s) affected by the isolation.

- The DNO shall notify the Health & Safety Manager and Fire Officer, when a serious leak of medical gas occurs.

- The DNO will issue appropriate instructions to make the situation safe, such as to open windows in the affected area and close doors. If necessary, evacuation will be considered.

- The Porter will remain on standby to provide extra gas cylinders as required.

- The Authorised Person (MGPS) will arrange for repairs to the system(s) to be carried out under the Permit to Work system.

- The Authorised Person with XX to and QC to be in attendance

**Total or Partial failure of medical gas supply**

In these circumstances:
The person discovering the failure will inform the Estates Service Desk or Switchboard immediately.

- The Designated Nursing Officer(s), the Porter and the Authorised Person (MGPS) will be informed of the failure by the Estates Service Desk Switchboard.

- Details of the failure should be confirmed: i.e. floor level, department, room number(s), the gas involved and if patient ventilators are in use.

- As a precautionary measure, PHO Nurse in charge will also notify critical areas, e.g. Theatres that a failure has occurred on part of the system, so that they are prepared in the event of the fault extending to their departments. (These departments will also be telephoned as a matter of course, if it is immediately evident that the fault is affecting the whole system).

- It is the responsibility of the Nurse in charge to check which patients may have been put at risk by the failure and, if necessary, to arrange immediate emergency medical action.

Depending on the reason for the failure and its possible duration:

- The Authorised Person (MGPS) will decide the most appropriate method of long-term emergency gas provision. This may involve establishing locally regulated cylinder supplies at ward / department entrances.

- Nursing and medical staff should attempt to reduce gas consumption to a minimum during the emergency.

- Portering staff will be required to monitor / replenish cylinders at any emergency stations and at plant room emergency supply manifolds. Pharmacy / portering will arrange emergency cylinder deliveries as necessary.

The Authorised Person (MGPS) will liaise with the approved contractor and competent person (MGPS) to complete emergency repairs needed to re-instate the gas supply, using the Permit to Work system.

In situations where it is envisaged that there will be long term loss of oxygen service, the Nurse in charge will liaise with clinical colleagues, and the Authorised Person (MGPS) on the need for transfer of critically ill patients to other hospitals, as department closure maybe warranted in extreme circumstances.

**Contamination of a medical gas supply:**

(Evidenced by unusual fumes coming from connected equipment)
It is not unusual for a smell to be noticed when using “plastic” equipment hoses to deliver gas to a patient. This smell usually disappears rapidly after first uses of the hose and will generally be familiar to operatives.

However, if either operatives or patients complain of any unusual or strong smells from equipment, or if any patient suffers an adverse reaction to the provision of medical gas, the situation MUST be treated seriously and IMMEDIATE action taken to ascertain the cause. Where it is obvious that the smell is coming from the pipeline rather than a piece of connected equipment, the GAS SUPPLY MUST NOT BE USED and steps taken to prevent others from using the same supply. In this event the fault should be treated as a complete gas failure to that area and the actions described above taken IMMEDIATELY.

The AP should be informed immediately, who will advise the Nurse in charge to relay information and guidance on the problem to all departments, starting with the critical care areas.

**Contamination of a medical vacuum system**

Contamination of the medical vacuum system can occur where the vacuum regulators or jars are incorrectly assembled. This will usually be detected during routine maintenance inspection and evidenced by the presence of liquid in the on-line bacteria filter drain flask, however contamination in sufficient quantity can also cause a blockage of the pipeline system. The Infection Control Team should be informed immediately where any contamination has been found or suspected. They should advise on any additional precautions required and to effect bacterial filter changes safely.

Portable suction units may be used in areas where there is a possibility of the vacuum system being contaminated. (The need for portable suction units should be discussed with the Infection Control Team)

It is the responsibility of the approved Competent Person (MGPS) to change the filter in accordance with the procedure described in HTM 02-01 taking into consideration any additional advice from the Infection Control Team.

If the contamination is due to system misuse, the ward/department must complete a DATIX Incident Report Form. The Form is to be sent to the Risk Manager, so that the appropriate Manager can be informed and remedial action taken.

Decontamination of pipework (if necessary) should be carried out in accordance with the procedure described in HTM 02-01 BEFORE filters are changed.

**Failure of the AGS system**

Failure of the anaesthetic gas scavenging system will result in spillage of gaseous/vaporised anaesthetic agents into the area of use of the system. In Theatres, ventilation rates are generally quite high (about 20 air changes per hour) and the effects of this spillage will be minimised. However, it is likely that staff exposure to the
spilled gases will exceed the COSHH recommendations for exposure when working in the area for extended periods.
A Theatre O.D.P. or Theatre Technician will be the first to notice AGS failure who should immediately inform the Authorised Person (MGPS) and the Theatre Manager. All attempts should be made to limit or reduce staff exposure, if operations continue with a failed system.

When repairs have been completed (under a Permit to Work signed by the Theatre Nurse Manager, or their nominated deputy) Theatre staff should be made aware (by the person signing off the Permit to Work) that the system is back in use.

**High or Low Pressure of one or more systems**

All medical gas systems are protected by the use of pressure safety valves. However, these units operate at pressures 25% above the normal system working pressure. Although all connected equipment should be designed to withstand this (and higher) excess pressures, it is not good practice to operate with system pressures higher than normal. In some instances, gas-mixing devices may give incorrect mixtures if one gas supply to the mixer is subjected to higher than normal pressures.

A similar effect can take place with lower than normal pressures but a more serious consequence of the latter is the inability of some equipment e.g. ventilators and surgical tools to operate below certain pressures. Be especially aware that a low pressure alarm could actually mean that there is no pressure and that no gas is getting to the equipment / patient.

High (or low) pressure problems are signalled local alarm displays and should be reported in accordance with this Policy.

**Nitrous Oxide and Entonox Systems**

**Fire**

Procedures in accordance with the Trust Fire Policy should be followed in the event of a fire involving, or likely to involve the MGPS. During a fire the Fire Service Incident Commander will assume full control of the area(s) affected.

If a fire occurs in a ward or department covered by the piped medical gas system, the DMO/DNO must evaluate the oxygen usage within that area and wherever possible isolate the medical gases at the area valve service unit (AVSU).

**UNDER NO CIRCUMSTANCES SHOULD MEDICAL GAS SUPPLIES BE ISOLATED UNTIL THE DESIGNATED MEDICAL NURSING OFFICER HAS CONFIRMED THAT ALL PATIENTS LIKELY TO BE AFFECTED HAVE BEEN EVACUATED AND/OR HAVE ALTERNATIVE GAS PROVISION.**
Emergency Cylinder Request Procedure

In the event of a shortage of cylinders the DMO/DNO officer should contact the porters who will arrange further cylinder deliveries.

Where there is a general emergency and a complete medical gas system has been lost to a number of ward areas, priority of supply will be determined by the Nurse in charge.
**Alarm System Indications**

The following tables describe the individual alarm legends for each gas, the meaning of the alarm and what action must be taken as a result. When relaying information to the AP Engineer, Portering or nursing staff it is imperative that the panel location and the location of the individual plant or manifold is communicated.

**Oxygen Systems**

<table>
<thead>
<tr>
<th>Alarm Position</th>
<th>Alarm Indication</th>
<th>Meaning</th>
<th>Action by Switchboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>0Green</td>
<td>Normal</td>
<td>Normal</td>
<td>No action required</td>
</tr>
<tr>
<td>1Yellow</td>
<td>Refill Liquid</td>
<td>Liquid Oxygen systems needs routine refilling</td>
<td>Normal working hours: Pharmacy to contact oxygen supplier to arrange delivery.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Out of hours: On-call engineer and pharmacist to be contacted.</td>
</tr>
<tr>
<td>2Yellow</td>
<td>Refill Liquid immediately</td>
<td>Oxygen system liquid depleted and running on compresses back up.</td>
<td>Normal working hours: Pharmacy to contact oxygen supplier to arrange emergency delivery.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact supplier for emergency delivery.</td>
<td>Inform Estates immediately.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Out of hours: On-call engineer and pharmacist to be contacted.</td>
</tr>
<tr>
<td>3Yellow</td>
<td>Reserve Low</td>
<td>The reserve manifold has depleted to its alarm level of 50%. Replace cylinders as soon as possible. If this message is in addition to conditions 1 and 2 then the supply is in danger of imminent failure. Action required immediately.</td>
<td>Normal working hours: Pharmacy to contact oxygen supplier to arrange emergency delivery.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Out of hours: On-call engineer and pharmacist to be contacted.</td>
</tr>
<tr>
<td>4Red</td>
<td>Pressure Fault</td>
<td>Emergency. Pressure Fault on Oxygen System. The system pressure is outside the set limits, this could mean that the system is over-pressurised or that all gas has been exhausted. Action is required immediately.</td>
<td>AT ALL TIMES: Urgently inform AP (MGPS) and PSCO of situation, together porters and Pharmacy who may need to organise additional cylinder deliveries to ward areas.</td>
</tr>
</tbody>
</table>

**Note:** In addition to site alarms, the trusts oxygen supply has monitored telemetry to BOC direct; this allows oxygen usage to be monitored.
# Nitrous Oxide and Entonox Systems

<table>
<thead>
<tr>
<th>Alarm Position</th>
<th>Alarm Indication</th>
<th>Meaning</th>
<th>Action by Switchboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>OGreen</td>
<td>Normal</td>
<td>Normal</td>
<td>No action required</td>
</tr>
<tr>
<td>1Yellow</td>
<td>Replace Cylinders</td>
<td>The duty bank of cylinders are depleted and require to be changed</td>
<td>DECT message notifies porters to action. If alarm persists contact Estates Service Desk or Switchboard.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2Yellow</td>
<td>Replace Cylinders Immediately</td>
<td>The duty banks of cylinders are depleted and the standby bank is only 10% full. Danger of total loss of gas. Cylinders require changing immediately.</td>
<td>DECT message notifies porters to action. If alarm persists contact Estates Service Desk or Switchboard.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3Yellow</td>
<td>Reserve Law</td>
<td>The emergency reserve manifold has only 50% of the online capacity left. Replace cylinder as soon as possible. If this message is in addition to conditions1 and 2 then the supply is in danger of imminent failure. Action required immediately as this would be the only alarm condition before total failure.</td>
<td>DECT message notifies porters to action. If alarm persists contact Estates Service Desk or Switchboard.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4Red</td>
<td>Pressure Fault</td>
<td>Emergency. Pressure Fault on system. The system pressure is outside the set limits, this could mean that the system is overpressurised or that all gas has been exhausted. Action is required immediately to investigate and rectify.</td>
<td>DECT message will notify Shift Craftsperson to investigate. If alarm persists contact Estates Service Desk or Switchboard.</td>
</tr>
</tbody>
</table>
## Medical Air Systems

<table>
<thead>
<tr>
<th>Alarm Position</th>
<th>Alarm Indication</th>
<th>Meaning</th>
<th>Action by Switchboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>OGreen</td>
<td>Normal</td>
<td>Normal</td>
<td>No action required</td>
</tr>
<tr>
<td>1Yellow</td>
<td>Plant Fault</td>
<td>An error has been detected on the medical air compressor. The system is still functional but could be running on the standby compressor.</td>
<td>DECT message notifies porters to action. If alarm persists contact Estates Service Desk or Switchboard.</td>
</tr>
<tr>
<td>2Yellow</td>
<td>Plant Emergency</td>
<td>The fault in the medical air system has escalated to a point where system integrity could be compromised. There might be minimal medical air remaining before the system changes to limited manifold supply.</td>
<td>DECT message notifies porters to action. If alarm persists contact Estates Service Desk or Switchboard.</td>
</tr>
<tr>
<td>3Yellow</td>
<td>Reserve Law</td>
<td>The emergency reserve manifold has only 50% of the online capacity left. Replace cylinder as soon as possible. If this message is in addition to conditions 1 and 2 then the supply is in danger of imminent failure. Action required immediately as this would be the only alarm condition before total failure.</td>
<td>DECT message notifies porters to action. If alarm persists contact Estates Service Desk or Switchboard.</td>
</tr>
<tr>
<td>4Red</td>
<td>Pressure Fault</td>
<td>Emergency. Pressure Fault on Medical Air System. The system pressure is outside the set limits, this could mean that the system is over-pressurised or that all gas has been exhausted. Action is required immediately.</td>
<td>DECT message will notify Shift Craftsperson to investigate. If alarm persists contact Estates Service Desk or Switchboard.</td>
</tr>
</tbody>
</table>
**Medical Vacuum Systems**

<table>
<thead>
<tr>
<th>Alarm Position</th>
<th>Alarm Indication</th>
<th>Meaning</th>
<th>Action by Switchboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>1Yellow</td>
<td>Plant Fault</td>
<td>An error has been detected on a medical vacuum pump. The system is still functional but could be running on the standby pump set.</td>
<td>DECT message will notify Shift Craftsperson to investigate. If alarm persists contact Estates Service Desk or Switchboard.</td>
</tr>
<tr>
<td>2Yellow</td>
<td>Plant Emergency</td>
<td>The fault in the medical vacuum system has escalated to a point where system integrity could be compromised. There might be minimal medical vacuum remaining before the system is completely depleted.</td>
<td>DECT message will notify Shift Craftsperson to investigate. If alarm persists contact Estates Service Desk or Switchboard.</td>
</tr>
</tbody>
</table>

**NOTE:** There is no 3rd level alarm condition with vacuum systems as there is no emergency reserve manifold

| 4Red            | Pressure Fault   | Emergency. Pressure Fault on Medical Air System. The system pressure is outside the set limits, this could mean that the system is outside the set limits. This could mean that the system is low on vacuum capacity or that has already run out immediately | DECT message will notify Shift Craftsperson to investigate. If alarm persists contact Estates Service Desk or Switchboard. |

Example of a medical gas alarm panel found on wards/departments
Appendix 5

Contractor Information

Maintenance & Installation Contractor Details

The maintenance contractor(s) shall provide details of the following and re-issue this information every year.

Qualifications & Accreditation of senior officers in the company

BS EN ISO 9001/BS EN ISO 13485 registration certificates detailing scope of Registration

Copies of Certificates of AP and CP training.

Details of product training for installation and maintenance of MGPS equipment

Calibration certificates for test equipment used

Copies of Insurance Held:

- Public Liability
- Professional Indemnity

The information provided is to be retained in estates records by the AP
Appendix 6

Estates Information

Documentation

It will be the responsibility of the Authorised Person for each site to maintain up to date copies of all relevant standards and guidance, together with items defined by HTM02 – 01.

As-Fitted Drawings

As fitted drawings are the primary tool of the AP (MGPS) and should be maintained at all times. A hard copy should be kept and identified within this document with electronic copies available in pdf format on the intranet.

Plant log-sheets

Should be completed at every occasion it is necessary to visit plant or manifold installations (e.g. routine maintenance checks or changing cylinders). The completed sheets should be returned to the AP (MGPS) for analysis and stored as a record.

Installation and Maintenance specifications

Specifications for work to be completed should be derived by the Trust from the needs of the installed equipment. See sample maintenance contract HTM02-01 Part B that should be used as the basis of the Trust’s maintenance contract.

Compliance report and Risk assessments

Although HTM02 is not retrospective in its requirements, it does necessitate a compliance report detailing the whole system and the action plan intended to bring the system up to standard.

In all areas of non-compliance, there will be a risk, either to patients, staff, public or financially. These risks should be itemised and formulated enabling a remedial action plan to be put into a prioritised list.

This should be completed as a part of the audit and risk assessment process, and should be updated as a regular part of the medical gas committee meeting.

Permit to work book and copies

New copies of the permit to work books for HTM02 are obtainable from TSO on the following ISBN numbers.

- HIGH Hazard permits 0-11-322739-6
- LOW Hazard permits 0-11-322738-8
- Bacteria filter change permit 0-11-322740-X (See Appendix 1 and 2 for examples)
Site Layout

Operating procedures – plant and manifold areas

General

All medical gas systems are designed to be fully automatic in normal operation; some however require manual intervention to enable the standby systems to fully operate.

All supply units should be examined as a minimum on a weekly basis or whenever requiring attention and a record kept on the plant log sheets attached to the item of equipment.

No medical gas plant, manifolds or supply units should be operated or adjusted unless by an adequately trained individual.

Vacuum Plant

In the event of “Plant Emergency” wards/departments are to rely on portable suction stored within the ward/department.

Routines

The operation of the vacuum plant will necessitate one of the bacterial filters to be changed annually. This should be completed in line with the maintenance schedule and the procedure detailed in HTM02-01 Part B. (Appendix 2)

Maintenance

All medical gas plant and equipment is covered by a contract with a specialist maintenance company. Estates also carry out weekly plant checks. Pharmacy QC also carries out quarterly quality checks.

Cylinder Handling

Only staff that have been trained in the correct procedures and the dangers involved should handle medical gas cylinders. In line with current Manual Handling Regulations, a full risk assessment should be carried out and that the following precautions should be observed:

- Cylinders should only be moved with specifically designed and appropriately sized trolleys
- Cylinders should be handled with care, never knocked violently or allowed to fall over
- Small cylinders fitted with thumbwheel pin index valves must be handled with care during transport.
- Only remove the seal fitted to the valve just prior to using the cylinder to maintain the protection in place to prevent the thumbwheel from being opened inadvertently.
- When handling used cylinders, extra care should be taken not to open the valves inadvertently.
- Never roll cylinders along the ground as this may cause the valve to open accidentally. It will also damage the cylinder label and paintwork.
- Never churn large nitrous oxide or carbon dioxide cylinders fitted with hand wheel valves, as the valve may open accidentally and could cause cold burns due to escaping liquid.
- When handling full nitrous oxide and carbon dioxide cylinders fitted with hand wheel valves, do not remove the valve seal until the cylinder is ready to use.
- Where possible place cylinders near to an exit so that they can be removed quickly in an emergency. They must not, however, block the exit.
- Never paint or obscure any markings or labels on cylinders.
- Never apply any unauthorised labels or markings to cylinders, unless advised by your gas supplier to identify faulty or incident cylinders.

**Cylinder changing on Reserve Oxygen manifold**

For Manual Changeover manifolds ensure that:

- The cylinder valves on the running bank are open.
- The cylinder valves on the reserve bank are closed.
- Before the running bank cylinders are empty (approx. 10% capacity), open the valves on the reserve bank and manually changeover the manifold, to ensure no loss of line pressure during emergency operation.
- The cylinders on the now empty bank should now be turned off and replaced with fresh cylinders. The connections are leak tested and the cylinder valves then left closed.
- Monitor usage and prepare to change cylinders back, once currently running bank approaches empty.
- Ensure that all empty cylinders are taken back to the cylinder store immediately.

**Delivery of gas cylinders to store**

For normal deliveries the delivery driver will unload the cylinders into the Full Cylinder Store and collect any empty cylinders from the Empty Cylinder Store on a regular basis replacing full for empty cylinders as a routine. If any extra cylinders are required (for example due to a planned shutdown of a system) adequate warning
should be given to the medical gas cylinder supplier to enable provision during the next scheduled delivery.

For emergency deliveries the delivery driver should report to Portering supervisor, who will provide Portering staff to assist with unloading cylinders at the Cylinder Store.

**Housekeeping and segregation**

It is important to ensure that all cylinders are stock rotated, so that the last cylinders delivered are the last to be used. This will ensure that no cylinders remain unused at the back of the store and become out of date.

Cylinders should be segregated by size, by type and by full and empty. Overstocking should be avoided wherever possible and all cylinders should be secured to avoid falling.

It is essential that floor areas are kept clean and free from debris to avoid potential slipping or tripping hazards when moving cylinders. Make sure that any seals and caps that are removed from cylinders are placed in a suitable waste bin and that the waste bin is regularly emptied.

It is the responsibility of the Portering Department to ensure that the floors are swept clean, any litter removed and waste bins emptied on a weekly basis both in the main cylinder store and also the manifold rooms.

**Personal Protective Equipment**

Except when nurses are moving cylinders within ward areas on trolleys, PPE must be worn at all times when moving or transporting cylinders.

This will include wearing a minimum of: gloves and steel toe-capped shoes and when changing cylinders on manifolds, goggles also.
Appendix 7

Maintenance and Emergency Works

Routine Planned Work

Sufficient notice shall be given prior to all routine work on the MGPS which could result in an interruption of supply, with copies to all affected stakeholders.

Emergency Work

Communications subsequent to emergency action shall be made as soon as practically possible after the event and confirmed within 24 hours.

Permit to Work System

A Permit to Work (PTW) Scheme is primarily a system for the safety of patients and is designed to safeguard the integrity of the medical gas system.

Before any work can be undertaken on any area of the Trust’s MGPS, consideration must be given to other areas that might be affected or interrupted by the work, the time to be taken, the level of risk and backup systems required. The issue of a PTW and the way in which the work is carried out must follow the directions of HTM02-01, unless otherwise defined in this Policy. (Example Appendix 1)

The effectiveness of the PTW scheme relies on the training and thorough understanding of the signatories. Each individual has defined responsibilities as detailed previously in this document above.

Definition of Level of Hazard

The following section defines the level of hazards that the Authorised Person should attribute to varying categories of work on the MGPS. If there is any doubt as to the hazard level of a particular Permit to Work, advice should be sought from The Trust AP (MGPS) orAuthorising engineer. If appropriate advice is not available then the hazard should be escalated to High Hazard.

HIGH Hazard

High Hazard work is defined as any work on the MGPS that can introduce hazards of cross-connection or pollution and/or cross-connection or isolation of a patient supply other than for servicing terminal unit second-fix components. It therefore follows that work on any part of the MGPS that requires cutting or brazing will be classified as HIGH HAZARD.

High hazard work may be limited to a planned interruption of a single ward or could be as major as the shutdown of a system for the whole site.

As a minimum, cross-connection, performance, identity and quality tests shall be required before the MGPS is taken back into use.
LOW Hazard

This applies to all work on the MGPS that does not give rise to a high hazard situation. Low Hazard work is defined as work on the MGPS which will not introduce any hazard of cross-connection or pollution. Accordingly this limits the permissible work to that on an individual terminal unit (in addition to vacuum) that does not comply, or multiple Medical gas outlets that do comply with BS 5682:1984 / BS ENISO 7396.

Low hazard permits will cover all PPM inspections, but some remedial work may require issue of a high hazard permit; for example, examination of a leaking terminal unit may reveal that the supply to the ward will require isolation in order to allow replacement of a damaged first-fix component.

As a minimum, a performance test will be required before the MGPS is taken back into use.
Process Diagram High Hazard Work

1. MEDICAL GAS MEETING (Overview of works and if interruptions will take place)
   Authorised Person liaises with DNO, Pharmacy, QC, Pharmacy and Contractors (CP (MGPS))

2. Authorised Person AP (MGPS)
   - Prepare Permit
     - Prepare Temp supply & liaise with portering dept for installation of
     - Request permission to commence work by obtaining DNO

3. Affix “DO NOT USE” Notices to terminal units out of service
   - Describe works and site safety to competent person
   - On completion of work, determine tests and supervise CP (MGPS)

4. Sign off engineering tests on Permit to Work
   - Witness QC testing and sign off permit with QC
   - Obtain acceptance of systems reinstatement by DNO signing
   - Remove “DO NOT USE” Notices from terminal units back in service

5. Sign permit to accept work has been completed and system is back in use
   - CP accepts instructions and signs Permit to commence work
   - CP isolates system as detailed on Permit, supervised
   - QC carries out tests detailed, witnessed by the AP, QC signs off
   - CP carries out work and advises AP on completion
   - CP carries out required tests under supervision
   - Critical Path
Examples of a high and low hazard permits held by AP’s (MGPS) in estates.
Appendix 9

Example of Bacteria Filter Permit to Work
Appendix 10

Emergency AVSU isolation procedure

Typical Area Valve Service Unit in normal supply condition

The Area Valve Service Unit (AVSU) valve operating handle (shown here in red) is shown in the “on” position supplying gas to the ward or department.

Adjacent to each AVSU there should be a sign detailing which areas / beds will be isolated. If the sign is not perfectly clear detailing the exact extent of supply from that particular AVSU, the valve should not be operated.

Before isolation of a gas supply it is essential that patients connected to the system be provided with alternative supplies. Be aware that ISOLATION CAN KILL. ENSURE THAT ESSENTIAL LIFE SUPPORT IS MAINTAINED

To isolate a gas supply:

Type 1: with glass door.

BREAK THE GLASS WINDOW in the valve box door with a hard / heavy object.

Be sure that all glass shards are out of the opening before reaching in to

Turn the valve quarter-turn from fully on to fully off i.e. to the vertical position, as shown below. Be aware of splintering glass and any shards that may be left in the door aperture.
**Type 2:** with plastic pull out front.

Push in the valve box door and extract the plastic cover, reach into the valve housing and turn the valve quarter-turn from fully on to fully off i.e.to the vertical position, as shown below.

Typical Area Valve Service Unit in emergency isolated condition

Usually, the valve box contains an arrow showing the direction of the gas flow. The handle should be in line with the gas flow arrow under normal circumstances (usually in the horizontal position) and at right angles to it when closed (usually the vertical position, as shown in the diagrams above). There may be other markings present which show which way to turn the handle.

Familiarity with different types of valve and their operating methods is essential and may differ from ward to ward.

**NOTE:** If the gas supply has ever needed to be isolated in an emergency, it should only be re-established by the AP (MGPS) after the system has been proved safe and possibly given clearance by the Quality Controller.

The hexagonal “nuts” either side of the valve operating handle are known as NIST connections and can be used to provide temporary supplies to an area or for taking gas samples. Staff should ensure:

- They know which gases are to be isolated (Usually all of them in the event of a fire in the ward);
- They are aware of valves that control these gases and their location(s)
- They understand the method of operating the valve(s)
That the Authorised Person (MGPS) is told immediately that the valve has been closed. (This may be when the emergency is over)

Appendix 11

Faulty and Incident Cylinder Procedure

Faulty Cylinders

Faulty Cylinders are those that can be described as having a minor problem such as:
- Being empty or part full
- Faulty valve operation
- Damaged valve outlet
- Minor leaks from valve

On discovering a faulty cylinder it must be removed from service immediately and identified by attaching a label to the cylinder (made locally). The cylinder should then be segregated from other cylinders. The Pharmacist must be informed that a faulty cylinder has been found who will contact the supplier to report the fault.

The following information will be required.
- Customer Name, Address and Account Number
- The details of the person to receive the investigation report (if required)
- The number of cylinders involved
- The Batch Number, Fill Date, Cylinder size code and Gas type for EACH cylinder involved.
- A description of the fault

The Pharmacist will arrange for the cylinder to be segregated from the main stocks and ensure that the temporary label contains a brief description of the problem and also identifies the cylinder as: DEFECTIVE CYLINDER DO NOT USE.

Under no circumstances should the cylinder be let back into general circulation.

Incident Cylinders

Incident cylinders are those that can be considered as being potentially more dangerous. This could be due to:
- Wrong gas or wrong specification
- Gas Contamination
- Doubts about gas identity
- Incorrect labelling
- Cylinder empty when needed for immediate use
- Shell failure/damage
- Discharge from safety valve or bursting disc
- Serious cylinder valve leak
- Ignition of cylinder shell or valve
- Cylinder involved in a Road Traffic
- Cylinders involved in a fire

In addition to segregating the cylinders as detailed with faulty cylinders above, extra care should be taken to ensure that if the incident could be related to the manufacturing process e.g. if the gas is contaminated or if the gas is to the wrong specification. **ALL OTHER CYLINDERS IN THE SAME BATCH MUST BE COLLECTED AND SEGREGATED FOR COLLECTION AND INVESTIGATION.** Where a cylinder has been involved in a fire or accident, the emergency services should remove the cylinder(s) to a safe area for collection.
Appendix 12

LEaD (Leadership, Education & Development) Training Needs Analysis

If there are any training implications in your policy, please complete the form below and make an appointment with the LEAD department (Louise Hartland, Strategic Education Lead or Sharon Gomez, Essential Training Lead on 02380 774091) before the policy goes through the Trust policy approval process.

<table>
<thead>
<tr>
<th>Training Programme</th>
<th>Frequency</th>
<th>Course Length</th>
<th>Delivery Method</th>
<th>Trainer(s)</th>
<th>Recording Attendance</th>
<th>Strategic &amp; Operational Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOC medical gas training Via LeaD</td>
<td>Every 3 years</td>
<td>Variant dependant on knowledge hours approx. 2 hours</td>
<td>Via LeaD Learning Management System on line</td>
<td>Specialist training by BOC made available</td>
<td>Via LMS on LeaD system</td>
<td>Chief Pharmacist</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Directorate</th>
<th>Division</th>
<th>Target Audience</th>
</tr>
</thead>
<tbody>
<tr>
<td>MH/ld</td>
<td>Adult Mental Health</td>
<td>All staff due to risk of exposure in community and inpatient and clinic areas</td>
</tr>
<tr>
<td></td>
<td>Learning Disability Services</td>
<td>All staff in supported living or inpatient areas where medical gases are used</td>
</tr>
<tr>
<td></td>
<td>Older Persons Mental Health</td>
<td>All staff due to risk of exposure in community and inpatient and clinic areas</td>
</tr>
<tr>
<td></td>
<td>Specialised Services</td>
<td>All staff due to risk of exposure in community and inpatient and clinic areas</td>
</tr>
<tr>
<td></td>
<td>Tqtwentyone</td>
<td>All staff in supported living or inpatient areas where medical gases are used</td>
</tr>
<tr>
<td>ICS</td>
<td>Adults</td>
<td>All staff due to risk of exposure in community and inpatient and clinic areas</td>
</tr>
<tr>
<td></td>
<td>Children’s Services</td>
<td>All staff in supported living or inpatient areas where medical gases are used</td>
</tr>
<tr>
<td></td>
<td>Specialist Services</td>
<td>All staff in supported living or inpatient areas where medical gases are used</td>
</tr>
<tr>
<td>Corporate Services</td>
<td>All (Workforce &amp; Development, Finance &amp; Estates, Commercial)</td>
<td>All estates, portering and facilities staff due to risk of exposure,</td>
</tr>
</tbody>
</table>
Appendix 13

Southern Health NHS Foundation Trust:
Equality Impact Analysis Screening Tool

Equality Impact Assessment (or ‘Equality Analysis’) is a process of systematically analysing a new or existing policy/practice or service to identify what impact or likely impact it will have on protected groups.

It involves using equality information, and the results of engagement with protected groups and others, to understand the actual effect or the potential effect of your functions, policies or decisions. The form is a written record that demonstrates that you have shown due regard to the need to eliminate unlawful discrimination, advance equality of opportunity and foster good relations with respect to the characteristics protected by equality law.

For guidance and support in completing this form please contact a member of the Equality and Diversity team

| Name of policy/service/project/plan: | Medical Gas and Medical Gas Pipeline Systems (MGPS) Policy |
| Policy Number:                   | SH NCP 65                 |
| Department:                      | Estates and Facilities in association with Pharmacy |
| Lead officer for assessment:     | Marie Corner              |
| Date Assessment Carried Out:     |                         |

1. Identify the aims of the policy and how it is implemented.

<table>
<thead>
<tr>
<th>Key questions</th>
<th>Answers / Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Briefly describe purpose of the policy including</td>
<td>The policy will be supported by the LEaD team Estates and Pharmacy Team. As a result of this policy it is intended that the trust staff will be enabled to gain the knowledge and information to enable the safe use of medical gases in the trust.</td>
</tr>
<tr>
<td>▪ How the policy is delivered and by whom</td>
<td></td>
</tr>
<tr>
<td>▪ Intended outcomes</td>
<td></td>
</tr>
</tbody>
</table>
2. Consideration of available data, research and information

Monitoring data and other information involves using equality information, and the results of engagement with protected groups and others, to understand the actual effect or the potential effect of your functions, policies or decisions. It can help you to identify practical steps to tackle any negative effects or discrimination, to advance equality and to foster good relations.

Please consider the availability of the following as potential sources:

- **Demographic** data and other statistics, including census findings
- Recent research findings (local and national)
- Results from consultation or engagement you have undertaken
- Service user monitoring data
- Information from relevant groups or agencies, for example trade unions and voluntary/community organisations
- Analysis of records of enquiries about your service, or complaints or compliments about them
- Recommendations of external inspections or audit reports

<table>
<thead>
<tr>
<th>Key questions</th>
<th>Data, research and information that you can refer to</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 What is the equalities profile of the team delivering the service/policy?</td>
<td>Mixed as delivered to all applicable trust staff</td>
</tr>
<tr>
<td>2.2 What equalities training have staff received?</td>
<td>Mandatory training</td>
</tr>
<tr>
<td>2.3 What is the equalities profile of service users?</td>
<td>Mixed as per trust delivery strategy</td>
</tr>
<tr>
<td>2.4 What other data do you have in terms of service users or staff? (e.g results of customer satisfaction surveys, consultation findings). Are there any gaps?</td>
<td>NA</td>
</tr>
<tr>
<td>2.5 What internal engagement or consultation has been undertaken as part of this EIA and with whom? What were the results? Service users/carers/Staff</td>
<td>NA</td>
</tr>
<tr>
<td>2.6 What external engagement or consultation has been undertaken as part of this EIA and with whom? What were the results? General Public/Commissioners/Local Authority/Voluntary Organisations</td>
<td>NA</td>
</tr>
</tbody>
</table>
In the table below, please describe how the proposals will have a positive impact on service users or staff. Please also record any potential negative impact on equality of opportunity for the target:

In the case of negative impact, please indicate any measures planned to mitigate against this:

<table>
<thead>
<tr>
<th>Positive impact (including examples of what the policy/service has done to promote equality)</th>
<th>Negative Impact</th>
<th>Action Plan to address negative impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>The policy will support the positive support of all service users</td>
<td>Actions to overcome problem/barrier</td>
<td>Resources required</td>
</tr>
<tr>
<td>Age</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>Disability</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>Gender Reassignment</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>Marriage and Civil Partnership</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>Pregnancy and Maternity</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>Religion or Belief</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>Sexual Orientation</td>
<td>none</td>
<td></td>
</tr>
</tbody>
</table>
Sign Off and Publishing

Once you have completed this form, it needs to be ‘approved’ by your Divisional Director or their nominated officer. Following this sign off, send a copy to the Equality and Diversity Team who will publish it on the Trust website. Keep a copy for your own records.

<table>
<thead>
<tr>
<th>Name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designation:</td>
</tr>
<tr>
<td>Signature:</td>
</tr>
<tr>
<td>Date:</td>
</tr>
</tbody>
</table>