

The Newcastle upon Tyne Hospitals NHS Foundation Trust

Medical Gas Pipeline Systems (MGPS) Policy

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1 Introduction

The Newcastle upon Tyne Hospitals NHS Foundation Trust recognises that it has a responsibility to provide a safe environment for all patients, staff and visitors.

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

- Campus for Aging and Vitality
- Freeman Hospital, including PFI
- International Centre for Life
- Royal Victoria Infirmary, including PFI

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.

The Newcastle upon Tyne Hospitals 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 of 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 Scope

This policy is intended for use by all staff involved with MGPS in The Newcastle upon Tyne Hospitals 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 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 than where its mode of use may affect system operation or safety.

Medical equipment is the responsibility of the Medical Electronics Department.

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.

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 (MGPS) 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); Designated 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 (Interserve) both on the Freeman Hospital and Royal Victoria Infirmary estates.

It is the responsibility of the Trust to provide an Authorised Person (MGPS) support to the Facilities Service Provider (Interserve).

3 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.

4 Duties (Roles and Responsibilities)

The following are the key personnel who have specific responsibilities within the operational policy:

- Chief Executive
- Head of Estates and Facilities
- Hospital Engineer
- Authorising Engineer (MGPS)
- Authorised Person (MGPS)
- Competent Person (MGPS)
- Designated Porter (MGPS)
- Quality Controller (QC (MGPS))
- Designated Medical or Nursing Officer DMO/DNO (MGPS)

4.1 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.

4.2 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 Hospital Engineer.

4.3 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), when required, with monitoring the implementation of the MGPS Operational Policy and Procedures.

4.4 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 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 the recommendation of the Authorising Engineer (MGPS), who has specialist knowledge of MGPS and is on the 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 the fullest compliance of all staff and their acceptance and understanding of the individual responsibilities involved. The Authorised Persons (MGPS):

- takes the lead 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 MGPS;
- 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 have been 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.

4.5 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). This register must be made available to an Authorised Person (MGPS) on request.

4.6 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.

4.7 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 MGPS. 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.

The designated Medical or Nursing Officer (MGPS) must fully understand the implications of the permit to work prior to their authorising signature.

4.8 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.

5 Definitions

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

AE	Authorising Engineer
AGSS	Anaesthetic Gas scavenging System
AP	Authorised Person
AVSU	Area Valve Service Unit
CP	Competent Person
CPAP	Continuous Positive Airway Pressure
DMO	Designated Medical Officer
DNO	Designated Nursing Officer
HTM	Health technical Memorandum
IHEEM	Institute of Healthcare Engineering and Estates Management
LVA	Line Valve Assembly
MGPS	Medical gas Pipeline System
QC	Quality Controller
TU	Terminal Unit
VIE	Vacuum-insulated cryogenic storage vessel

6 MGPS System Management

The Medical Gas Pipeline System (MGPS) for The Newcastle upon Tyne NHS Foundation Trust comprises 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; Oxygen (O₂), Nitrous Oxide (N₂O), Entonox (50%/50% O₂/N₂O), Medical Air (MA), Surgical Air (SA), Medical Vacuum (Med Vac), Carbon Dioxide (CO₂) and Anaesthetic Gas Scavenger System (AGSS).

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.

6.1 The Authorised Person (MGPS) will maintain copies of the following:

- up-to-date and accurate as-fitted drawings (including valve/key numbers/TU identification) for all MGPS;
- any necessary MGPS insurance/statutory documentation;
- MGPS safety valve replacement schedule (on a five-yearly basis);
- new and completed permit-to-work books for work on the systems;
- schedule of hose replacement on pendants;
- plant history/maintenance records;
- manufacturer's technical data sheets/manuals for all MGPS components;
- Health Technical Memorandum 02, all latest editions of any associated supplements and NHS Model Engineering Specifications;
- MGPS contractors' service contracts and ISO 9001 (or equivalent) certificates, staff training records, equipment calibration certificates (copies);
- a register of all personnel associated with the MGPS, especially the permit-to-work system;
- emergency and other useful telephone numbers;
- Trust MGPS staff training records;
- calibration certificates for all test equipment;
- the MGPS operational policy

6.2 Pharmacy will maintain copies of the following:

- delivery notes for medical gas cylinders;
- sales invoices for medical gas cylinders;
- delivery summary form (tracks cylinder stock information)
- cylinder rental invoices;
- cylinder rental reconciliation form (monitors trends in cylinder use over six months);
- delivery notes for special gas and industrial gas cylinders;
- sales invoices for special gas and industrial gas cylinders;
- rental invoices for special gas and industrial gas cylinders;
- calibration records of QC test equipment and records of all QC tests performed;
- Quarterly testing of medical air systems.

The pharmacy have overall responsibility of delivery and quality of Liquid Oxygen to all VIE's across the estate.

The following appendices offer further guidance and support for the safe operation of the medical gas systems across the Trust:-

Appendix 1 – Contact numbers for Designated Trust Personnel

Appendix 2 – Operating procedures wards and departments

Appendix 3 – Medical Gas Alarms

Appendix 4 – Emergency Procedures

Appendix 5 – Contractor Information

- Appendix 6 – Estates Information
- Appendix 7 – Maintenance and Emergency Works (including Permit Flow Diagrams)
- Appendix 8 – High and Low Hazard Permit to Work; example
- Appendix 9 – Bacteria Permit to Work; example
- Appendix 10 – Emergency AVSU isolation
- Appendix 11 – Faulty Cylinders

7 Training

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

Personnel	Retraining	Re-assessment
Authorising Engineer	Every 3 Years	Every 3 Years
Authorised Person	Every 3 Years	Every 3 Years
Competent Person	Every 3 Years	Every 3 Years
Designated Medical officer	Every 3 Years	Every 3 Years
Designated Nursing Officer	Every 3 Years	Every 3 Years
Quality Controller	Every 5 Years	Every 5 Years
Designated Porter	Every Year	Every Year

8 Equality and Diversity

The Trust is committed to ensuring that, as far as is reasonably practicable, the way we provide services to the public and the way we treat our staff reflects their individual needs and does not discriminate against individuals or groups on any grounds. The document has been appropriately assessed.

9 Monitoring Compliance

Standard / Process / Issue	Monitoring and Audit			
	Method	By	Committee	Frequency
Compliance with monitoring and review	Monitoring of policy expiry dates and outstanding reports	Committee Chairperson	Medical Gas Committee	Annually
Training as per requirements of HTM	Compliance relevant to individual responsibilities	Departmental Managers Individuals to maintain own records	Medical Gas Committee	Quarterly
Changes to Guidance	Report changes relevant to individual responsibility	Committee chairperson to collate	Medical Gas Committee	Quarterly
Report on Incidents	Report from the DATIX risk management system	Liaison Officer	Medical Gas Committee	As necessary
Monitoring compliance / effectiveness of this policy	Audit report	Internal Audit	Medical Gas Committee	As necessary
Documentation	Audit report	Authorising Engineer	Medical Gas Committee	Annually

10 Consultation and Review

A Medical Gas Committee has been established to review the content and monitor 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 etc 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.

The Committee incorporates a varied cross section of members to give a balance between operation and engineering disciplines.

- Clinical / Nursing
- EBME (Medical Electronics)
- Estates
- External Authorising Engineer (independent non-Trust member)
- Health and Safety
- Pharmacy
- Porters
- Risk Management

- Specialist Contractor (as invited to discuss topical issues)

The Committee will also act as a forum for all MGPS related matters.

The Committee will report to the Medicines Management Committee.

11 Implementation (including raising awareness)

This policy will be implemented by the Trusts Medical Gas Committee. Raising awareness of the policy will also be the responsibility of the Medical Gas Committee.

12 References

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

13 Associated documentation

- [Cleaning & Disinfection Procedure](#)
- [Decontamination of Healthcare Equipment Prior to Service or Repair](#)
- [Decontamination of the Patient Environment \(including Terminal & Deep Cleaning\)](#)
- [Infection Prevention & Control Practice in the Operating Department](#)
- [Oxygen Management Policy](#)
- [Training in the Safe Use of Medical Devices Policy](#)

Appendix 1

Designated Trust Personnel

Title and Location	Name	Medical Gas Role	Contact No.
Chief Executive	Sir L R Fenwick Via Mrs S Bessford	Executive Director	Via switchboard
Director of Estates and Facilities	Mr M Bell	Senior Estates Manager	Dect 21503
Estates Officer (FH)	Mr N Hood	*Authorised Person (MGPS)	Dect 48782
	Mr T Steele		Dect 31336
	Mr G Wilson		Dect 31057
Estates Officer (CAV)	Mr C Murray	*Authorised Person (MGPS)	Dect #61650
Estates Officer (RVI)	Mr D Burns	*Authorised Person (MGPS)	Dect 25096
	Mr I Clayton		Dect 29195
	Mr C Hood		Dect 24973
	Mr L Ritson		Dect 24174
Director of Pharmaceutical Services	Mr N Watson		Dect 31458
Quality Controller	Mr P Hutton	*Quality Controller (MGPS)	Tel20367
Clinical Director Anaesthesia/ Theatres		*Designated medical Officer	
Director of Nursing		*Designated medical Officer	
Head of Medical Engineering	Mr D Crawford (FH)		Dect 48261
	Mr J Stephenson (RVI)		Dect 29608
Health and Safety Manager			
Clinical Risk Manager			
Switchboard Supervisor	Available 24 hours		Dect 48811
Head Porter	Mr M Brannen	Designated Person (MGPS)	Dect 24893
Patient Services	Available 24 hours		Dect 24300

*Persons nominated under the Permit to Work System.

MGPS Key Holders

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

Keys for cylinder storage areas are available via portering services.

Important contact details.

Estates Department	Daytime contact – Fault Line – Tel 0191 2825910
Estates Department	Out of hours contact – Shift Craftsman RVI - 29201 FH – 48804 CAV – Engineer on call (after 8pm)
Portering	Daytime contact Tel 0191 2829205
Portering	Out of hours contact Tel No Via Switchboard
Pharmacy	Daytime contact Tel 0191 2829222
Pharmacy	Out of hours contact Tel No Via Switchboard
Risk Management	Daytime contact
Risk Management	Out of hours contact Tel No Via Switchboard
Specialist MGPS Contractor Beacon-MED/ES	Service Department Tel No Emergency Number 0800 252050
Medical Gas Cylinder Orders, BOC Gases	Contact Pharmacy
Liquid Oxygen BOC Gases	Tel No 01642 542481 Emergency No 0800 111 333

* To contact switchboard Tel 0191 2336161

Operating Procedures Wards and Departments

All ward-based equipment is serviced and maintained by the Estates or Clinical Engineering Department 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 15l/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:

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

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

- 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 suction 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 number 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 suppliers 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:

Check to ensure for the correct gas and matching regulator.

Check to ensure the gas is in date

Connect the face mask and low pressure tubing between the flowmeter and patient.

Advise the patient of the particular dangers

Turn on the cylinder valve and adjust the regulator to give the correct flowrate according to the % required and prescription.

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 than quarter full.

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.

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 ext 21000.

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.

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 flowrate to patients has increased. Check to ensure what is being delivered. It may need to be adjusted to compensate, additionally, if

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, the Patient Services Co-ordinator 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 Patient Services Co-ordinator 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.
- Porter 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 Patient Service Co-ordinator 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 Patient Services Co-ordinator 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 exposed 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.

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 Patient Services Co-ordinator.

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 System

Alarm Position	Alarm Indication	Meaning	Action by Switchboard
0Green	Normal	Normal	No action required
1Yellow	Refill Liquid	Liquid Oxygen system needs routine refilling	Normal working hours: Pharmacy to contact oxygen supplier to arrange delivery Out of hours: On-call engineer and pharmacist to be contacted.
2Yellow	Refill Liquid Immediately	Oxygen system liquid depleted and running on compressed back up. Contact supplier for emergency delivery.	Normal working hours: Pharmacy to contact oxygen supplier to arrange emergency delivery. Inform Estates immediately. Out of hours: On-call engineer and pharmacist to be contacted.
3 Yellow	Reserve Low	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.	Normal working hours: Pharmacy to contact oxygen supplier to arrange delivery. Out of hours: On-call engineer and pharmacist to be contacted.
4Red	Pressure Fault	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.	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

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

Alarm Position	Alarm Indication	Meaning	Action by Switchboard
0Green	Normal	Normal	No action required
1Yellow	Replace Cylinders	The duty bank of cylinders are depleted and require to be changed	DECT message notifies porters to action. If alarm persists contact Estates Service Desk or Switchboard.
2 Yellow	Replace Cylinders Immediately	The duty bank of cylinders is depleted and the standby bank is only 10% full. Danger of total loss of gas. Cylinders require changing immediately.	DECT message notifies porters to action. If alarm persists contact Estates Service Desk or Switchboard.
3Yellow	Reserve Low	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	DECT message notifies porters to action. If alarm persists contact Estates Service Desk or Switchboard.
4Red	Pressure Fault	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.	DECT message will notify Shift Craftsperson to investigate. If alarm persists contact Estates Service Desk or Switchboard.

Medical Air Systems

Alarm Position	Alarm Indication	Meaning	Action by Switchboard
0Green	Normal	Normal	No action required
1Yellow	Plant Fault	An error has been detected on the medical air compressor. The system is still functional but could be running on the standby compressor.	DECT message notifies porters to action. If alarm persists contact Estates Service Desk or Switchboard.
2Yellow	Plant Emergency	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 a limited manifold supply.	DECT message notifies porters to action. If alarm persists contact Estates Service Desk or Switchboard.
3Yellow	Reserve Low	The emergency reserve manifold has only 50% of the online capacity left Replace cylinder bank 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	DECT message notifies porters to action. If alarm persists contact Estates Service Desk or Switchboard.
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 over-pressurised or that all gas has been exhausted. Action is required immediately.	DECT message will notify Shift Craftsperson to investigate. If alarm persists contact Estates Service Desk or Switchboard.

Medical Vacuum Systems

Alarm Position	Alarm Indication	Meaning	Action by Switchboard
0Green	Normal	Normal	No action required
1Yellow	Plant Fault	An error has been detected on a medical vacuum pump. The system is still functional but could be running on the standby pump set.	DECT message will notify shift craftsperson to investigate. If alarm persists contact Estates Service Desk or Switchboard.
2Yellow	Plant Emergency	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	DECT message will notify shift craftsperson to investigate. If alarm persists contact Estates Service Desk or Switchboard.
NOTE: There is no 3rd level alarm condition with medical vacuum systems as there is no emergency reserve manifold			
4Red	Pressure Fault	Emergency. Pressure Fault on Medical Vacuum System. The system pressure is outside these limits, this could mean that the system low on vacuum capacity or that has already runout. Action is required 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



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

Information provided is to be retained in estates records by the AP

**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 when ever 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.

Oxygen System

For both the RVI and Freeman sites, under normal operation the liquid oxygen is monitored by telemetry to BOC and on site alarms/DECT message system. BOC monitor usage and refilled on demand before an alarm condition occurs.

In the event of any continued oxygen the Trust AP shall be notified immediately. During the refilling of the VIE there is sometimes spurious signals given – this is normal.

Vacuum Plant

On both the RVI and Freeman sites, under normal operating conditions, the vacuum pumps will start and stop automatically according to the pressure in the receiver. In the event of plant alarm faults, a DECT message will be relayed to the Shift Craftsperson to investigate.

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 daily and weekly plant checks. Pharmacy QC also carry 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.

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 24hours.

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 back up 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 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) or Authorising 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 shut down 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.

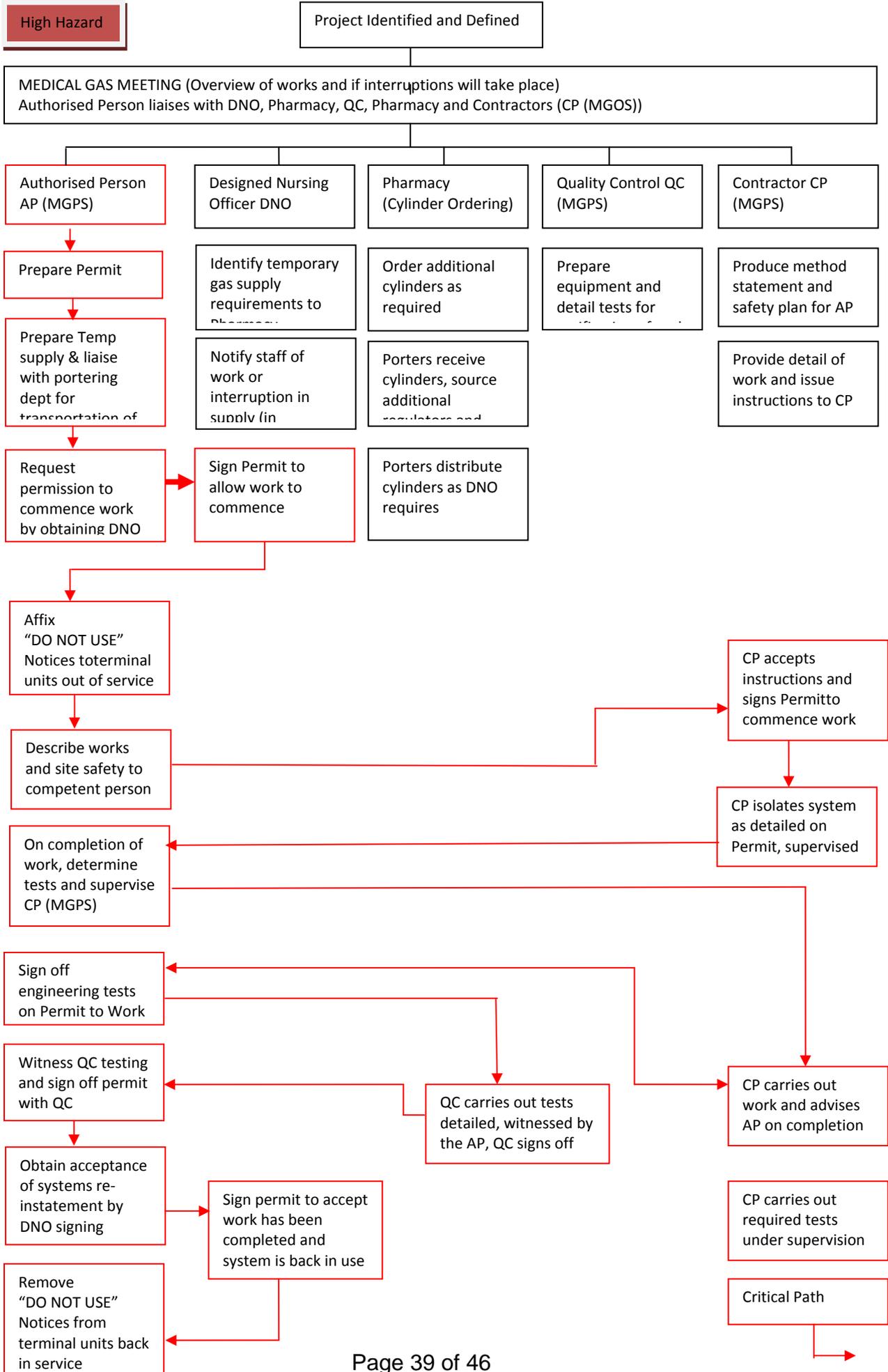
LOW Hazard

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.

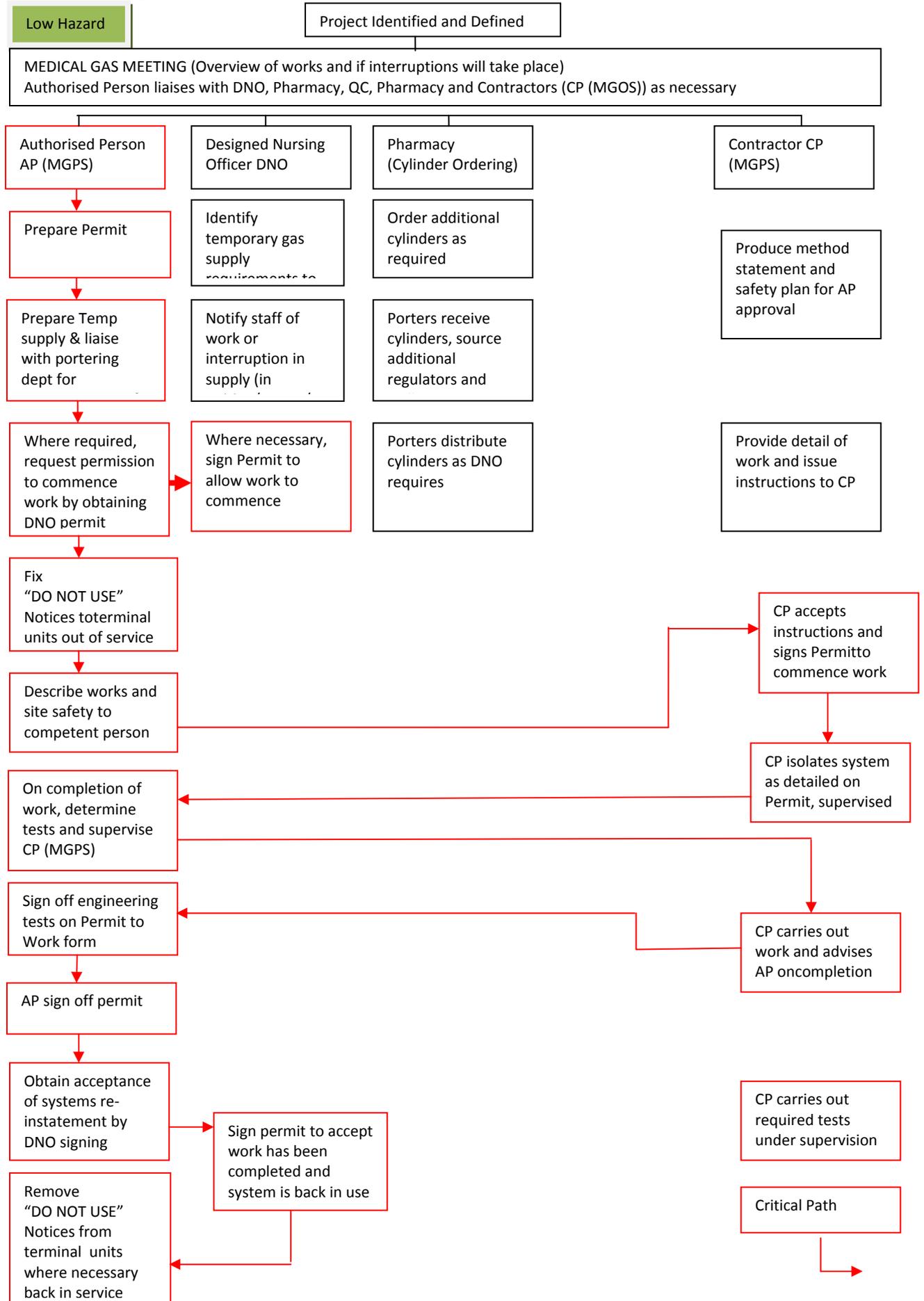
Low hazard permits will cover all PPM inspections, but some remedial work may require issue of a high hazard permit; for example, examination of a leaking terminal unit may reveal that the supply to the ward will require isolation in order to allow replacement of a damaged first-fix component.

As a minimum, a performance test will be required before the MGPS is taken back into use.

Process Diagram High Hazard Work



Process Diagram Low Hazard Work



Examples of a high and low hazard permits held by AP's (MGPS) in estates.

MEDICAL GAS PIPELINE SYSTEMS – HIGH HAZARD PERMIT TO WORK – in accordance with HTM 02

Hospital/Trust _____
Delete as applicable*

Permit No 06/67890

Part 1 Description of work by Authorised Person and permission to proceed from Designated Medical/Nursing Officer

The following work is to be carried out.

Drawing reference No _____ Spec No _____ Date _____

The work will take place between _____ hours on _____ and _____ hours on _____ and will affect medical gas pipelines supplying (Circle gas(es)).

O ₂	N ₂ O	O ₂ /N ₂ O	MA	SA/SN ₂	VAC	AGSS	He/O ₂	CO ₂
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to the following area(s):

Supplies are*/will be* isolated*/reinstated* at

Valve(s) No(s) _____ Location(s) _____

AP (MGPS) Name (print) _____ Sign _____ Date _____ Time _____

AP (MGPS) taking over. Name (print) _____ Sign _____ Date _____ Time _____

Clinical/Nursing permission is required for this work and is granted by

DMO/DNO Name (print) _____ Sign _____ Date _____ Time _____

Ward/Dept _____

NO OTHER WORK WILL BE CARRIED OUT UNDER THIS PERMIT

Part 2 CP (MGPS) acceptance of work and conditions

I accept responsibility for the work as described.

No other work will be carried out by me or persons working under my control.

I am fully conversant with the work described and relevant fire and safety requirements.

Other Permits to be used Type _____ No _____

_____ Type _____ No _____

CP (MGPS) Name (print) _____ Sign _____ Date _____ Time _____

CP (MGPS) taking over. Name (print) _____ Sign _____ Date _____ Time _____

Part 3 Confirmation of work completion, HTM 02 engineering test results and readiness for pharmaceutical testing

Work described in Part 1 has been completed and the following engineering tests have been carried out.

TEST	P/F	TEST	P/F	TEST	P/F

I have advised the AP (MGPS) of all work and tests carried out and provided details of the installation.

Test results are*/are not* satisfactory.

The installation has been left in a safe condition.

CP (MGPS) Name (print) _____ Sign _____ Date _____ Time _____

The system is*/is not* ready for pharmaceutical testing. This Permit is hereby cancelled*

AP (MGPS) Name (print) _____ Sign _____ Date _____ Time _____

Comments (Sign and date) _____

Part 4 Pharmaceutical tests and authorisation to use system

GAS	O ₂	N ₂ O	N ₂ O/O ₂	MA	SA/SN ₂	VAC	AGSS	He/O ₂	CO ₂
	P/F	P/F	P/F	P/F	P/F	P/F	P/F	P/F	P/F
Purging and filling									
Gas Identity									
Gas Quality									
Particulate matter									
Pipeline Odour									

Comments (Sign and date) _____

The test results are*/are not* satisfactory. The system may*/may not* be taken into use.

QC (MGPS) Name (print) _____ Sign _____ Date _____ Time _____

AP (MGPS) Name (print) _____ Sign _____ Date _____ Time _____

Part 5 Acceptance of system status by Designated Medical/Nursing Officer

I declare that all aspects of the work have been explained to me. I hereby accept that the system is ready*/not ready* for service and I will undertake to advise all the appropriate staff of this service status.

DMO/DNO Name (print) _____ Sign _____ Date _____ Time _____

Ward/Dept _____

Original (white) copy to be retained in book by Authorised Person (MGPS)
Pink copy to Quality Controller (MGPS)
Yellow copy to Competent Person (MGPS)
Green copy to be retained in book by Authorised Person (MGPS)

HTM 02-01 FW2 Ver 1.0

MEDICAL GAS PIPELINE SYSTEMS – LOW HAZARD PERMIT TO WORK – in accordance with HTM 02

Hospital/Trust _____
Delete as applicable*

Permit No 06/67890

Part 1 Description of work and authorisation/permission to proceed

The following work is to be carried out.

The work will take place between _____ hours on _____ and _____ hours on _____ and will*/will not* affect terminal units supplying (Circle gas(es)).

O ₂	N ₂ O	O ₂ /N ₂ O	MA	SA/SN ₂	VAC	AGSS	He/O ₂	CO ₂
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to the following area(s):

NO OTHER WORK WILL BE CARRIED OUT UNDER THIS PERMIT

WARD SUPPLIES WILL*/WILL NOT* BE ISOLATED FOR WORK ON ALARMS*/TERMINAL UNITS*

AP (MGPS) Name (print) _____ Sign _____ Date _____ Time _____

AP (MGPS) taking over. Name (print) _____ Sign _____ Date _____ Time _____

Clinical permission is*/is not* required for the work described and is granted by*

DMO/DNO Name (print) _____ Sign _____ Date _____ Time _____

Ward/Dept _____

DMO/DNO Name (print) _____ Sign _____ Date _____ Time _____

Ward/Dept _____

DMO/DNO Name (print) _____ Sign _____ Date _____ Time _____

Ward/Dept _____

Part 2 CP (MGPS) acceptance of work and conditions

I accept responsibility for the work as described.

No other work will be carried out by me or persons working under my control.

I am fully conversant with the work described and relevant fire and safety requirements.

CP (MGPS) Name (print) _____ Sign _____ Date _____ Time _____

CP (MGPS) taking over. Name (print) _____ Sign _____ Date _____ Time _____

Part 3 Confirmation of work completion and HTM 02 engineering test results

Work described in Part 1 has been completed and the following HTM 02 engineering tests have been carried out.

TEST	P/F

I have advised the AP (MGPS) of all work and tests carried out and provided details of the installation.

Test results are*/are not* satisfactory.

The installation has been left in a safe condition.

CP (MGPS) Name (print) _____ Sign _____ Date _____ Time _____

Part 4 AP (MGPS) authorisation to use system

This system may be taken into use.*

If the system may not be taken into use, as further work under a new Permit is now necessary*

AP (MGPS) Name (print) _____ Sign _____ Date _____ Time _____

Part 5 Acceptance of system status by Designated Medical/Nursing Officer

I declare that all aspects of the work have been explained to me. I hereby accept the system back into service and will advise all the appropriate staff that the service has been reinstated.*

I understand that further work on the system is now required and will ensure that all patients likely to be affected by this work will have alternative provision and/or will not be put at risk.*

DMO/DNO Name (print) _____ Sign _____ Date _____ Time _____

Ward/Dept _____

DMO/DNO Name (print) _____ Sign _____ Date _____ Time _____

Ward/Dept _____

DMO/DNO Name (print) _____ Sign _____ Date _____ Time _____

Ward/Dept _____

Original (white) copy to be retained in book by Authorised Person (MGPS)
Pink copy to Quality Controller (MGPS)
Yellow copy to Competent Person (MGPS)

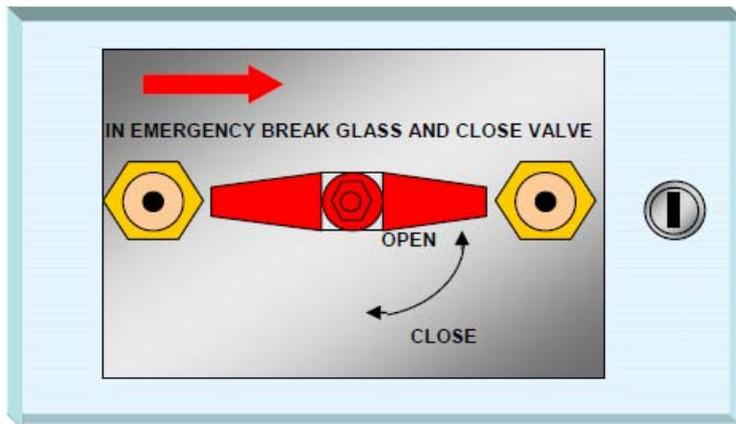
HTM 02-01 PW1 Ver 1.0

Example of Bacteria Filter Permit to Work

Hospital Permit No <u>06/V6789</u> <p style="text-align: center;">PERMIT-TO-WORK Bacteria filter replacement – Central medical vacuum plant</p> Location of plant Plant No Area served
I hereby authorise to remove and replace: LEFT/RIGHT/BOTH bacteria filter(s) on the above plant and dispose of the used filters in accordance with hospital policy. The work will take place on: DATE at: TIME SIGNED PRINT NAME Authorised Person (MGPS) DATE TIME
Additional hazards have been identified as: TOXIC INFECTIOUS SIGNED PRINT NAME Infection Control Officer DATE TIME
I accept responsibility for carrying out the above filter change(s) according to the procedure detailed in Health Technical Memorandum 02. I am familiar with safety policies relevant to this task. SIGNED PRINT NAME Competent Person (MGPS) DATE TIME
I declare that I have completed the work described above and have informed the Authorised Person (MGPS). SIGNED PRINT NAME Competent Person (MGPS) DATE TIME
I confirm that the above work has been carried out to the required standard and the plant is fully operational. SIGNED PRINT NAME Authorised Person (MGPS) DATE TIME

Original (white) copy to be retained in book by Authorised Person (MGPS) HTM 02-01 PW's Ver 1.0
 Blue copy to Infection Control Officer
 Yellow copy to Competent Person (MGPS)

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.

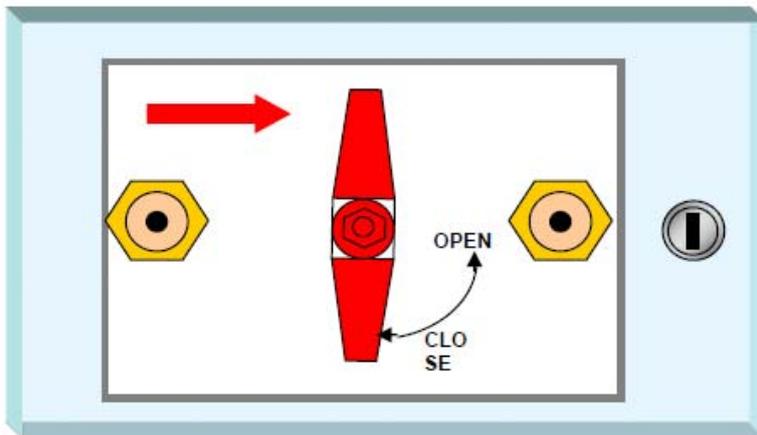
BREAK THE GLASS WINDOW in the valve box door with a hard / heavy object.

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. . Beware 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)

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 Accident
- 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.

THE NEWCASTLE UPON TYNE HOSPITALS NHS FOUNDATION TRUST
IMPACT ASSESSMENT – SCREENING FORM A

This form must be completed and attached to any procedural document when submitted to the appropriate committee for consideration and approval.

Policy Title:	Medical Gas Pipeline Systems (MGPS) Policy	Policy Author:	Ian Clayton - Energy Officer
		Yes/No?	You must provide evidence to support your response:
1.	Does the policy/guidance affect one group less or more favourably than another on the basis of the following: (* denotes protected characteristics under the Equality Act 2010)	No	
	• Race *	No	
	• Ethnic origins (including gypsies and travellers)	No	
	• Nationality	No	
	• Gender *	No	
	• Culture	No	
	• Religion or belief *	No	
	• Sexual orientation including lesbian, gay and bisexual people *	No	
	• Age *	No	
	• Disability – learning difficulties, physical disability, sensory impairment and mental health problems *	No	
	• Gender reassignment *	No	
	• Marriage and civil partnership *	No	
2.	Is there any evidence that some groups are affected differently?	No	
3.	If you have identified potential discrimination which can include associative discrimination i.e. direct discrimination against someone because they associate with another person who possesses a protected characteristic, are any exceptions valid, legal and/or justifiable?	No	
4(a).	Is the impact of the policy/guidance likely to be negative? (If "yes", please answer sections 4(b) to 4(d)).	No	
4(b).	If so can the impact be avoided?	No	
4(c).	What alternatives are there to achieving the policy/guidance without the impact?	No	
4(d)	Can we reduce the impact by taking different action?	No	

Comments:	Action Plan due (or Not Applicable): N/A
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Name and Designation of Person responsible for completion of this form: Ian Clayton - Energy Officer..... Date: 7th June 2013

Names & Designations of those involved in the impact assessment screening process: Medical Gas Committee.....

(If any reader of this procedural document identifies a potential discriminatory impact that has not been identified on this form, please refer to the Policy Author identified above, together with any suggestions for the actions required to avoid/reduce this impact.)

For advice on answering the above questions please contact Frances Blackburn, Head of Nursing, Freeman/Walkergate, or, Christine Holland, Senior HR Manager. On completion this form must be forwarded electronically to Steven Stoker, Clinical Effectiveness Manager, (Ext. 24963) steven.stoker@nuth.nhs.uk together with the procedural document. If you have identified a potential discriminatory impact of this procedural document, please ensure that you arrange for a full consultation, with relevant stakeholders, to complete a Full Impact Assessment (Form B) and to develop an Action Plan to avoid/reduce this impact; both Form B and the Action Plan should also be sent electronically to Steven Stoker within six weeks of the completion of this form.