In this article I plan to focus on the challenges facing medical gas pipeline supplies, exposing some stark realities about the way training in this critical hospital support service is viewed today in the health service, and highlighting a number of key themes. My views on medical gas training sometimes oppose conventional approaches, and also raise the case for greater involvement from areas outside ‘Estates’, and a closer partnership between Pharmacy and the nursing teams.

During the past few years – while delivering medical gases training and undertaking a number of significant compliance and safety audits – I’ve met many healthcare professionals across a number of different roles, encompassing Authorised Persons (engineers); Competent Persons; porters; nurses, and Board members. Several common themes have arisen – some anticipated, while others have emerged unexpectedly. My knowledge and experiences have now led me to adopt a different approach in the training I deliver, reflecting not just what I have discovered within the UK, but equally across a much wider international audience, and certainly with the emphasis on patient and staff safety remaining at the centre of everyone’s focus.

Key issues apparent

None of us stop learning and absorbing information, and, during my time spent in hospitals focused on medical gas pipelines, a number of issues for me have become significant:

- Pharmacy is not involved in medical gas training (or, it appears, may not even be interested). This is somewhat strange when we consider that medical gas is a medicine, and that most organisations’ pharmacy policies include a section on oxygen administration.

- Authorised Persons attending refreshers are seemingly unaware of HTM 02-01 Part B, section 10 (operational checks).

- Authorised Persons and Competent Persons display a nervousness when operating or setting up equipment.

- HTM 02-01 is viewed as ‘only guidance’.

I am sure some of you may raise your eyebrows at what appear to be strong, sweeping statements. However, these common themes continue to be evident, and are presenting ongoing challenges. If we just consider each in turn, readers may well see how, following analysis, some clear problems appear.

Not seen as integral to patient care

Surprisingly, medical gas pipeline systems are not always seen as integral to patient care. Of course things change rapidly when there is a problem, and HTM 02-01, and especially Part B, address many of the issues in points 1 and 2 above. However, the document is extensive, and I would argue that the salient points need to be put into a form of ‘management speak’ and summarised, preferably on one side of A4. The Pharmacy and nursing teams really do need to be brought into the medical gases training loop.

I was, however, surprised by the third point above – a clear lack of knowledge of operational checks. Yet on reflection I cannot recollect – when attending medical gas training myself over the past...
20 or so years – any specific time put aside for such key checks, which are the responsibility of the Authorised Person, as identified in section 10 or the relevant section in HTM 2022. Furthermore, although HTM 02-01 does not specifically list this as course content or a learning outcome for APs, it is ‘implied’.

A lack of practice
In the case of point 4 above, and the confidence of trained CPs and APs, it appears that this has been more to do with a lack of practice on the equipment itself, and, as we are all aware, it would not be prudent to ‘practise’ on live plant with patients connected.

At Eastwood Park we work to identify gaps in training needs from client feedback, and apply ourselves to developing and delivering training solutions against those gaps identified. We have the advantage of having at our disposal a wide range of skills and backgrounds.

In this case we looked at the problem from another viewpoint, and asked ourselves:
- Who needs to be influenced?
- What is the knowledge or competency gap?
- Why ‘patient safety’?
- How are we going to satisfy the needs?

Let us begin with points 1 and 2 – the lack of Pharmacy involvement, and lack of nurse training. These issues are outside the control of an Authorised Person.

As medical gas is identified as a medicine, it follows that gases supplied in cylinder form follow the same route and line responsibilities as any other medicine.

However, the Authorised Person has perhaps the greatest on-site knowledge of the medical gas requirements (excluding administration), so we saw an imperative to develop a simple tool to enable the Authorised Person to influence colleagues working within other healthcare disciplines.

Patient safety the priority
The fundamental element of this is that patient safety is the priority, and if we take HTM 02-01 and apply the four tenets of supply (Continuity, Quality, Quantity, and Identity) – see Figure 1, we can illustrate this clearly, ensuring that the patient is at the centre.

Showing the patient at the centre, however, unfortunately, meant very little to most who had had no medical gas training, and even to some who had. We then explored the concept of patient-centred healthcare again – with the patient at the centre – and how the process of drug administration was undertaken. Put simply, the patient is administered medicines by registered healthcare professionals; medicines are prescribed by doctors or by clear protocol. Porters or auxiliaries move medicines from the Pharmacy to the ward or department, with Pharmacy responsible for procuring or manufacturing the correct medicine. Pharmacy will also provide local policy and procedures. At the local level this is overseen by the Clinical Risk Group and or Patient Safety Group, and in the UK nationally by MHRA, and inspected by the CQC. From this a management flow chart can be created – see Figure 2.
Medical gas ‘a medicine’
As medical gas is identified as a medicine, it follows that gases supplied in cylinder form follow the same route and line responsibilities as any other medicine. HTM 02-01 Part B paragraph 8.1, states that: “Medical gases are medicines….”
A common misconception is that porters manage medical gas cylinders, but in fact the portering department moves cylinders. Decisions concerning stock levels, and types of gas held on site, can only be made by medically informed groups. The chief pharmacist (at the particular healthcare establishment) will be named as the licence holder for medical gases, in accordance with MHRA guidelines.
It has been noticeable in hospitals where the chief pharmacist is involved with medical gas cylinders, and controls the medical gas budget, that cylinder management is more effective. Suitable ward and department stocks appear appropriate for the clinical risk level, and there tend to be fewer unused cylinders on site.

Challenging the estates role?
From this model it can be determined that while there is no traditional estates function, HTM 02-01 provides useful guidance on how to comply with health and safety requirements, and address patient safety concerns. Particularly pertinent are HTM 02-01 Part B section 8, ‘Cylinder management’, and section 7, ‘Training and communication’.
To summarise, these sections of the HTM cover:
- Appropriate training of registered healthcare professionals (nurses etc.), porters, and those involved with others to enable them to meet the requirements of HSE publications on safe use of gas cylinders and ‘Oxygen in the work place’, BCGA (British Compressed Gases Association) Approved Codes of Practice, and manual handling.
- Policy and procedures to ensure the safe, effective, and efficient, use of medical gas cylinders.
- Specific training for those administering gaseous medicines in line with pharmaceutical good practice; use of correct medical gas; recording, and patient monitoring.

In healthcare organisations without piped medical gas systems, management personnel should ensure that these areas of potential staff and patient risk are addressed.

Putting the pipes in
If we look at the medicines ‘flow chart’ in Figure 3, the medical gas pipeline system has been added to the diagram in red, which is the preferred solution for larger healthcare facilities as a means of storing or manufacturing (medical air) gases on site, where the consumption levels would lead to excessive movement of medical gas cylinders. Physically, the piped system will consist of:
- The primary source.
- A secondary source (to activate automatically should the primary source fail).
- A third system of supply.
- Pipework to the wards and departments.
- An emergency shutdown valve, referred to as an AVSU (area valve service unit), to be operated by the person responsible for patient welfare referred to as the DNO (designated nursing officer) in a particular area, should there be an emergency, and, more specifically, a fire.
- Central alarms monitoring the primary and secondary source, requiring monitoring.

It has been noticeable in hospitals where the chief pharmacist is involved with medical gas cylinders, and controls the medical gas budget, that cylinder management is more effective

Comment from HEJ technical editor, Mike Arrowsmith BSc (Hons), CEng, FI MechE, FIHEEM
I am far from convinced that Pharmacy is totally oblivious to the training requirements for medical gas pipeline operation. Indeed for many years the Pharmaceutical Technical QA Group has, in association with Leeds University, run successful medical gas training courses which, in some cases, I believe, lead to postgraduate qualifications. Also, the Group maintains a register of suitably qualified personnel, and issues guidance, which is continuously reviewed. The current chair, following on from John Sprake, Lynn Morrison, is most proactive.
Of all the QC pharmacists, perhaps the one who has contributed most to training, and indeed has considerable engineering knowledge, is Paul Jones of Medical Gas Testing Services.
That nurses ‘appear to have insufficient training regarding medical gas piped systems’ is not surprising, but nevertheless regrettable. For its part, the Medical Gas Association (of whose membership (HEEM’s Medical Gas Technology Platform is constituted), has sought to bridge the gap between engineers and nursing staff, with, it has to be said, limited success. Readers of the HEJ August 2014 issue article by June Lancaster titled ‘Less Jargon, More Common Ground’, will adduce that clearly a lot more needs to be done.
Unlike statutory Codes of Practice, in the unfortunate circumstances of any member of a Trust appearing in court following an ‘untoward incident’, the defence that HTM 02-01 is ‘only guidance’ would not wash. Clearly, Michael Ell, and others involved in training, have a serious task to address.

Local or area alarms monitoring medical gas pressure at the patient outlet, referred to as the ‘terminal unit’. These alarms are to warn the persons responsible for patient welfare at the ward or department level should there be the possibility that the supply of medical gas they are administering is failing. These particular alarms are not targeted at estates personnel.

Downstream from the patient
Additional items ‘downstream’ from the patient outlet include flowmeters, nebulisers, hoses, and such like – these items are not part of the medical gas pipeline system.
To summarise the management requirements of a medical gas piped system:
- An Authorised Person is appointed (following training and on-site assessment) to manage, on a day-to-day basis, the medical gas pipe system only.
- Work on the system is carried out by suitably qualified persons referred to as Competent Persons.
- The chief pharmacist appoints a quality control pharmacist to carry out appropriate quality and identity tests following any works on the system, on newly installed pipework, and in the case of on-site manufactured gases’ quarterly tests.

Over many years little has changed – nurses still administer medicines – solid,
Medical gases

Medical gases

liquid, and gaseous, doctors prescribe, and Pharmacy ensure quality. So why are medical gases often considered an estates function? I wish I knew the answer. What we do know is that when nursing staff are shown videos and pictures of the damage that an incorrectly operated cylinder can do, they are often visibly shaken, since in many cases they had no idea of this risk to themselves (The Health & Safety Executive states that ‘Staff should be made aware of risks in the workplace and procedures put into place to reduce staff and patient risk.’)

We also know that in September 2009 the National Patient Safety Agency issued a report on oxygen safety – which recommends the use of HTM 02-01 Part B to manage medical gases effectively.

An ‘estates matter’?
To summarise, the root of the problem is that the HTM is just that – a Health Technical Memorandum, and is widely viewed simply as ‘something for Estates to deal with’.

It would be interesting if the HTM document was issued by Pharmacy, with technical appendices covering the engineering functions and design etc. However, this is neither the case, nor is it likely to occur.

While HTM 02-01 Part B is not the only interpretation of the management process, it does bring together the various elements involved with medicine delivery, including the medical gas pipeline system, and I have found it a useful tool in introducing senior managers from all disciplines to medical gas systems and their responsibilities around such equipment.

Refresher courses
Focusing on our refresher courses at Eastwood Park, we have identified that many students attending courses for refresher reassessment have had little opportunity to practise their skills over the intervening years. To address this, we again asked ourselves what was needed, how could we deliver a meaningful course that enables students to practise, and how we could assess competency.

The Authorising Engineer process assesses on-site competency, but this is on a ‘live’ site, where some aspects of the Authorised Person role would be a risk if assessed. We have therefore introduced a practically-based course with less emphasis on knowledge transfer (after all we would expect a reasonable level of knowledge retention), and more time (approximately 80 per cent) spent on applying knowledge. Course content ranges from equipment set-up using the facility’s live on-site medical gas system, to applying sections of the HTM to the equipment, notably the routine checking identified in section 10 of Part B.

Encouraging thinking
The combination of exploring the content of HTM 02-01, and practical application of the guidance on a live system in a controlled environment, has proven challenging to some course attendees, drawing comments such as ‘I didn’t expect to have to think’. However, an alternative standpoint would be that student involvement which generates thinking, interest, and discovery, is more likely to lead to a more motivated person who is enthused to investigate their workplace, and to seek potential improvements – ultimately improving patient safety.

Assessment on these courses is via a combination of project work and a final examination. Students’ output and course content are reviewed regularly to prevent repetition of work previously undertaken.

Further developments have enabled us to deliver QC pharmacist refresher courses in accordance with the requirements of the Pharmaceutical Technical QA Group, undertaken in a similar way, i.e. via the creation of an environment of both individual and shared learning.

We recognise that this approach is not for everyone, as it requires the student to participate actively, as opposed to regurgitating facts. We do, however, believe that competency is of greater importance than the ability to retain facts when it comes to patient safety, and, by encouraging practising of practical skills, techniques, and self-exploration, all of these approaches are very effective learning tools, and should help to ensure the safest possible environment for patients.

Pictured here leading medical gas training at Eastwood Park, Michael Ell says: “Student involvement which generates thinking, interest, and discovery, is more likely to lead to a more motivated person who is enthused to investigate their workplace, and to seek potential improvements.”

References

Michael Ell

As the training facility’s Medical Gas portfolio manager, Michael Ell leads and develops medical gas training at Eastwood Park, in Falfield, Gloucestershire.

Formerly a marine engineer, hospital engineer, estates manager at a 750-bed general hospital, and a medical gas risk specialist and trainer, he has over 25 years’ hospital engineering experience. Michael Ell offers in-depth knowledge of the role of a medical gas AP, as well as the management of medical gases on a range of sites. His course delivery encourages as much interactivity, and as many practical elements, as possible.