

Journal Article

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Managing critical systems a challenging task

Simon Everett, a Senior lecturer in the Built Environment at Wrexham University, discusses some of the challenges of managing 'legacy' AHU systems across the healthcare estate, and some of the key steps for healthcare engineers to consider to minimise the risks of such equipment failing.

Critical ventilations systems, i.e., those serving areas that cannot function safely without such systems (for a full list see HTM 03-01 a, paragraph 4.31¹) in healthcare premises, when designed, installed, and maintained correctly, help control the spread of airborne pathogens through the dilution and removal of contaminated air. Not all systems comply with current standards, and even some of those may not meet their design specifications – which may go unnoticed until their annual verification. For Estates teams, managing risks associated with legacy equipment is a significant and complex challenge. Assessing the condition of air-handling units (AHUs) regularly is important from a maintenance perspective, but is also crucial for effective lifecycle management, because early warnings can help avoid costly and sometimes catastrophic failure of the equipment, which in turn poses risk service interruption, infection control issues, and other safety considerations.

Competing with other capital funding requests

NHS Estates teams are often competing with other capital requests, and often clinical needs trump infrastructure, but is this because of a lack of understanding at a strategic level, and what happens when infection rates in operating theatres soar, and Infection Prevention and Control (IPC) teams investigate the root cause? From an Estates perspective, ensuring that AHUs have been maintained to the correct standard is vital, then. The plant should be performing to criteria laid out in HTM 03-01, but this might not always be the case – particularly with respect to plant installed prior to the most recent guidance. There should be annual verification and performance testing conducted, with performance compared with the



A modern UCV theatre air-handling unit.

validation figures obtained at the time of installation and commissioning. The values measured must achieve a minimum of 80% of the original air-change rate (HTM 03-01b, paragraph 4.16). The HTM makes the point that systems nearing their end of life may reduce in performance: “it is to be expected that over the lifetime (typically 20 years) of a ventilation system its performance will gradually reduce...” (paragraph 24, part B). However, the HTM is clear that equipment that is not performing to the required criteria should not be used. In this instance, what options should Estates teams consider?

In this article, we will discuss the pitfalls facing Estates teams, focusing on critical ventilation air plant, and suggest strategies for managing capital budget expectations, IPC risks, and operational and compliance considerations.

Pragmatism or idealism?

With no data specifying the number of AHU systems in hospitals at the end of (or nearing) their useful life currently publicly available, it's difficult to arrive at an accurate cost of replacing or upgrading to condition B all units across the country. However, for Trusts that operate and maintain legacy AHU systems, it is likely there will be other backlog issues

for its buildings such as heating or fire compartmentation. Where there are life-critical safety implications (for example, fire protection), these will often trump less 'visible' – but potentially as critical – legacy plant such as AHUs because of perceived risk.

Understanding the backlog profile of the estate should be a priority for Estates management teams, but often the correct methods are not employed. For Trusts in England, responses from the latest Estates Return Information Collection (ERIC) data² indicate that approximately 41% of sites had been surveyed formally, and just over 20%, since 2018. The latter figure is significant, as this might indicate an established rolling programme. Those sites with up-to-date backlog data are likely to be much better informed on their position and have a better understanding of where their assets are in their lifecycle. This doesn't necessarily mean that there is detailed information for any AHUs on the site. For critical ventilation plant (as defined in paragraph 4.7 of HTM 03-01b), a key document in understanding current performance capability would be the annual verification report. This document will identify whether the equipment meets the requirements set out in HTM 03-01, and – crucially – where, and why.



Left: A ‘barn’ theatre. There are very few examples of this type of theatre in the UK, and clinical staff should be reminded to pay particular attention to theatre equipment placement to avoid blocking any extracts.

Right: Plantrooms should be kept tidy, clean, and secure, particularly where they contain air-handling units, to avoid contamination during maintenance. This plant serves theatres installed in the early 1990s.

Where AHU plant is not performing to the standards laid out in the HTM, the annual verification report will identify this, and as per para 4.34 of the HTM, the system ‘should not be returned to service’.

In theory, this scenario should not come as a surprise to senior leaders in a healthcare provider organisation – although in practice it often does. If the correct governance mechanisms are in place in the Trust, the Ventilation Safety Group (VSG), whose members are ultimately acting on behalf of the Chief Executive, will be made aware of any lifecycle issues and subsequently conduct a risk assessment to determine the level of risk to patients and staff if equipment fails between re-verifications. The risk assessment should consider variables such as the type of occupancy in the rooms served by the ventilation system, the age of the plant, previous failure data, the level of current maintenance, and the depth and frequency of other maintenance or testing (if beyond the minimum quarterly inspections).

Mitigations required?

Once the risk assessment is complete, the VSG should decide if there are any mitigations required. This might then provide some assurances that the plant is running optimally, the degradation is slowed, and early warning provided where the plant is reaching a point of failure. Such mitigations might include increased frequency of inspections, increased frequency of testing (for example, testing 1 m and 2 m velocities above floor level for UCV theatres to ensure they are consistently meeting minimum requirements), and settle plate testing.

A key output of the risk assessment is to log the asset on the Trust risk register. By doing so, the VSG is informing and escalating the issue to Board (typically, an

informed position at Board level should be a key responsibility of the Designated Person (DP)), and in effect making the board members aware that investment is needed to either refurbish or replace the equipment. Estates management personnel should consider the interpretation of the risk, and whether the translation from any proprietary scoring differs when using matrices outside the department. It is much easier for clinical and executive teams to understand the risk rating provided by the Estates team by using the Trust risk rating matrix, which can sometimes be different to the scoring matrices employed, for example, in the construction industry.

Estates teams should also consider holding a risk register independently that they periodically review (quarterly as a minimum would be a good recommendation). This will influence a backlog priority list that can be shared with the Finance team during budget setting. A replacement programme should be considered based on the risks identified in the assessments, budget costs sought, and a plan drafted to carry out the works.

Identifying issues with an AHU, either through proactive or reactive means, is often only the start of the challenges facing the Estates team. The rising cost to eradicate backlog³ across the estate means there are competing assets for capital investment. Capital investment funding is increasingly being diverted to subsidise revenue spend,⁴ which is being increasingly squeezed, in part due to the breakdowns experienced as a result of the estate backlog, and, perhaps more significantly, the cost of energy to run inefficient and antiquated plant.

Running and maintaining end-of-life and legacy systems requires a well-trained team of competent individuals (Competent Persons (Ventilation)), a

well-considered and planned maintenance regime with detailed procedures and strict safe systems of work, and a robust system for reactive maintenance calls. Crucially, it requires expertise at junior and mid-management level (Authorised Persons (Ventilation)) to ensure that the maintenance is being carried out as per plans, and that the system continues to be safely operated. Having oversight of all this is even more important, so reporting should be comprehensive, but succinct.

Role of the AE

Ensuring that the Trust employs an Authorising Engineer (Ventilation) who is an active participant of the VSG will be helpful for the Estates team in articulating the issues facing them to senior leadership, and provide a stronger position for securing funding. The precedent set during the COVID-19 crisis has, to an extent, focused senior leaders’ attention on indoor air quality, giving them a better understanding of the contribution that mechanical ventilation makes to patient and staff safety, and clinical outcomes.

However, it may well be the impact on business continuity and capacity that will have the most leverage when considering capital investment. Over 6,700 Estates and Facilities incidents (including overheating) were reported in the latest ERIC report, with over 11,000 hours of downtime as a result of infrastructure failure.

The reality for most Trusts is that significant capital investment is not a certainty; Estates teams may thus have to manage until failure; and as discussed, this is not ideal. What can be done to improve in this situation? Individuals fulfilling the duties of CP (Ventilation) will need to be trained and proved competent, and so should understand the maintenance and inspections being carried out between annual verifications. Regular Continuing



A modern UCV theatre. Note the demarcation to the floorcovering to indicate the canopy boundary. Even in modern UCV theatres, some of the largest of their kind, overcrowding from equipment can be a challenge, and should be considered when conducting performance tests and troubleshooting.

Professional Development (CPD) can be helpful here, but as a minimum, the standard CP (Ventilation) certification is required. The same applies for the AP (Ventilation), and CPD might be even more helpful to these individuals so that they can maintain best practices and industry standards. CPD can also help when considering any additional maintenance requirements for ventilation systems. CPD is also important for stakeholders of the VSG, who might also then be better informed for making recommendations for mitigations or early warnings.

Taking the ASE's advice

Where teams are unsure, it is always best to seek the guidance of the Trust AE (Ventilation).

To summarise, the following strategies might be used to manage legacy AHU systems. This is not an exhaustive list, nor is it a checklist, but some Estates teams might find it useful to compare against their current strategies:

- Conduct a six-facet survey,⁵ and maintain an asset register. It is also important to consider decant costs as part of the valuation process during surveys, along with any disruption to services due to failure.
- Recruit and retain a well-trained, experienced, and competent team of individuals carrying out and managing the maintenance and comprehensive assessments, to identify issues such as filter degradation, airflow restrictions, fan deterioration, and microbial

contamination.

- Commission an engaged and experienced AE (Ventilation).
- Maintain a VSG that is well-attended (recording and reporting attendance and absenteeism to the overseeing committee can help manage this), with membership that includes the Director of IPC, the Trust microbiologist, other clinical colleagues, and the AE (Ventilation).
- A comprehensive maintenance schedule, influenced by the determined level of risk. It is also recommended that a physical 'Operations Manual' be available to all parties in the Estates office (this may feature in a future article), including drawings, verification reports, escalation routes, and policies and procedures,

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A smaller UCV theatre from the early 2000s.

- Maintain a good working relationship between the Director of Finance and the Estates Director. This is good practice for the sound management of finance, but it also helps nurture a relationship of mutual trust – via which the Estates Director’s concerns be taken seriously, and the DoF’s management of Trust finances respected.
- Assess and maintain a risk register, considering which risks are appropriate for the Trust risk register, ensuring that the DP can inform the board of any significant risks,
- Consider retrofitting where appropriate – savings in both carbon and finances can be the major benefits of this strategy, although not at the cost of patient safety,
- Also consider additional mitigations to provide early warning for system failure for high-risk systems such as theatres – e.g. settle plate testing, 1 m and 2 m velocity readings, and increased frequency of visual inspections.

Conclusions

Managing critical ventilation systems in healthcare facilities is an intricate and demanding task for Estates teams, especially when balancing the competing priorities of capital investment and clinical needs. The growing backlog (and therefore temperamental legacy equipment), along with limited funding options, continue to challenge Trusts, and make it essential for Estates teams to adopt a proactive, strategic approach to maintenance and risk management.

Ensuring that these systems meet the standards outlined in HTM 03-01 is crucial for patient and staff safety. Where there is a lack of comprehensive data on the

condition of these systems, combined with the pressures of addressing other urgent infrastructure issues, Trusts should be prepared for complex decision-making, and should implement processes to support teams in reaching decisions. However, by introducing the recommendations I have discussed, Estates teams should find themselves in a much stronger position for managing ventilation systems’ lifecycles moving forward.

Collaboration the key

Collaboration between Estates teams, clinical leaders, and finance departments is vital to managing the risk holistically. Establishing robust governance mechanisms, such as the VSG, and maintaining an accurate risk register, ensures that issues are communicated effectively, and senior leadership can then make informed decisions. The importance of Continuing Professional Development for all stakeholders is just as important, not only because it helps maintain high standards in the face of changing guidance and legislation, but equally because stakeholders will then have an appreciation of the importance of their roles, and the role of healthcare ventilation systems in the context of patient safety.

While the opportunity for significant capital investment may remain uncertain for many Trusts, adopting interim measures and mitigations can help manage the risks associated with legacy AHUs. Enhanced inspection schedules, early warning systems, such as the use of settle plates, and the consideration of retrofitting can offer substantial benefits. Developing a culture of collaboration



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across departments will strengthen the case for necessary funding and improve the overall resilience of the estate.

By focusing on these strategies, Estates teams can improve the reliability of critical ventilation systems, and ensure they continue to protect the health and wellbeing of patients and staff, despite limited resource and day-to-day operational challenges.



References

- 1 Health Technical Memorandum 03-01: *Specialised Ventilation for Healthcare Premises*. Department of Health and Social Care. 22 June 2021. <https://tinyurl.com/yukabxcf>
- 2 NHS England (2023) Estates Returns Information Collection, Summary Page and Dataset for ERIC 2022/23. <https://tinyurl.com/5n8sah5p>
- 3 Wickens C. *The NHS estate continues to deteriorate*. The King’s Fund. 14 December 2023. <https://tinyurl.com/3awsufjh>
- 4 Capital Investment in the NHS. The King’s Fund. 29 January 2024. <https://tinyurl.com/2whnwkp>
- 5 *Land and Property Appraisal*. NHS England. 2007. <https://tinyurl.com/2a4xah8f>