

Guidance on the security and storage of medical gas cylinders

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Tackling fraud and managing security

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Executive summary

1. This guidance provides security advice to staff responsible for the management and use of medical gas cylinders, medical gas pipeline systems (MGPSs) and vacuum-insulated evaporators (VIEs) in NHS organisations across England.
2. Through intelligence received by NHS Protect and work conducted with the British Transport Police, it was identified that in particular parts of the country known for their 'rave' culture, gangs were targeting health bodies' medical gas storage facilities to steal medical gas cylinders for a number of reasons, including their use as a recreational drug, and for the financial value from the sale of cylinder contents and scrap metal value of the cylinder.
3. A scoping exercise conducted at a number of NHS organisations across England, and meetings with the suppliers of medical gas cylinders, has highlighted some of the security issues experienced by NHS organisations and the subsequent security measures put in place to prevent future incidents of this nature. The guidance aims to share these experiences and learning and also discusses wider security measures that can be put in place.
4. This document has been designed to be a practical resource and should be read in conjunction with *Guidance on the security and management of NHS assets*. Ensuring the security of NHS assets, along with good crime prevention measures and asset management, can help contribute to the provision of good patient care and the achievement of greater financial efficiencies.
5. The main messages of this guidance are as follows:
 - as far as reasonably practicable, all stages of the delivery and receipt of cylinders should be witnessed and supervised by an appropriate member(s) of NHS organisation staff
 - processes should be in place to verify the identity of supplier (driver), the number of cylinders delivered and collected, and accompanying paperwork to enable discrepancies to be detected at an early stage
 - a risk assessment should be undertaken to establish the physical security requirements for the storage facility and a multi-layered approach to security applied
 - any new builds or refurbishment of storage facilities should have due regard to incorporating security measures into the early stages of the design process, in discussions with the local police Designing Out Crime Officer/Crime Prevention Design Advisor, involvement of the Local Security Management Specialist and taking account of relevant guidance
 - suitable arrangements should be put in place for tracking cylinders from point of receipt into the NHS organisation to their return empty to the supplies
 - appropriate arrangements should be made for recording, assessing and investigating concerns of theft and/or misuse of cylinders
 - appropriate training should be made available to all staff to equip them to recognise security risks.

6. Section 1 introduces the problem and the aim of the guidance. Section 2 discusses the key staff roles and their responsibilities at NHS organisations in relation to the secure management of medical gas cylinder stock. Section 3 provides good practice guidance to reduce any risk of loss, theft, or other irregularity during the process of requisitioning from the supplier.
7. Section 4 covers a wide range of good practice guidance on physical security measures for premises and areas where medical gas cylinder storage facilities, MGPS facilities and VIEs are located. The measures discussed aim to prevent, deter, detect and delay any criminal activity that may impact the medical gas supply. Section 5 covers audit and reporting arrangements, where the aim is to reduce the risk of theft, as well as ensuring an appropriate and timely response to identified losses, discrepancies or other irregularities.
8. The guidance ends with a case study that illustrates how vulnerabilities in the different layers of protection in a medical gas cylinder storage facility were exploited and a number of cylinders stolen on more than one occasion. Two checklists have been developed to accompany this guidance as a practical resource for NHS organisations to review their existing security arrangements for medical gas cylinders.

1. Introduction

1. This document provides a framework for NHS organisations to develop or adapt local policies, procedures and systems to ensure the security of medical gas cylinders against theft. The guidance has been developed to support mainly NHS providers of acute and community based hospital services where medical gas cylinders are in use.
2. The purpose of this guidance is to raise awareness of the security issues around medical gas cylinders and highlight good practice and preventative measures to secure these items from theft. This is to assist NHS organisations and professionals tasked with responsibility at various stages of procurement, management and use at NHS sites, to assess the risks and vulnerabilities that exist, and develop a proportionate response against theft and loss, whilst balancing the need for authorised access.

Who is the guidance for?

3. This guidance is primarily intended for NHS organisations and NHS staff, however its provisions may equally benefit non-NHS healthcare providers holding medical gas stocks.
4. This guidance is intended for the following staff roles/groups:
 - Chief Pharmacists
 - Estates and facilities
 - Portering
 - Clinical
 - Security
 - Medical Gas Committee
 - All staff involved in the management and use of medical gas supplies
 - Local Security Management Specialists (LSMSs) or nominated equivalent for those organisations that don't have an LSMS.
5. The guidance content has been developed in consultation with the medical gas suppliers to the NHS, the British Compressed Gases Association and LSMSs.
6. This document discusses a range of measures available to organisations to prevent and tackle the problem of medical gas cylinder theft and/or interruption to the medical gas supply and outlines recommended actions for the requisitioning, delivery, physical security and storage of these items. All of these systems and each step of the medical gas cylinder process should be written into a standard operating procedure (SOP) which describes the responsibilities and the procedures, including audit, necessary to safely and accountably manage any set of processes around the total management of medical gas cylinders and the medical gas supply.

What is the problem?

7. Medical gas cylinders are targeted for two reasons: scrap metal value and their contents. As worldwide prices of copper, lead and other non-ferrous metals continue to rise, metal theft has become a serious issue. It is estimated to be costing the British economy in excess of £800 million per year. In December 2011, the British Transport Police were appointed to lead a National Metal Theft Taskforce to coordinate intelligence and enforcement nationally across law enforcement agencies, manufacturers, the insurance industry, service providers, communities and other stakeholders affected by metal theft. NHS Protect is a stakeholder on this taskforce.
8. This work has identified that as well as metal such as copper, aluminium, lead and steel, medical gas cylinders have also been targeted. A number of police searches at scrap dealers have uncovered stolen copper, cable and gas cylinders. As well as their scrap value, medical gas cylinders are also targeted for their contents for recreational drug use and onward sale. Commonly, nitrous oxide gases are targeted for this purpose. It has also been reported that medical gas cylinders' contents are targeted for use as a fuel to improve the performance of cars.
9. Historically, many medical gas stores have been located in isolated buildings and/or old disused buildings with basic security measures in place. The security of these storage areas has not been seen to be a priority. From the reported incidents of medical gas cylinder theft, it has been identified that some NHS organisations have been the victim of repeated attempts of theft. This has resulted in some organisations upgrading their security, see Appendix 1 for a case study. A number of these incidents have been reported in the media¹, however the true nature and scale of the problem is rather more difficult to establish. This can be attributed to inconsistent audit practices among NHS organisations in relation to their medical gas cylinder stock.
10. One of the three main suppliers of medical gas cylinders to the NHS estimated that in 2012, 6,000 cylinders were lost /stolen from hospitals². A second supplier, whilst not providing a figure for the number of cylinders lost, provided a figure of £300,000 as cylinder replacement costs for 2012.
11. There is a financial cost associated to lost and stolen cylinders. Replacement cylinder costs can range from £70 to £250 per cylinder depending on the cylinder size³. In addition there is an associated cost to the NHS organisation for emergency supplies. Using the previous example (in paragraph 10), the financial loss to the NHS, based on the estimated 6,000 lost cylinders, is projected to be in the range of

¹ See the following articles:

<http://www.thamesvalley.police.uk/yournh-tvp-pol-area-chilt-newsitem?id=86747>

<http://news.bbc.co.uk/1/hi/england/surrey/8025968.stm>

<http://www.cambridge-news.co.uk/Saffron-Walden/Painkilling-gas-stolen-from-hospital-store.htm>

http://www.greatyarmouthmercury.co.uk/news/man_arrested_after_gas_canisters_stolen_from_james_paget_hospital_in_gorleston_1_1868919

<http://www.hpc-uk.org/complaints/hearings/index.asp?id=1449>

<http://www.whittington.nhs.uk/document.ashx?id=1816>

http://www.getsurrey.co.uk/news/s/2073746_hospital_thieves_taking_laughing_gas_to_get_high

² Data provided by Air Liquide.

³ Data provided by Air Liquide.

£420,000 - £1,500,000. These costs do not include the costs for an emergency delivery to replace stock.

12. When the cost of £300,000 provided by the second supplier is added, this takes the projected costs to anything in the range of £720,000 - £1,800,000 plus emergency delivery costs. It is likely that the costs to NHS organisations (based on supplier data) are higher as data provided does not give a complete picture.

Background

13. NHS Protect undertook a review of stock management processes, reporting, audit, storage and security arrangements for medical gas cylinders at a number of NHS organisations in England to identify good practice and gain an understanding of the operational issues around managing cylinder stock. NHS organisations in all the regions were visited. The review examined the processes from point of receipt through to their use and finally to the return of empty cylinders to the supplier.
14. Medical gas cylinders are used in areas where there is no piped gas supply, where demand is low, or as a back up to a fixed pipeline supply. Although not all medical gases are medicinal products under the Medicines Act 1968, they all present similar safety risks to patients and staff if mishandled or misused and should therefore be treated as if they were all medicines and required to have the appropriate degree of control and supervision as with other medicines⁴. Medical gas cylinders can be used to supply a variety of medical gases and air such as carbon dioxide, Entonox⁵ or equivalent, helium, nitrous oxide and oxygen.
15. The cylinders are available in different sizes and are the property of the medical gas supplier(s). They are supplied to NHS organisations under a rental agreement. Rental costs reflect cylinder size. When a cylinder⁶ needs to be refilled a charge is applied for the gas refill.
16. Suppliers of medical gases have responsibility for delivering cylinders to a designated storage area within the NHS organisation's premises. After delivery, the responsibility for the safe storage and security of cylinders lies with the NHS organisation.
17. Loss of medical gas cylinders can lead to disruption in service delivery and affect patient care. If misused or mishandled, the consequences can be serious and may potentially be fatal if the contents are tampered with or misused. The failure to take adequate security measures that result in the theft and misuse of medical gas causing harm could potentially leave an organisation open to legal action.

⁴ The most common medical gases used in hospitals are: oxygen; medical air; medical vacuum (not actually a gas at all, but an essential medical gas service); Entonox; nitrous oxide. Other gases used include carbon dioxide, Heliox (a propriety mixture of 21% oxygen and 79% helium, nitric oxide and many different "special" gases).

⁵ 'Entonox' (50% Oxygen / 50% Nitrous Oxide) is a trade name and other names include 'Equanox' and 'Donopa'.

⁶ Cylinders come in various sizes, which are noted by letters - the smallest size is a 'C' and the largest a 'J'. Cylinders are also colour coded.

Legislation and guidance

18. All medical gases are regulated by UK legislation and European directives and the key pieces of legislation that apply include:
 - Medicines Act 19681 (and the role of The Medicines and Healthcare products Regulatory Agency)
 - Management of Health and Safety at Work Regulations 1999
 - The Control of Substances Hazardous to Health Regulations
 - Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1985
 - The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 20041
 - The Pressure Equipment Regulations 19991.
19. A range of guidance is also made available by supplier organisations and others, such as the Health and Safety Executive and Department of Health (DH). This document should be read in conjunction with the DH Estates and Facilities Division 'Health Technical Memorandum 02-01: Medical Gas Pipeline Systems - Part B Operational Management' document (referred to as HTM02-01).

NHS Protect

20. NHS Protect⁷ is the organisation with policy and operational responsibility for tackling crime affecting the NHS, including criminal damage and theft of NHS property and assets. Further information about NHS Protect's strategy and remit can be found at www.nhsprotect.nhs.uk.
21. Historically, NHS organisations were required to put in place anti-crime arrangements to counter fraud and manage security under Secretary of State Directions. The reforms in the health sector, and the passing of the Health and Social Care Act 2012, mean that most matters related to providers, including anti-crime activity, will now be managed via the Standard Commissioning Contract rather than via Secretary of State Directions.
22. Instead of DH directing NHS hospitals, it will be the responsibility of commissioning organisations, like NHS England or a Clinical Commissioning Group, to ensure that the providers with which they have entered into contracts fulfil their contractual obligations. The contract contains mandatory clauses around the anti-crime arrangements that providers are expected to put in place.
23. Given that the commissioning contract applies to all providers of NHS services, irrespective of size, the clauses in the contract need to be applicable to everyone. The anti-crime clauses on fraud and security have therefore changed substantially, and rather than a prescriptive one-size-fits-all approach that doesn't take into account the many types of providers in the reformed health sector, NHS Protect has adopted a risk based model requiring each provider to carry out an internal crime profiling process, using NHS Protect's organisational crime profile toolkit. The toolkit

⁷ NHS Protect is the operating name of the NHS Counter Fraud and Security Management Service.

will help providers confirm which anti-crime standards the organisation will be expected to meet as part of their contractual obligations.

24. The standards have been developed to help providers ensure they have appropriate security management arrangements in place within their organisation, to protect staff and patients and to ensure NHS assets are kept safe and secure. They will assist providers in implementing key aspects of security management, in identifying areas requiring improvement and in developing local plans for improvements. It is the responsibility of the organisation as a whole to ensure it meets the required standards, although responsibility for the implementation of a particular standard may fall on one or more departments, business units or individuals.

The specific standard applicable in the case of security of medical gas cylinders can be found at:

Standard 3.6

The organisation has systems in place to protect all its assets from the point of procurement to the point of decommissioning or disposal.

25. The rationale for the standard is that protecting assets – in this case medical gas cylinders – throughout their entire life-cycle will assist the organisation in protecting itself from the potential financial cost as a result of theft and loss.

2. Key roles and responsibilities

26. Due to how cylinders are procured, maintained, distributed and used within NHS organisations, multiple departments and individuals are involved in their management. This may result in a lack of oversight by any one department or individual which presents a number of risks to the secure management of cylinder stock. HTM02-01 outlines the key staff roles and their responsibilities at NHS organisations in relation to the management, maintenance and administration of cylinder stock. However, these actions relate to the quality control, supply and safe administration of the contents of the cylinders and not specifically to the security of the cylinder stock.
27. The key staff roles outlined in HTM02-01 include:
 - Chief Executive
 - Chief Pharmacist
 - Estates and facilities staff/department
 - Authorising Engineer
 - Authorising Person
 - Competent Person
 - Quality Controller
 - Medical Gas Committee
 - Portering
 - Security
 - Ward manager/Designated Medical or Nursing Officer
 - All staff (e.g. nursing staff).
28. In addition to the above list of roles the LSMS (or nominated security management specialist) and contracted supplier also have a part to play in the secure management of cylinder stock. Paragraph 40 provides further information on the LSMS role.
29. All the roles, with the exception of the Authorising Engineer, Authorising Person, Quality Controller and Competent Person, will be discussed in relation to their input to the security and secure management of cylinder stock. It should be noted that the responsibilities, department and job titles can vary across different NHS organisations.
30. The [Chief Executive](#) has overall responsibility for ensuring that the NHS organisation meets its statutory and non statutory obligations in respect of the management of medical gas cylinders (e.g. allocation of resources and appointment of personnel) and implementation of organisational policies to discharge these obligations.
31. The [Chief Pharmacist](#) has overall delegated responsibility for medical gases within the NHS organisation. This includes ensuring that there are written policies and SOPs in place on the management and safe use for all aspects of medical gas supply and administration. Where appropriate these written policies and SOPs

should reflect the appropriate measures to support security and secure management of cylinder stock, particularly at the requisition, monitoring of stock control, storage and distribution stages.

32. **Estates and facilities departments** will typically have responsibility for the storage facilities for cylinders as well as the medical gas pipeline system (MGPS)⁸. This will include ongoing maintenance and security of existing storage facilities, external areas and the design and construction of new cylinder storage facilities. With regard to security, any provision or implementation of a security system or hardware should be provided following a risk assessment, which should be undertaken in conjunction with the LSMS or equivalent. The Chief Pharmacist should also be consulted as part of this process.
33. HTM02-01 recommends that a **medical gas committee** be established to oversee the general operation and management of the MGPS. The membership is dependent on local circumstances, but is likely to include at a minimum, representatives from estates and facilities, clinical areas, pharmacy, health and safety, risk management, portering service and a member of the Board. It is also recommended that the LSMS or equivalent be part of this committee and security is a standing agenda item when the committee meets. The occurrence of security incidents/reviews and existing levels of security measures should also be discussed.
34. A **designated porter/security officer** should have undergone specialist training in the identification, safe handling and storage of medical gas cylinders. This person has particular responsibility for medical gases, including assisting with the delivery of cylinders from the gas supplier (in some NHS providers, gas cylinders are delivered directly to the medical gas store by the supplier's delivery driver) and onward delivery of cylinders from the central/main store(s) to wards/departments.
35. A **Ward Manager/Designated Medical or Nursing Officer** has responsibility for their particular area/department and is the person who the Authorised Person liaises with on matters affecting or interrupting the MGPS. The Ward Manager/Designated Medical or Nursing Officer is also responsible for ensuring that all relevant security policies and procedures are disseminated, implemented and adhered to by their staff.
36. **All staff** involved in the handling or administration of medical gases have a responsibility to adhere to the NHS organisation's SOPs on security and the secure management and use of medical gases.
37. The contracted **supplier** of medical gases also has an important role to play in the secure management of cylinder stock. The supplier will have a wealth of expertise and experience, and can provide advice and make recommendations on the secure management of cylinder stock.

⁸ The MGPS is a pipeline distribution system connected to a source of medical gas supply to terminal units, to which the user connects and disconnects medical equipment.

The Local Security Management Specialist role

38. Historically, anti-crime work in the NHS has relied on the bespoke roles of the LSMS for security management work and the Local Counter Fraud Specialist (LCFS) for counter fraud work, roles that were developed specifically for the NHS environment. How these roles will fit within the reformed health sector is still under consideration.
39. We acknowledge that not all organisations to which this guidance will apply will have the LSMS role in their organisation. In such cases it is important that organisations designate a member of staff at the appropriate grade or level of responsibility to assume overall responsibility for some or all of the functions of the LSMS. The title used for these roles will be 'nominated security management specialist'.
40. The LSMS takes forward security management work locally in accordance with national standards, reporting directly to the Security Management Director. The LSMS will be able to identify specific security risks and offer advice on measures that can be implemented to reduce them.
41. The NHS provider's LSMS should be involved in providing input on secure storage and security-related aspects of the policies and SOPs around the management of cylinder stock. In the event of suspected theft of cylinders or other security-related incidents, the LSMS should be involved in the ensuing investigation.

Security culture

42. All staff with responsibility for medical gas cylinders at any stage from receipt to disposal/return of empty cylinders, should be encouraged to act in a security conscious manner. This may include not leaving cylinders in non-designated areas, ensuring doors to storage areas are secured and reporting security-related incidents.
43. The security culture should support the policies and procedures implemented by the provider organisation and the physical security measures in place. They should be effectively communicated to staff at all levels. Staff should be made aware of their responsibility for the security of medical gases, and policies and procedures that are in place to prevent misappropriation and misuse. This may be facilitated through:
 - job descriptions/staff handbooks - clearly written policies and procedures
 - induction programmes
 - awareness-raising sessions by risk managers and health and safety professionals
 - training (e.g. security patrolling)
 - presentations/team briefings
 - intranet or newsletters.

3. Ordering, requisitions, receipt and internal distribution

44. This section provides good practice guidance on the process of ordering and receiving cylinders. It is recognised that NHS providers operate differing systems with regard to ordering cylinder stock. In all cases it is the aim of this guidance to reduce any risk of loss, theft, or other irregularity during the process of ordering.

Stock levels

45. The risk of loss/theft of cylinders can be limited by ensuring stock levels are kept at all times between agreed minimum and maximum levels. Stock levels should be set based on past patterns of use, an assessment of current need and potential requirements during periods of unexpectedly high demand and emergency incidents. It should not be left to the supplier to solely determine how many cylinders are provided without input from the NHS provider. Ideally stock levels should be checked on a regular basis as this can create savings for the NHS provider in terms of reducing rental charges and avoiding payment for unaccounted stock due to poor audit procedures.
46. It should be noted that simply counting cylinders is not sufficient when checking stock levels. A check on whether the cylinder is full or empty should also be carried out. This is to ensure that full cylinders are not being misappropriated and returned empty. Stock checks also offer an opportunity to better reconcile gas amounts purchased versus that which is received, taking into account the amounts which can be reasonably accounted for through patient use.

Cylinder ordering procedure from suppliers

47. The contract or service level agreement (SLA) between suppliers and NHS organisations should define the responsibilities of all parties. The NHS organisation should have a local SOP in place that indicates the person(s) responsible for ordering cylinder stock from suppliers and the ordering procedure for cylinders. Ideally this should be a legally authorised local single point of contact to order cylinders from the contracted supplier, even if some tasks are delegated to other members of staff. As the gases contained in the cylinders are treated as a medicine, responsibility for this process often falls to the Chief Pharmacist and may also include the authorisation of payment to the supplier.
48. Records should be maintained for auditing and reconciliation purposes. Maintaining a robust recording and administration process reduces the risk of billing for lost, stolen or otherwise unaccounted for cylinder stock following an audit by the supplier. Unaccounted for cylinder stock and poor records may result in substantial financial loss for the NHS provider and impact patient care.
49. As a matter of good practice, the person receiving or collecting cylinder orders should not be the same person who placed the order. This increases the transparency of the process and reduces the opportunity for diversion of cylinder stock by one individual.

Receiving orders from suppliers

50. As far as reasonably practicable, all stages of the delivery and receipt of cylinder stock from suppliers should be witnessed and supervised by an appropriate member of staff. The names and titles of staff authorised to collect orders should be recorded in the local SOP and communicated to the suppliers and their delivery staff.
51. A process for verification of the identity and authorisation of staff receiving cylinder orders should be adhered to by the supplier as agreed with the NHS organisation or SLA. This should at a minimum, be that staff must present the appropriate ID card, showing the individual's photo and full name, and be in uniform when receiving orders. It is the NHS organisation's responsibility to develop and agree working arrangements with suppliers that incorporate these verification procedures.
52. Any discrepancies should be queried with the delivery driver before leaving and contact made with the distribution centre. A responsible manager should be notified immediately. The process around the delivery of cylinders including how discrepancies are reported and dealt with should be included in the SOP (see section 5 for further information).
53. Deliveries of cylinders should never be left unattended in an unsecured location if a delivery driver is unable to find a staff member. Ideally, all deliveries should be signed for and witnessed by an appropriate member of staff. Orders that have been correctly delivered should be confirmed by signature of both the person delivering and the person collecting or receiving, as part of the audit trail.

Unsupervised deliveries

54. Where deliveries are unsupervised robust mechanisms should be put in place to reconcile what has been delivered against what was ordered. Orders that have been correctly delivered should be confirmed by signature of the person undertaking the stock check, as part of the audit trail. This check should be undertaken as soon as practicable.
55. Deliveries of cylinders should be left in an agreed secure location, which should be determined by the NHS organisation by undertaking a risk assessment. On completion of delivery the storage area should be secured.

Delivery checks

56. Although the common practice is to replace empty cylinders with full cylinders, the received cylinders should be checked upon delivery against the delivery note and the original order form to verify that the correct medical gas type, cylinder size, and quantity have been received. They should also be examined to ensure that any tamper-evident seals are intact.

Contract/SLA points

The contract/SLA between suppliers and NHS providers should consider the following security measures:

- agreed minimum and maximum cylinder stock levels
- time of deliveries
- agreed means of communication (between the supplier's delivery driver and receiving staff) on arrival at NHS provider premises
- arrangements for the supplier's delivery vehicle entering the premises
- arrangements for supervised and unsupervised deliveries
- actions for both organisations' staff in the event of a discrepancy.

Record of received cylinder stock

57. On the day that cylinder stock is received by the NHS organisation (or if that is not reasonably practicable, on the following day), the organisational register or stock management system must be updated with the quantity and other details of cylinder stock that have been requisitioned and received. Ideally the system should be updated to include:
- Date and time of entry
 - Supplier/distribution centre information
 - Quantity and type of cylinders received
 - Details of the person who received the order
 - Stock totals.

Internal procedure for requisitioning cylinders from central stores

58. The local SOP should outline the procedure for how wards/departments requisition cylinder stock and who is authorised to do so. The local SOP should define any local stock levels that are maintained outside of the central or main cylinder stores.
59. To ensure that the process from delivery to receipt is fully auditable in the event of any incident, it is recommended that the record include:
- name of person (e.g. porter) allocated with responsibility for making the delivery
 - date/time cylinder collected from store/satellite sub station
 - the department/ward the cylinder is delivered to
 - date and time of delivery
 - if full cylinders are exchanged for empty cylinders, a record should be made of cylinders collected.
60. Ideally numbers should be recorded in words as well as figures to reduce the chance of entries being altered. Errors should not be cancelled or obliterated in any way. Corrections should be dated and initialled.

Tracking systems

61. Tracking systems that enable NHS organisations to follow and use information about the location and status of cylinders throughout the healthcare facility can be used to track cylinder movement from point of delivery to disposal/return of empty cylinders. These systems use barcoding, scanners and radio frequency identification (RFID) technology.
62. If considering the use of such technology to manage cylinder stock, NHS organisations are advised to consult with their medical gas supplier.

4. Physical security and secure storage

63. This section provides good practice guidance on physical security measures for premises and areas where medical gas cylinder storage and MGPS facilities are located.
64. The security of cylinders and a reliable supply of medical gases for patient use can be safeguarded by ensuring appropriate physical security measures are in place to prevent, deter, detect and delay any criminal activity that may impact on them. This chapter will discuss the security arrangements that apply to the following areas:
- main stores
 - ready to use stores
 - local storage (wards/departments)
 - local storage (non-specific storage areas)
 - manifold rooms and MGPS
 - VIE.

Risk assessment

65. A risk assessment should be undertaken to establish what security measures are needed in any of the medical gas cylinder storage and MGPS areas. Risk can be assessed by considering the threats to and vulnerabilities of these areas⁹. A risk exists if there is a probability that an attack may be attempted and be successful in (exploiting vulnerabilities and) causing damage to, or possible theft or loss of, cylinders from the cylinder stores, or an interruption to the MGPS. Suitable physical security measures that address identified risks, supported by a strong pro-security culture among staff, provide further protection.
66. Security risks will vary depending on the building, environment and other external factors. There are a number of general security considerations which, if incorporated within the buildings or areas where medical gas cylinders are stored and where the MGPS and VIE are located, can mitigate some threats. These are discussed individually below.

Perimeter security

67. It is recognised that perimeter security in the form of fencing and/or gates will not always be appropriate for all types of areas. However, where it is to be used, the following points should be considered with regard to the surrounding external areas, the site perimeter of the external cylinder storage facility, and the VIE:
- define public and private areas with the use of defensive landscaping and barriers such as fencing

⁹ Risk = threat x vulnerability. Threat is the likelihood or probability of the storage area being damaged or of the theft or loss of cylinders. Vulnerability is the weaknesses that could enable damage to, or theft or loss of, property from the storage area. The storage area could be vulnerable if for example it is located in an isolated place and any attacks on it are likely to go undetected, or even if they were detected there could be a delay in response getting to the facility.

- indicate with signage where areas and/or buildings are restricted access only and not accessible to the public
- address permeability issues if the site location overlaps with public footpaths/access rights to other premises
- implement lighting schemes particularly at all entrances, so as not to allow any areas of shadowing/pooling
- review the impact of neighbouring businesses (type and/or activity)
- review vehicle access and traffic management
- fencing should be certificated to LPS 1175 SR1
- implement perimeter alarms to aid detection of unauthorised activity such as passive infrared sensors (PIR) or passive infrared detectors (PID), an intrusion detection system (IDS) or perimeter intrusion detection system (PIDS).

Vehicular access and parking

68. HTM02-01 recommends that 'clear and secure access to all cylinder stores is provided, including adequate space for vehicular access and cylinder loading/unloading'.
69. Whilst a risk assessment will determine what components of physical security are put in place to safeguard cylinder storage facilities at any particular site, it is recommended that consideration be given to:
 - the use of vehicle barriers as these may reduce the likelihood of vehicles being used to compromise the security of gas cylinders.
 - designating one area, where practicable, for parking of delivery vehicles. No parking by any other vehicles should be permitted in this area. This is to ensure that suppliers making deliveries can park close to the storage area and the possibility of theft of cylinders from either the delivery vehicle or storage area during deliveries is minimised.

Landscaping

70. Trees and vegetation can be exploited by would-be offenders, therefore any vegetation at the site should be kept to a maximum height of 1000mm in respect of ground planting, and any tree foliage should fall to no lower than 2m from the ground. The resulting height differential allows for clear lines of sight between lower-level vegetation and taller tree foliage. As well as ensuring that natural surveillance of and from the building or parked vehicles is not impeded by trees or other vegetation, this avoids creating any potential hiding places. Foliage and trees may also be used as a potential climbing aid and will need to be cut back and maintained on a regular basis to prevent their potential use to commit security breaches.

Building security

71. The external building fabric of the medical gas cylinder storage facility should offer no opportunities or climbing aids to would-be criminals, such as canopies, projecting windowsills or exposed rainwater downpipes. The building should be lockable, access controlled and monitored by CCTV.

72. Vulnerabilities in the walls and ceilings of the medical gas cylinder storage facility and manifold room can also be exploited to gain unauthorised access. Therefore walls and ceilings should provide the same level of protection as doors.

Doors

73. The doors to the medical gas cylinder storage facility and manifold room should be capable of being locked and they should be certificated to LPS 1175 SR2 or similar as a minimum requirement. Doors to these areas should be capable of supporting the use of access control systems and alarms.
74. When selecting doors for these areas, the suitability of the entire door set should be considered. Elements that make up the door such as its bolts, hinges and frames should provide the same level of strength and protection as the door itself.
75. The door's locking system, the location of any glazing in the door, as well as directions of opening should also be considered as these features have the potential to affect the level of security¹⁰ provided. The choice of locking mechanism on doors with automatic locks, whether these are configured to be fail-safe or fail secure¹¹ in the event of an alarm/interrupted power supply, should be fully evaluated taking account of the need to ensure a reliable supply of gases for medical use at all times, and the need to ensure security of medical gas cylinders.
76. Glazing in doors should be laminated to a minimum thickness of 7.5mm (on at least one pane in double-glazed unit) or BSen356:2000 Performance Specification P3a (minimum requirement).

Access control

77. Storage areas for medical gas cylinders and manifold rooms where the NHS organisation's MGPS originates should be restricted to authorised individuals only. Therefore doors leading to these security-sensitive areas should be access controlled.
78. Where practicable, NHS organisations should consider undertaking a cost-benefit analysis of installing and utilising automated access control systems, such as a swipe card or fob, which can provide an audit trail of individuals gaining access to medical gas storage areas and immediate management of an individual's access rights in the event of an incident.
79. Only certain doors are appropriate for use with access control systems, therefore the type of door used should be considered when planning and implementing the system.

¹⁰

http://www.bre.co.uk/filelibrary/Fire%20and%20Security/Certification_of_Fire_and_Security_Doors_180112.pdf

¹¹ With a fail-safe configuration, the doors will open if there are any problems with the power supply. With a fail-secure configuration, the doors default to being locked if there are any problems with the power supply.

80. An access control system provides an audit trail and allows the NHS organisation to control access levels for its staff; therefore this system should have strong links to human resources processes, so that starters and leavers information is reconciled with access permissions. The system should also be monitored and reviewed on a regular basis to ensure compliance, and modifications should be made when necessary. The LSMS should have oversight of the implementation and maintenance of this system and incidents of abuse or weaknesses should be reported to them so that further deterrent and preventative measures can be put in place. Access control measures work best when used properly by staff.
81. It is recommended that numeric key pads are avoided for these areas, because they do not enable auditing of movements in and out of an area, and codes can be easily observed. If numeric key pads are used, the codes should ideally be changed once a month. Key pads should be checked regularly for signs of wear and replaced if needed.

Key management

82. In the event that keys rather than access control systems such as swipe cards are used to access restricted areas storing medical gases, the following precautions should be taken to securely manage access.
83. All keys should be signed for on initial issue and logged in and out at a central control point.
84. A SOP should be established for the distribution of keys, including an audit trail that shows how keys are managed and used, who has accessed the storage facility, at what time and for how long.
85. Having the same key to access more than one lock is strongly discouraged as it presents a security risk.
86. As part of the system to manage keys, a regular inventory should be done of the keys in possession of individuals/departments. The frequency of this inventory should be determined by a local risk assessment.
87. There should be much stricter controls around the access to, and use of, master keys which open all the locks of a particular set. In the event that a master key is used to provide access, its use should be supervised. Key holding responsibility for master keys should be strictly limited to a small number of authorised staff.
88. Keys providing access to secure storage facilities for medical gas cylinders or to the MGPS should be kept in a secure cabinet in a secure location (locked room within a supervised area). There are now secured key cabinets that can provide an electronic audit trail and only give access to authorised users. However the use and implementation of this type of system can be costly; NHS organisations are advised to undertake a risk assessment and cost benefit analysis before considering such an investment. The LSMS should be involved in this process.
89. Key holders should be advised that they are not to duplicate keys and made aware of the NHS organisation's protocol for reporting lost or missing keys. If keys providing access to secure storage areas are lost or missing, extra precautions should be taken to ensure that a secure environment is maintained.

Alarms

90. Alarms should be considered for areas where there is limited activity, particularly external areas such as the external central/main stores and VIE. Alarms can be installed on the doors/gates/fences or corridors/paths leading to the restricted area.
91. A risk assessment would assist the NHS organisation in determining the requirement for these areas to be alarmed, whom the alarm will alert, and the response required. If an alarm is installed, it should be linked to contacts on all external doors. Best practice recommends that door alarms should be activated both in case of forced entry and if a door is left unsecured. There should be a local SOP in place for the response when the alarm is activated. Alarms should be installed to BSEN 50131:2008 grade 2 requirements. Alarm receiving centres should be certificated to BS5979.
92. PIR and PIDS alarm technology is useful in detecting unauthorised activity and provides time for a security response to an unauthorised intrusion. Depending on the environment conditions and site constraints, PIR and PIDS alarms can be placed on fences, walls or in the ground, or they can be free-standing. However, it should be noted that these types of alarms are best used as part of an overall integrated security system, where other security measures, personnel and procedures can assist in both the detection and delay of the threat.

CCTV and lighting

93. The use of CCTV as part of an overall integrated security strategy can help to deter, prevent and detect security-related incidents, as well as providing evidence for investigations following an incident. CCTV can be intrusive and its operation must comply with the provisions of the Data Protection Act 1998 and the Information Commissioner's Office CCTV code of practice (2008).
94. The installation of overt and well-publicised CCTV cameras should be considered for areas where there is an identified security risk. In particular it is recommended that:
 - approach route(s) to the medical gas storage facility and VIE areas are taken into account during risk assessment for installation of CCTV
 - CCTV is used to monitor access points to all of the storage facilities and areas for medical gas cylinders, MGPS and VIE
 - where there is an identifiable security risk and CCTV is in use, suitable monitoring arrangements are in place to detect any security breaches. If feasible, CCTV should be automatically linked to pan to any alarm/PIR/PID activation.
 - CCTV cameras are placed at an angle that allows them to capture activity, in addition to the identification of the individuals accessing the storage areas and number plates on vehicles accessing the vicinity
 - lighting is used to ensure there are no dark areas or 'blind spots', and to support adequate CCTV coverage to enable identification of any individuals gaining access to the gas storage area.

95. Lighting schemes should ensure there is no shadowing, pooling, dark corners or areas that could be used as hiding places. They also need to take account of CCTV, as they can help or hinder the identification of individuals on screen. This applies to both external and internal lighting schemes. Lighting in the medical gas cylinder storage and MGPS areas should be motion-activated to support CCTV coverage when individuals enter the room/area.
96. Lighting fixtures should produce white light as opposed to yellow or orange light. Metal halide light bulbs (or bulbs with comparable output) offer superior colour rendition over alternatives such as high- and low-pressure sodium bulbs. Lighting systems should meet the requirements of BS5489:2003 or EN13201. Further information on '[Lighting Against Crime](#)' is available from ACPO Secured by Design.

Design principles for new builds/refurbishment

- Where a medical gas cylinder storage facility is being newly built or refurbished, NHS organisations should have due regard to incorporating security measures into the early stages of the planning and design process. The team designing the new storage facility should discuss designing in security measures with the local police Designing Out Crime Officer (DOCO)/Crime Prevention Design Advisor (CPDA) and ensure the involvement of the LSMS who would be aware of local risks, incidents, hot spots etc. The LSMS will be able to identify specific security risks at the site and local area, and offer advice on measures that can be used to reduce them.
- The DOCO/CPDA is able to offer free information and advice to secure the new build scheme to *Secured by Design* specifications and reduce crime through its design. Further information on *Secured by Design* and the contact details of DOCOs/CPDAs can be found at www.securedbydesign.com.

5. Reporting and audit

97. This section provides good practice guidance relating to the reporting and audit of all aspects of the use and management of medical gas cylinders. The aim is to reduce the risk of theft as well as to ensure an appropriate and timely response to any identified loss, discrepancy or other irregularities.
98. The ordering, requisition, use, movement and return/disposal of medical gas cylinders should be recorded in a dedicated stock management system. The stock management system should be able to provide information in relation to the medical gas cylinder stock levels in the NHS organisation and what has been received from, and returned to, the supplier.
99. Suitable arrangements should be put in place for tracking cylinders from the point of receipt into the NHS organisation to their return to the supplier. This can ensure that the correct number and type of cylinders are received and used. It can also be useful in highlighting excessive stock holdings of empty cylinders for which rental charges continue to apply. In addition, the NHS organisation should ensure there are appropriate arrangements for recording, assessing and investigating concerns of theft and/or misuse of medical gas cylinders.
100. Accurate, reliable and complete (electronic or paper based) record keeping can, where necessary, provide a means for reconciling discrepancies between supplier held data and NHS organisation records. It can also support detection and investigation of breaches of the NHS organisation's security policy.
101. It is advisable for NHS organisations to develop a formal policy that addresses:
 - how the management and use of medical gas cylinders will be tracked
 - who will have responsibility at different stages of the process
 - management commitment
 - responsibility for ensuring compliance with the policy
 - how often the policy will be reviewed/updated.
102. Where the policy involves keeping a paper based record/audit log, staff should be provided the appropriate level of training to ensure reliable and complete record keeping.

Stock checks and audits

103. A stock check consists of ensuring that the expected levels of cylinders and records of the running total recorded match the actual stock stored. A stock check of all medical gas cylinders stored at the main stores, local stores and manifold rooms should be carried out by the responsible manager at a sufficient frequency determined by a local risk assessment. Ideally, stock checks should always be witnessed by another member of staff.
104. NHS organisations should aim to undertake a more in-depth audit of their medical gas cylinder stock. This should be undertaken independently of the annual audit undertaken by the supplier, and should be determined by a local risk assessment. It should take account of all cylinders in the possession of paramedics and healthcare

professionals (if applicable) and all those stored in vehicles, such as patient transport services, and at smaller satellite services, such as clinics etc.

105. In addition, it is advisable that unannounced snapshot audits or spot checks be carried out to reconcile different sets of records or to ensure compliance with policies, procedures and record-keeping requirements relating to the use, management and security of medical gas cylinders. These should be undertaken based on information/intelligence received and risk assessment, as determined by the Chief Pharmacist in conjunction with the responsible manager.
106. All checks/audits should be recorded. At a minimum this should include:
 - Date and time
 - Stock total
 - Any discrepancies identified and to whom they were escalated
 - Name (legible) and signature of person conducting the stock check
 - Name (legible) and signature of witness.

Missing keys

107. If the keys to the storage area cannot be found then the responsible manager or manager on-call out of hours should be notified immediately. A procedure should be in place to ensure that the security of medical gas cylinder stocks is preserved and that, as soon as practicable, the contents of the affected storage area are checked against the records to identify any discrepancies or anomalies.
108. Once efforts to retrieve the missing key are exhausted and the keys still cannot be found, then the Chief Pharmacist and responsible manager should be informed as soon as practicable. The matter should be reported to the LSMS for investigation and depending on circumstances, the police should be contacted.
109. Any actions or decisions taken should be proportionate and risk-assessed based on the circumstances of the potential loss.

Reporting of stock irregularities, security incidents and breaches

110. All staff have a duty to report any suspicion that the security of medical gas cylinders/MGPS within the NHS organisation has been or may be compromised as soon as it arises. This would include reporting of any perceived loss, discrepancy in stock checks, and evidence of theft or a security incident or breach.
111. There should be a SOP in place that outlines staff actions in relation to the loss or theft of medical gas cylinder stock and/or incidents where the security of the MGPS has been compromised. The SOP should outline how incidents are reported, how they are escalated and when to involve/contact the police. As previously discussed in section 1, metal theft is a national priority for the police and all attempted metal thefts should be reported to the police. There should be a reporting system in place which is linked to the NHS organisation's risk management and incident reporting systems. In addition, all security-related incidents, such as theft or robbery (real or

attempted), should be reported to the LSMS for investigation and recorded on NHS Protect's Security Incident Reporting System (SIRS).

112. If you use an incident reporting system which is compatible with SIRS, such as Datix or Safeguard, then the upload function can be used to send multiple records in one file to be uploaded directly to SIRS. Otherwise, you can report individual incidents directly on SIRS, which is available at <https://SIRS.NHSProtect.nhs.uk> (you will need login details to access the system). For more information about SIRS please visit <http://www.nhsbsa.nhs.uk/4247.aspx>

Appendix 1: A case study

1. The following case study illustrates how vulnerabilities in the different layers of protection in a medical gas cylinder storage facility were exploited by offenders, and what security response was subsequently adopted to prevent further theft and disruption to the medical gas supply. The example is not intended to be an exhaustive list of all possible types of security breach.

Issue

2. On two separate occasions, vulnerabilities in the doors to the medical gas cylinder storage facility at a trust were exploited by thieves to steal cylinders.

What happened

3. Originally the medical gas store access consisted of two hardwood doors with 600mm square slatted air vents on the top and bottom of each. The store used in this case example was, and still is, located in a secluded area away from main buildings and had no alarm. One door was secured by dead bolts top and bottom, and the other door had a 5 lever mortice lock which secured the doors together.

First incident

4. The first incident involved the thieves levering the doors apart to steal two J size Entonox cylinders. Following this incident, metal bars were placed vertically on the back of the door to strengthen it (see figure 1). An additional padlock and hasp was also added to the door and a dedicated CCTV camera installed to monitor the area. The lighting was also improved to aid the CCTV coverage and act as a deterrent. However, this did not deter a second attempt.



Figure 1: Metal bars have been placed to strengthen the door.



Figure 2: Example of poor storage which was exploited and cylinders stolen.

Second incident

5. On the second occasion, two thieves in a car reversed up to the doors, put heavy duty chains through the vents and drove forward ripping the doors off. They then loaded the back of the car with x5 J size Entonox cylinders and drove away. The whole incident took less than 3 minutes. Despite the presence of CCTV, the persons stealing the medical gas cylinders in the day time could not be identified.



Figure 3 and 4: Example of traffic and vehicle management schemes to prevent unauthorised access to medical gas storage facilities.

6. The CCTV did not pick up the car entering the premises, or leaving it, as the cameras were not positioned to cover the route to the medical gas storage facility.

Outcome

7. The trust has now added an intruder alarm and panic alarm within the medical gas cylinder store. They have steel-plated the doors (see figure 5) externally and drilled into them some small ventilation holes. They have secured the doors with a high grade padlock and hasp.



Figure 5: Steel-plated doors.



Figure 6: Poor example of securing a medical gas storage facility.



Figure 7: Another poor example of securing storage.

8. Changes have also been made to how portering staff access the area out of hours. They now have a security escort whilst exchanging medical gas cylinders and must leave the access keys with switchboard, as there had been concerns that the portering staff may be targeted to release the keys for access to the stores. As a final upgrade, an inner steel mesh padlocked door was installed to delay access to the full Entonox bottles.