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IHEA MISSION STATEMENT
To support members and industry stakeholders to achieve best practice health engineering in sustainable public and private healthcare sectors.

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EDITOR'S MESSAGE

Another Australian summer emerges across the landscape and with it comes a myriad of seasonal challenges for healthcare facilities managers and the community at large.

I reflect over the past few summers, and they have been marked by some significant events, often described as "one-in-a-hundred-year" events – fires, floods or storms – such is the nature of increasingly severe weather events in Australia.

So, as you head towards summer, wherever you are, I hope the content of this journal is of interest to you, as I know many of you are introducing strategies to cope with these emergencies, and many more of you are developing plans to reduce the impact on the environment within your facilities.

We think particularly of our colleagues in parts of Australia who are already dealing with severe bushfires, and yet other parts who are recovering from severe rain events and flooding.

In this edition we share the increasing use of AI to enhance the role and benefit of facilities management practices, the ever-present challenges of infection control and we also keep the 2023 National Conference theme "Risk, Resilience and Relationships" alive on P47, and continue to bring you content from the 2023 Conference with material on fire safety compliance, among other things.

I am also happy to keep our regional international connections on your radar, by sharing with you some impressive work being done in Malaysia's public healthcare sector to reduce its environmental impact, and a brief report on the recent NZIHE Conference at which Jon Gowdy, IHEA National Past President and several IHEA members were present and contributed to a very successful New Zealand event.

As always, we are grateful to our corporate partners who support Healthcare Facilities with advertising, and for those who also provide technical content. We encourage you to take notice of the advice and ideas presented herein and consider if the information could benefit you and your colleagues in delivering world-class healthcare.

As we wrap up 2023, I wish all our readers a happy festive and holiday season and look forward to working with you again in 2024.

Regards
Darryl Pitcher – Editor

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NATIONAL PRESIDENT'S MESSAGE

As members would be aware, IHEA is a member of the International Federation of Healthcare Engineering, which represents the global fraternity of healthcare engineering bodies from more than 35 countries around the world. IHEA is a highly regarded member of the Federation, having hosted the 25th bi-annual IFHE Congress in Brisbane in 2018. IHEA regularly contributes to IFHE activities by submitting articles produced in Australia to the IFHE Digest, and by supporting other initiatives, including partnerships with WHO.

At the recent Congress, hosted by SMAES, the Mexican equivalent to IHEA, in Mexico City, the value of federation member contributions to recent WHO activities was widely applauded, as more than 20 programs had benefited from IFHE input in eleven countries. These initiatives included responses to appeals for COVID, Ebola and Emergency Disaster clinic support and the representative from WHO, Michele Di Marco expressed appreciation for the offers of information, design, advice and consultancy that allowed WHO to respond to emerging challenges. Future initiatives with WHO that IFHE members will be invited to contribute to, will include improved design guides for Indoor Air Quality and Ventilation, Climate Resilient Healthcare Design and manuals to support Establishing Emergency Clinics during Disasters. IHEA members will be welcome to contribute their expertise to these initiatives, and I encourage members to consider offering their support to this important work.

The IFHE Executive Committee and Council also met across two days of meetings early in November, and I attended these meetings in my role as IFHE, Joint General Secretary, whilst also representing IHEA as National President. The spirit of cooperation and camaraderie was very evident, and the meetings together with the 19th SMAES Congress of the Hospital of the Future, brought together delegates from 19 countries.

Of particular interest was a strategic workshop where Council delegates shared their insights into how IFHE can broaden its benefit and influence with member associations and individuals around the world, and as this work continues it will be shared with you.

A reminder to all IHEA members, that membership renewals have been sent out and are now due and payable. If you have not received an invoice or have any queries about payment, please reach out to Vanessa Gallina in Membership Services (ihea.membership@ihea.org.au) or by phone 1300 929 508.

All the best
Darryl Pitcher,
IHEA National President

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QUEENSLAND BRANCH REPORT

Healthcare facilities present a myriad of challenges. As I am thinking about what to report, I am being distracted by the welcome sound of thunder and rain BUT can't help wondering what issues may arise from leaks and drainage issues, what phone calls I will get (as luck would have it, I am on call) and if it keeps up, what queries from corporate office will arrive requesting reports on impacts. I am also reminded of my current workday, addressing challenges arising from a significant new build being planned for a congested brownfield site and the complexity of delivering and maintaining infrastructure that supports the delivery of first-rate health care. Whilst I am lucky to be able to get help from local colleagues and others across my organisation in these situations, IHEA is also great place to build those support networks. The adage "it is not what you know, but who you know" rings true in managing facilities that require support from many different disciplines.

New Members

I would like to welcome all members from Queensland that have joined recently. We look forward to catching up with you at our upcoming events and getting to know you.

Professional Development Seminars

As this journal goes to print, the Queensland Branch will be holding a professional development afternoon at the Pineapple Hotel on Thursday 23 November. The theme of the afternoon will be *"Water Quality, heavy metals, standards, solutions and learnings"*. CETEC and Enware have kindly offered to both sponsor the afternoon and present on related topics. Greg Jackson from the Queensland Health Water Unit will also be sharing, amongst other things, updates on the recent statewide metals sampling initiative.

To reduce the workload on the Branch Committee, Vanessa Galina (IHEA Membership Services) is kindly working with us to streamline registration and promotion of our events. The November PD is our first trial of registering via the website and issuing tickets – with anything new there is the likelihood of some teething issues, so please let us know of any challenges you experience.

Planning is also underway for another afternoon PD in early 2024. Please keep a look out for the information that will be forthcoming via emails and other means. The Branch organizing committee is always looking for great ideas for PD themes – your feedback on this would be greatly appreciated and if you want to volunteer a colleague (or yourself) for a presentation, please get in touch with us.

Committee of Management

Reflecting on the committee, it is great to see the overall age of those involved in the QLD committee dropping which bodes well for the future.

President	Danny Tincknell
Vice President	Michael Campbell
Treasurer	Michael Ward
Secretary	Josiah Padgett
State National Board Representative	Adrian Duff
Committee member	Christopher Aynsley-Hartwell
Committee member	Matt Smith
Committee member	Arthur Melnitsenko
Committee member	Mark Fasiolo
Committee member	Mark Collen
Committee member	Nic Coffey
Committee member	Andrew Leggate

If you would like to communicate with the QLD Branch via email, please do so at ihea.qld@ihea.org.au .

Wishing you all a safe and happy Christmas and New Year! Hope you all get to enjoy a well-earned break and quality time with family and friends.

Danny Tincknell
President, QLD Branch

NSW/ACT BRANCH NEWS

Hello everyone from NSW/ ACT branch and hoping everyone is getting organised for the mad Christmas rush and then planning to get a few weeks off for rest and recuperation.

For many of us within the healthcare facilities industry, the Christmas period is often the optimal time to get into areas that running at full speed during the rest of the year, to do those quick renovations, shut downs, change overs, and other wish-list projects. So, to all those people working, I hope you have your holidays booked for February.

The NSW/ACT Branch convened their Special Branch Meeting on September 19th and I am happy to advise the following people were nominated for Committee of Management:

President: Cameron Ivers
Vice President: Rick Dyer
Treasurer: Wes Abbott
Secretary: Jacki Maccullagh
Committee members: Jason Swingler, Jon Gowdy, Gregor Riese, Mal Allen, Greg Allen, John Miles, Justin Walker and Evan Mckay.

Thank you to everybody involved for those continuing and those joining the Committee for the coming year. We have a few planned events coming up including the very special PD day and Sydney Harbour boat cruise on December 1st which promises to be an excellent event, and I will provide a summary on in the next edition.

I would like to give a special thank you to Mal Allen NSW/ ACT Treasurer and Committee member for more than 20 years and Marcus Stalker who has been our valuable Secretary for over seven years. The NSW/ACT Committee has really valued their help and support and for Mal who also made a bug contribution to the National Board also. These two gentlemen have been a massive part of the national and state committees and have given many hours to the IHEA, supporting the membership, organising events and PD days. They will both remain on the state committee but will be stepping back from the executive roles and letting some 'newbies' take the reins.

NSW /ACT Branch members travel to New Zealand for NZIHE Conference

It was an amazing opportunity for Capital Infrastructure and Engineering-SLHD team to present at the NZIHE Conference in Auckland, New Zealand.

The conference was attended by Jon Gowdy, Meenal Sharma and Anthony Mikhail.

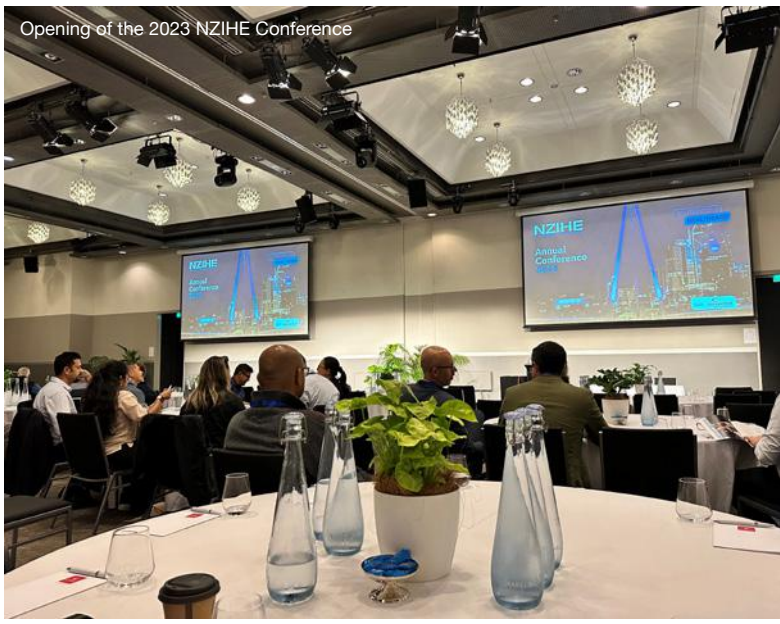
Meenal Sharma and Anthony Mikhail presented to the theme, "Curb the Risk" demonstrating how compliance obligations can be managed through customized in-house solutions that closed some gaps within the asset management systems.

There was a strong focus on sustainability in healthcare and how leveraging data can help to make more robust and reliable asset management decisions.

This was a great networking opportunity for everybody involved, and it was excellent to have the NSW branch well represented in the New Zealand national conference.

As part of the work, we do in hospitals around the country, MRI systems are one of the many complex things we are often working on, so I thought I might share some of my experiences on this. The main vendors we see are Siemens,


IHEA NSW-ACT Branch members travel into Auckland



Opening of the 2023 NZIHE Conference

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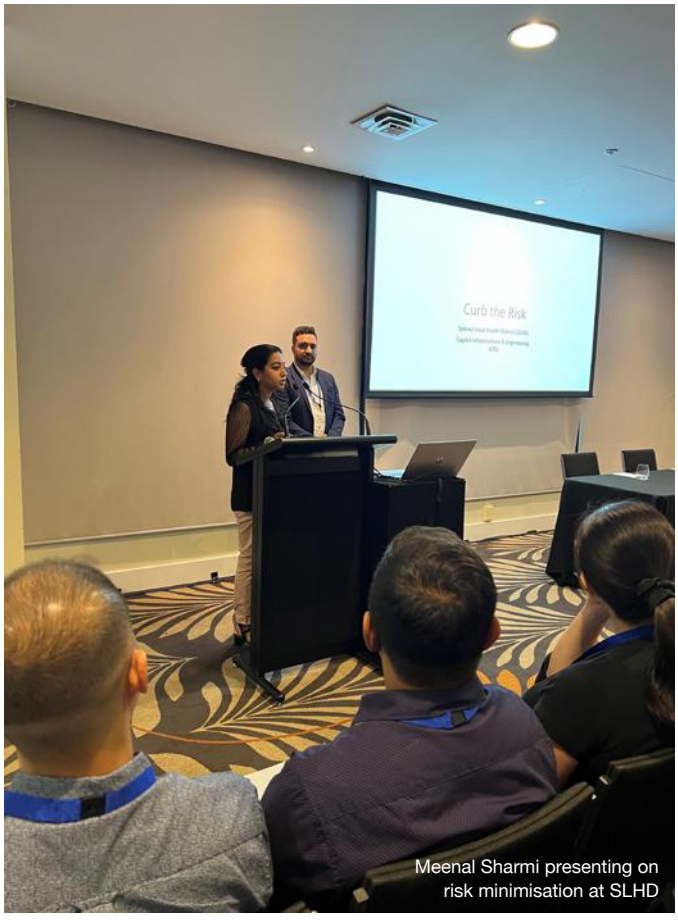
Phillips and GE and I have spoken to Greg McLaughlin from XMI to discuss the importance of understanding the complex world of all things MRI related.

Magnetic Resonance Imaging (MRI) design, safety and compliance within a hospital or healthcare environment are often overlooked by engineering facilities teams. Generally, there is high reliance on the supplier of the MRI equipment to ensure compliance and certification.

Given this is a highly specialised area of expertise, there are limited resources and even fewer companies our industry can rely upon to provide independent advice when introducing MRI services into a healthcare facility.

Anthony Mikhail talking about BME compliance management within NSW Health



Meenal Sharmi presenting on risk minimisation at SLHD

MRI Safety and Design

There are design principles and planning resources available via the Australian Heath Facility Guidelines, and as the name suggests, these are a guideline only. Each MRI manufacture has an extensive planning guide that must be interpreted and integrated correctly.

What is not often considered, is MRI safety. The Australian Society of Medical Imaging and Radiation Therapy (ASMIRT) is the peak body representing medical radiation practitioners in Australia and has published *RANZCR MRI Safety Guidelines* and is a key reference tool to understand and implement MRI safety in design. As an example, for the purpose of planning, it is necessary for four (4) safety zones. These zones are set out to ensure any person entering the MRI room has been screened for ferrous metal objects and as a control point to stop staff and patients simply walking into the active MRI space. Imagine what could happen if an untrained cleaner or un-screened hospital worker walked into the MRI with a vacuum cleaner or some other metallic object? This has the potential to be a serious safety issue and there are many examples globally where this has occurred.

MRI Compliance

MRI suppliers often have many models of equipment on offer, and each will have a model-specific equipment planning guide. Without the proper knowledge and insight, the ability to interpret, and implement the necessary information can be overwhelmingly difficult. You cannot reply on the information from a previous project, as there are regular updates to planning guides along with significantly different MRI magnetic strengths; 1.5 Tesla and 3 Tesla MRI's being amongst the most common.

Radio Frequency (RF) Shielding and Magnetic Shielding

An MRI does not produce radiation typical of other equipment generally used within a Radiology, Nuclear Medicine or an Oncology department.

However an MRI must be located within an RF shielding room and put simply, the MRI will not work without it. The RF shielding is not part of the MRI and will need to be procured through a specialist company. The RF shielding must comply with the equipment planning guides and perform to a minimum standard and tested at various frequency ranges. RF shielding is both complex and highly specialized and should be left to specialists to carry out these works

Magnetic Shielding

The MRI is basically a giant magnet and produces very strong magnetic fields. As mentioned above, patients must be screened for ferrous metal objects before entering the MRI

room and all materials and equipment must be MRI safe to enter the active zone.

The Magnetic field will extend further out than the MRI room itself and this magnetic field weakens the further it extends from the MRI, however the magnetic fringe field is still powerful enough to affect patients with medical implants like pace makers.

The “5 gauss line” is the safety line drawn around the perimeter of the main magnet of the MRI scanner, specifying the distance at which the stray magnetic field is equivalent to 5 gauss (0.5 mT).

Five gauss and below are considered ‘safe’ levels of static magnetic field exposure for the general populace. At five gauss and above: cardiac pacemakers and other implanted electronic devices are at risk of being interfered with by the static magnetic field, and ferro-magnetic materials may become projectiles (and are thus prohibited from crossing the 5 gauss line).

Note that the distance at which a 5-gauss line is drawn around a particular MRI scanner will depend on magnet strength.

To contain the 5-gauss fringe field additional magnetic shielding needs to be introduced to maintain safe and acceptable limits.

The material used to shield or contain the 5 gauss line is a specialist product and will need to be integrated into the RF shielding, and is therefore carried out by the specialist RF shielding company.

Summary

The introduction of an MRI to a facility or the replacement of an older MRI with a more advanced model is complex and sometimes confusing. Radio Frequency shielding, Magnet shielding, MRI safety zone and RF testing frequencies are not terms we hear every day. These are just a few of the critical items needed to make an MRI function correctly. You simply can’t walk into your local hardware store and buy the materials needed to construct a safe and compliant MRI treatment space.

There are a limited number of experts out there within this field, so the best advice is to speak to the project manager of the supplier or through the IHEA and we can connect you to the right people.

Thank you
Cameron Ivers
NSW/ACT Branch President

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SA/NT BRANCH NEWS

The SA/NT branch special meeting was held on the 25th of September and was kindly hosted by SA corporate member AHT in their new office, workshop, warehouse and training facility located in Thebarton.

AHT also recently celebrated their 10-year anniversary as a key provider of healthcare specific engineering and electrical solutions across Adelaide and SA, and AHT are to be congratulated for this important milestone. We thank AHT for their continued support of IHEA activities.

I am very encouraged to report that we have broadened our state committee numbers. I thank our new committee members for volunteering to participate in the SA Committee of Management, joining the existing committee members. We are grateful for all the contribution during the last year, as we hosted the IHEA national conference and ran a number of events in Adelaide.

We look forward to the refreshed energy the incoming committee members will bring and are very optimistic of bringing that enthusiasm to our members as we head into the new calendar year. We will be finishing off this year with an end of year / Christmas breakup networking drinks get together on the 29th of November. Keep your eyes open for details as we get closer to the date.

Committee of Management 2023–24

President	Andrew Russell
Vice President	Gary Clifford
Treasurer	TBA
Secretary	Josiah Gary Clifford
State National Board Representative	Andrew Russell
Committee member	Darryl Pitcher
Committee member	John Jenner
Committee member	Damien Breen
Committee member	Michael Scerri
Committee member	Hilton Guinness
Committee member	Gary Gilbert
Committee member	Harshi Karam
Committee member	James Patrick

To communicate with the SA/NT branch please email us at ihea.sa@ihea.org.au.

Andrew Russell
President, SA/NT Branch

WA BRANCH NEWS

Summer in Perth is a good time, the skies are blue, the temperature is hot and big events happen. We have had the footy grand finals, Telethon, the Perth Royal Show and of course the WA IHEA State Conference.

Sadly, I did not get to go to this year's conference, because someone has to stay at the hospital to keep things ticking over and this year it was my turn to take one for the team.

The feedback I received from the delegates was exemplary. Jana Simpson our president and convenor lifted the WA Chapter to another level of excellence, and I can think of no one better than Jana to tell us all what it was all about.

IHEA WA State Conference Friday 15 September 2023

The State event for Healthcare Facility Management & Design Professionals

The IHEA Western Australia (WA) Branch held its annual state conference on Friday 15 September 2023 at Fraser Suites in East Perth providing delegates with the best opportunity in 2023 to network with industry colleagues and hear about the latest industry trends.

Themed around *"Set to Soar"* Implementing change in the Healthcare Facilities Management Sector. The healthcare industry is fast-paced and the day focused on the latest changes that will shape healthcare's future. Participants learnt about solutions that will affect the industry, including cutting edge technology, trends and ways to improve energy efficiency.

With an inspirational line up of speakers and supported by a technical tour of Royal Perth Hospital (RPH) recently upgraded Heli Port, the 2023 IHEA WA State Conference certainly lived up to our expectations!

Stephen Barrett from NDY presented on the RPH new helipad and how to build a new helipad above fully functioning 6-story hospital building.

Robin Archibald from 3E Net Zero Group provided a case study on implementing energy efficiency and renewable energy solutions across a hospital portfolio.

Leif Jensen from Eco Jemss took us on a journey on external RMD reprocessing benefits and described some of the pitfalls.

Robert Coltrona from Carbon Reduction Ventures provided insight on flexible energy in the era of renewables and how green hydrogen fits into this complex landscape.

Andrew Waugh from Serco, Fiona Stanley Hospital, engaged with his take on an innovative maintenance approach to high voltage switchgear.

Judy Corpuz from Pall Medical educated us on the effects of water quality and current controls in health care water systems.

Alex Foster from Fosters Services took us through the challenges and changes that are coming to EV infrastructure.

Ryan Milne from EcoSafe International presented on sustainability goals conflicting with traditional water quality controls.

Lee Bayliss from Schneider Electric provided an overview of Building Advisor and the essential elements it brings to building management.

Deany Jaghdour from Jacobs provided a snap shot of cyber security in hospitals and gave us all some tips on where do you start.

And, to cap it off, the conference reception and trade show provided great opportunities for delegates to connect with facility managers and product and service providers.

We look forward to the 2024 IHEA WA State Conference planned for September 2024.

We would like to thank our sponsors for supporting the IHEA WA Conference.

Stephen Barrett presenting

Deany Jaghdour presenting

Ryan Milne presenting

Alex Foster presenting

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- Western Water Solutions
- Snap Plumbing
- KalCare
- EcoSafe International
- Norman Disney Young (NDY)
- QED Environmental Services
- EcoJemms
- Integrated Facilities Management (IFM)
- BGIS

Thank you, Jana.

On the 23rd of November 2023, Ultramax Pipelines & Filtration Systems will be hosting a professional development session at the John Leckie Pavilion College Park Nedlands, where they will be presenting their take on healthcare medical gas systems.

On the 8th of December 2023, we will be at the Whipper Snapper Distillery in East Perth to wind up 2023 with a tour, a cocktail master class and an opportunity for year-end networking. We will also be announcing our annual awards for WA Engineer, Tradesperson, Apprentice and Volunteer for 2023.

Regards
Fred Foley
Vice President

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KEY DATES

November 2023 – January 2024	Call for abstracts open
November 2023	Sponsorship opportunities open
December 2023	Early bird registrations open
February 2024	Program released
March 2024	Early bird registrations close
27 - 29 May 2024	IHEA National Conference

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DRIVERS BEHIND THE WIDESPREAD USE OF UV DISINFECTION TECHNOLOGY IN QUEENSLAND HOSPITALS

Gregor Riese, Director

Opira Group

Introduction

Ultraviolet (UV) disinfection technologies have been available for decades, but the COVID pandemic has renewed interest in infection prevention and control (IPAC) measures to limit the spread of hospital acquired infections. What's interesting is the widespread use of the technology in the Queensland hospital sector in contrast with much of the rest of the country. While many other technologies to kill pathogens are now available to infection control experts, the application of UV lamps emitting 254nm radiation (UVC_{254}) for air and surface disinfection is becoming the norm in Queensland hospitals.

This article looks at the reasons why Queensland hospitals are leading the country in the uptake of surface and air UV germicidal irradiation technologies and lessons for the rest of Australia.

Keeping air handler coils clean – surface disinfection using UVC_{254}

Queensland has a tropical climate, far warmer and more humid than most other Australian state and territories, with hot/warm and humid conditions affecting populated coastal areas.

Fouling of air handler coils caused by bacteria and fungi biofilms is common in tropical conditions because of the availability of moisture and the very large surface areas on the cooling coil fins of mechanical air handlers. The warm moist air provides conditions for optimal growth of mould and bacteria, and the debris and dust from unfiltered outside air or recirculated indoor air is a constant source of nutrition. Combined with the cool, dark and constantly moist conditions on the coils of most air handlers, microbial growth can flourish.

UV shined on cooling coils has been shown to eliminate microbial growth including all known bacterial and mould species. Independent studies on the energy cost saving of UVC_{254} installations in tropical climates similar to that experienced by many parts of Queensland, have demonstrated significant improvement in pressure drop, air speed across the coil and chilled water usage.

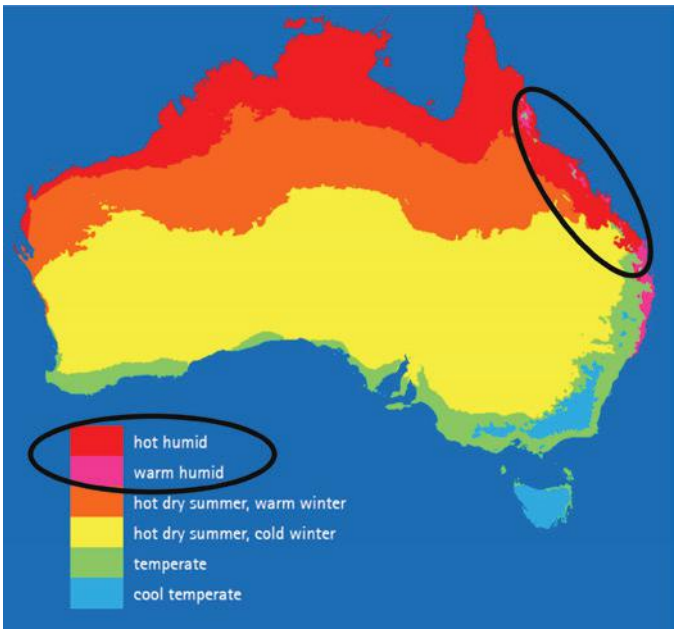

Figure 1 – Australian Climate Zones[1]

The reduction in energy usage in the heating, ventilation and air conditioning (HVAC) provided by the removal of biofilms and more effective heat transfer, reduces total energy costs of the system including the operation of the UVC lamps. In the Wang *et al*. study cited above, the savings in fan energy were 39% greater than the energy used by the UV lamps. These savings do not include the costs of manually cleaning the coils on a quarterly or twice-yearly basis.

Does UV treatment of coils benefit the health of hospital staff and patients?

While the energy savings with UVC_{254} have been shown to be significant, there are also health benefits to the hospital patients and staff associated with breathing air cleaned by UVC_{254} treated coils. One key study published in *The Lancet* applied UVC_{254} in an office building with 771 participating office workers. Treatment of cooling coils resulted in a:

- 99% reduction of microbial and endotoxin concentrations on irradiated surfaces

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Does Not Require Shut Down of System	●	○	○
No Rinse Required	●	○	○
Penetrates Any Depth of Coil	●	○	○
Does Not Cause Damage to HVAC Coils, Fins & System Parts	●	○	○
Can Identify and Focus on Blockage Areas in Coils	●	○	○
Removes Biofilm	●	○	○
Surface Area Coverage of Coil Achieved	99%	10%	10%
Water Usage	0.3L per minute	22L per minute	N/A

Average Pressure Drop across all AHUs

26%

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Examples of heavy microbial growth on coil and trays (Source: Opira Group)

- reduction in airborne bacteria of between 25–30%
- reduction in respiratory symptoms of office workers by 40%.[3]

Bacterial and fungal spores released from biofilms growing on the coil do not necessarily cause disease in healthy human populations, however the risk of disease in hospitals is higher with patients with compromised immune systems. UV treatment of coils can also achieve some degree of air disinfection by potentially killing pathogens recirculating in the HVAC systems. These effects are highly dependent upon air speeds[4] and room size.[5]

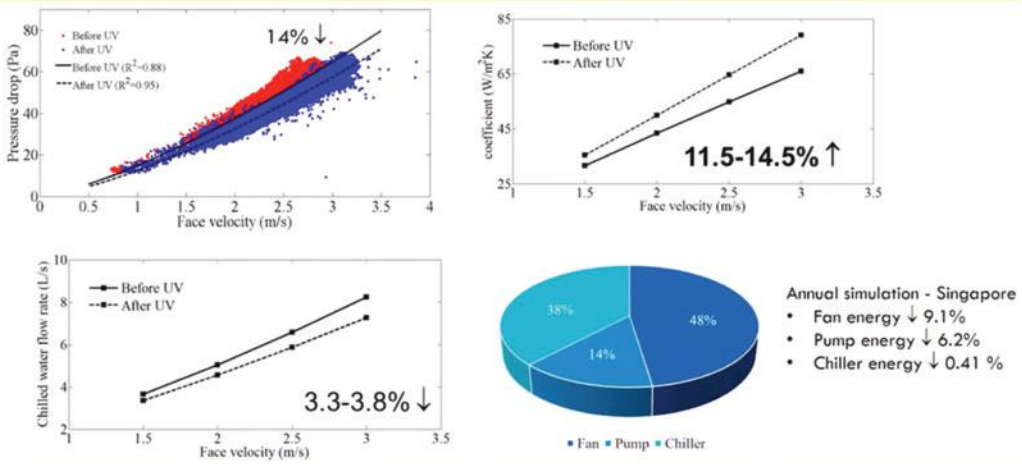


Figure 2 – Key HVAC system performance improvements from application of UVC_{254} on the coil face[2]

UVC_{254} installations can also be specifically designed for air disinfection. These systems are more efficient and effective in killing airborne pathogens than UVC_{254} coil system alone and are often positioned in supply air ducts or return air ducts to eliminate pathogen spread via the HVAC system. These are examined in more detail below.

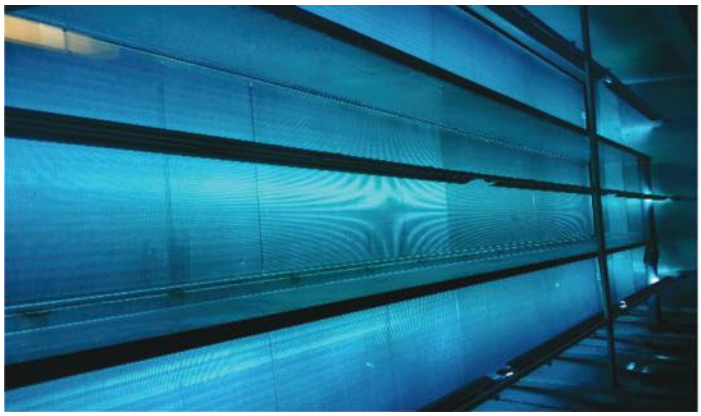
Air disinfection using UVC_{254} in HVAC systems

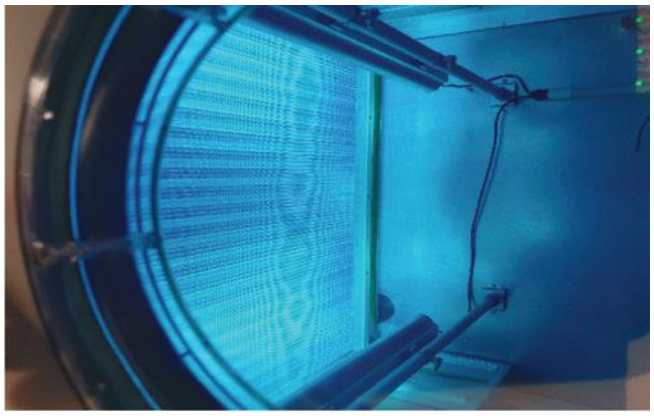
Given the widespread adoption of UVC_{254} in the air handling systems of Queensland hospitals, it is perhaps to be expected that they now apply the same technology for air disinfection. When sizing a coil installation, the key metric is UVC *irradiance* on the surface measured as microwatts per centimeter squared (μW/cm²). When disinfecting air, the key metric is the UVC *dose* necessary to deactivate a pathogen. This is measured in microjoules per centimetre squared (μJ/cm²).

There is nearly 100 years of research on the impact of UVC_{254} on various microorganisms.[6] This knowledge allows the sizing and installation of UVC_{254} systems in HVAC system ducts with a clinical precision targeting known pathogens for immunosuppressed or vulnerable hospital populations. In relation to SARS-CoV-2, recent research has shown the virus can be 99% inactivated by a dose of 1222 μJ/cm².[7] Knowing the duct size and maximum air speed through the duct provides all the information necessary to target these pathogens. The example delivers a 99.97 % (3-log) inactivation of SARS-CoV-2 with a single pass.

UVC_{254} is not a substitute for air filtration, and it is still recommended that a minimum of a F8/MERV13 (ISOePM1 50%) filtration is used in general hospital areas[8] and that HEPA filters continue to be used for surgeries and other critical care areas. It is also recognised that HEPA filters are very expensive to run due to the energy used to force air through their filters and they do not capture all the pathogens within an air stream.[9] A study by Azimi and Stephens (2013) looked at the cost effectiveness of filtration vs relative risk of and concluded that the optimum filtration to minimize pathogen risks is at the MERV 13/14 threshold.[10]

Recent research has shown a very significant improvement in health outcomes and cost of treatment associated with UVC_{254} air treatment.[11] As a result, Queensland hospitals have





Examples of coil cleaning UVC_{254} installations (Source: Opira)

Duct Info		General Info	
Duct Width	350.0 mm	Product	Bio24
Duct Height	250.0 mm	Lamp Length	609.6 mm
Duct Reflection Coefficient	0.57	Teflon Protection	No
Duct Temperature Increase	0.49 °C	Number of Biowalls	1
Duct Pressure Loss	0.422 mm H2O	Total Input Power Required	240.0 W
Duct Airflow	1458.0 m³/hr		
Duct Air Velocity	4.63 m/s		

Irradiation Dose Delivered

Min dose	Average dose	Max dose
3.48 mJ/cm²	5.01 mJ/cm²	8.29 mJ/cm²

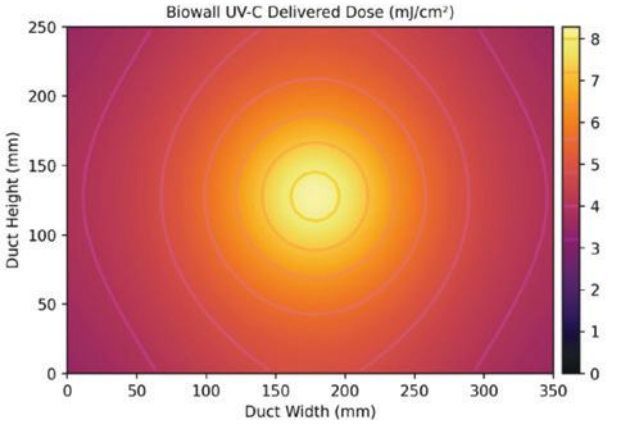


Figure 3 – Example of an in-duct sizing specification (Source: Sanuvox Fitting Software).

installed and continue to install many UVC_{254} air disinfection systems for surgeries and critical care areas. Unlike UVC_{254} installation on coils where the application may only be justified in higher humidity areas and tropical climates, air disinfection has far greater potential to limit hospital acquired infections in all areas across all Australian health services.

Adoption of UVC_{254} for surface and air disinfection

The COVID pandemic drove the risk assessment approach in the IPAC community with particular focus on hospital acquired infection risk in confined areas such as elevators, bathrooms and ambulances. Given the versatility and effectiveness of UVC_{254}, for air and surface cleaning the Queensland hospital sector now applies the technology in many other areas beyond coil cleaning.

What separates UVC_{254} from other technologies is the very long research history of UVC disinfection against known pathogens and other microbes.[12] The use of UVC_{254} to disinfect water is very common and its broader application to surface and air disinfection in the healthcare sector is likely in the future. This trend has been supported by several publications by healthcare authorities, government and NGOs giving guidance to hospitals on the application of the technology. These include (in date order):

- Kowalski, W. 2009. Ultraviolet Germicidal Irradiation Handbook for Air and Surface Disinfection. Springer-Verlag Berlin Heidelberg. Retrieved from: https://www.springer.com/gp/book/9783642019982
- NIOSH 2009 - Environmental Control for Tuberculosis: Basic Upper-room Ultraviolet Germicidal Irradiation Guidelines for Healthcare Settings. Retrieved from: https://www.cdc.gov/niosh/docs/2009-105/default.html
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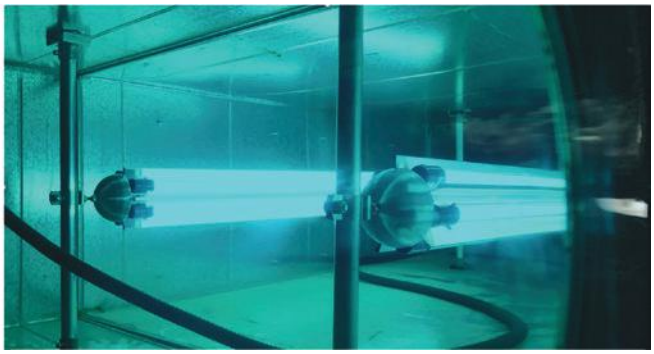
- ASHRAE Handbook 17 (2020). Ultraviolet Lamp Systems. Chapter 17 Retrieved from: https://www.ashrae.org/file%20library/technical%20resources/covid-19/i-p_s16_ch17.pdf
- UK NHS 2023: Application of ultraviolet (UVC) devices for air cleaning in occupied healthcare spaces: guidance and standards. https://www.england.nhs.uk/long-read/application-of-ultraviolet-uvc-devices-for-air-cleaning-in-occupied-healthcare-spaces-guidance-and-standards/

There is always some degree of risk with the introduction of new infection control technologies. What distinguishes the use of UVC_{254} from other technologies is that the mitigation and control measures are well established and understood, leading to increasing confidence in its application for air and surface disinfection in the hospital sector.



Examples of in-duct UVC_{254} air disinfection installations (Source: Opira)

Combined air and surface disinfection installed in far north Queensland hospital service lift

Disclosures: Opira is an Australian-based supplier of filtration, UV and fumigation technologies, primarily to the healthcare and pharmaceutical sectors

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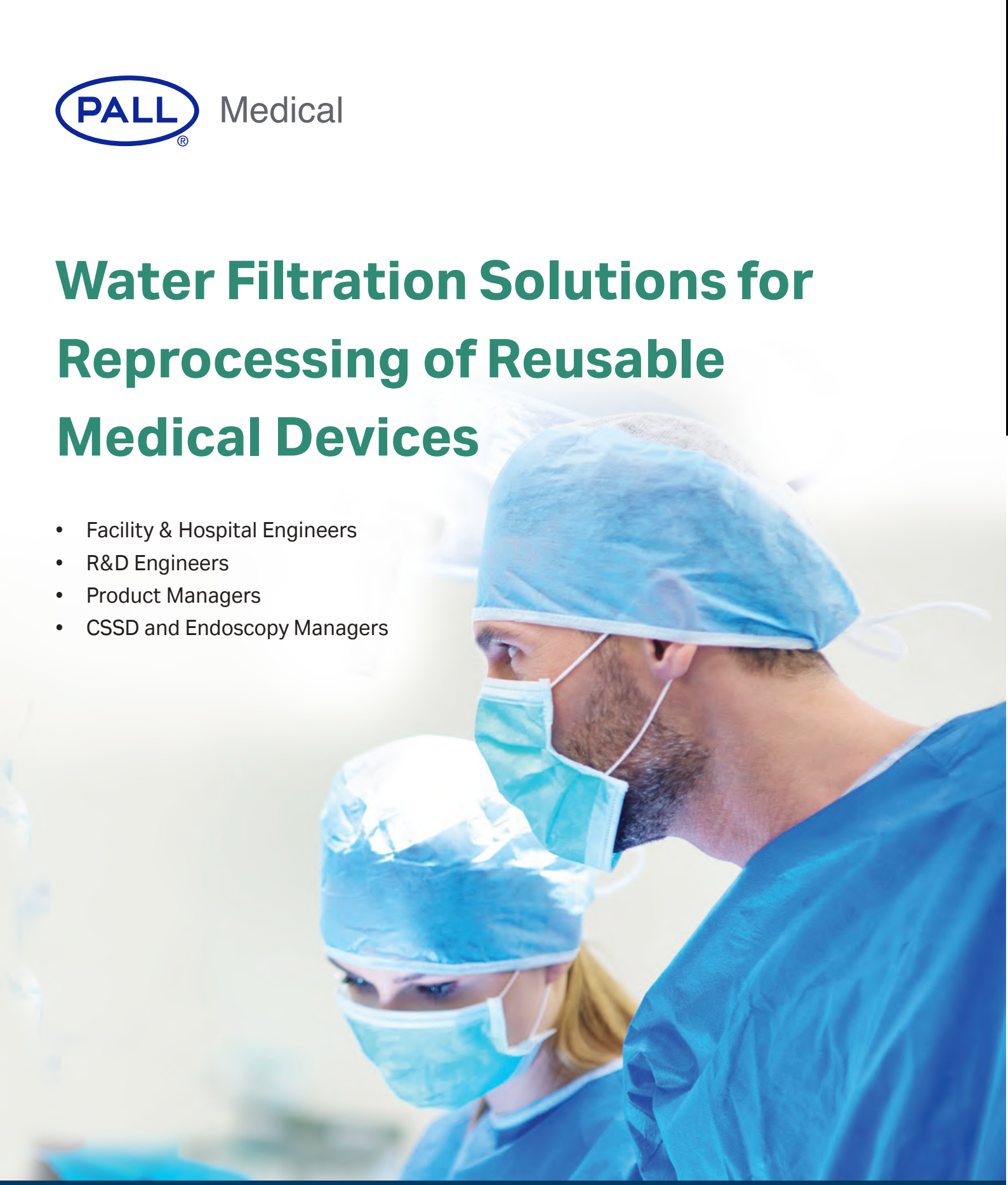

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A THOUGHT ON CAR CHARGERS IN HOSPITALS

Lachlan Gowdy

ACIA Electrical Services

While the government looks to mandate electric vehicles (EVs) on our roads over the next 10 years, the conversation around EV fleets and EV charging stations has inadvertently been appearing more and more in the Healthcare Industry. There is no hiding the fact our industry will be playing a part in the EV revolution over the coming years as we look to employ electric vehicles into hospital fleets. But how will these vehicles be charged? What is the associated infrastructure required for these chargers? Will these vehicles always need to be fully charged? These are the questions, as an industry, we should be asking in order to make the appropriate decisions, for a successful EV rollout.

As it was in the late 90s and early 2000s with the solar breakout (and generally how it is with any breakthrough industry), there is a lot of false information being spread regarding unrealistic costs, budgets, infrastructure requirements and a general lack of knowledge on the operation of car chargers. We decided to go looking for answers and this is what we've found.

At first thought, the ideal solution to charging a whole fleet is to get the quickest, most powerful chargers available such as a 22kW rapid charger. The problem with this, however, is the amount of power it demands, and the associated infrastructure required to accommodate this level of power. Most large carparks at our hospitals are out and away from the main buildings and away from the Main Switchboards. Meaning there would be substantial upgrades to substations and the cabling required to be run out to these carparks where the chargers would be located. Together with this, the practicality of these rapid chargers must be considered. Think about the daily situation where the fleet cars roll in around the late afternoon/evening and plug into these rapid chargers – the rapid charger will have your vehicles fully charged in 2-3 hours and by this time it is perhaps 6-8pm? Who is going to be there to move the cars and rearrange them to make sure all the cars are being charged overnight?

Due to the aforementioned issues, we propose the use of 2-3 rapid chargers and up to 40 wall mount, manufacturer supplied plug in chargers. This is based off a 200A incoming supply to a carpark where the charging station is situated. If we take a Tesla for example, its supplied charger draws 6-8A and will give you a minimum of 20% charge over a 12-hour period. This amount of charge provides approximately 100–130km worth of driving, making it extremely unlikely that the EV will run out of charge before the end of the next day (Are fleet cars going to travel more than 130 km in a day)?

As previously mentioned, the rollout of EVs and EV charging stations can largely be compared to the Solar PV days in the late 90s and early 2000s. The industry was moving in the right direction and the gear was of high quality. They all had their own minor issues, but manufacturers backed their systems with the appropriate support. Then, once it became popular, it was a race to the bottom, fuelled by who could supply the cheapest equipment in the quickest time. By exporting manufacturing overseas, we ended up with an abundance of non-tested, unregulated gear that was not backed with support upon failure. We must avoid having a repeat of this situation with EV chargers. To do this; high quality, reputable equipment must be used and installed by professionals.

While the right equipment is of high importance; no equipment is going to work if the appropriate planning and allowances aren't made for infrastructure modifications. Future proofing works that are being done now will be beneficial down the road. If you're digging up garden beds or roads now, install extra conduits. If you're running cable in

carparks, use bigger cable tray. Small modifications like this will save major disruptions in the future. Any modifications to switch boards over 125A will trigger the upgrade of your supply system, which is important to note as this could bring your whole operation to a grinding halt and cause major issues when trying to get funding. What are the conditions of your main switchboard? What is the quality of the cabling like? We must start planning to make these upgrades or at least taking the first steps of gathering information.

At the crux of the Electric Vehicle is the lithium-ion battery, and while these act as a greener alternative to the traditional combustion engine of a standard motor vehicle, they can also pose as a major hazard. There is mixed information about EV vs Petrol vehicles regarding the likelihood of either catching fire. Some research suggests that petrol and diesel cars are 20 times more likely than that of electric vehicles. However, what we are most concerned about is the TYPE of fire associated with an EV and the environment in which that might occur i.e., our charging stations under or above ground.

The important point to note is that in the event of an EV catching fire the risks are huge and the consequences are enormous.

This is due to the lithium-ion batteries that power EVs. When a lithium-ion battery is compromised the energy that was being stored is released as heat (thermal runaway).

The fires from EVs are extremely hard to extinguish and release large amounts of deadly toxic gas (carbon monoxide, hydrogen cyanide, hydrogen fluoride and cobalt).

What can we do in the event of a fire or large electrical fault at one of our charging stations? Will we have the infrastructure in place to be able to contain and respond to it safely?

This ties into the importance of selecting the right equipment and not importing non-compliant gear. The right equipment must have the right safety systems in place to prevent risk in an emergency.

At this point in time, the best approach is to avoid putting any form of charging stations in an underground setting as this could become a serious issue in the event of a fire, with limited access for emergency vehicles. To prevent such electrical faults and corresponding fire hazards, AS/NZS 3000 enforces protective devices for automatic disconnection of power supply such as a Residual Current Device & Circuit Breaker, additionally an isolator switch must be placed within 2 metres of each charging unit.

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- Pollen
- Animal epithelia
- Odour molecules

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It is believed that cold plasma technology will be the standard in various disciplines where hygiene is fundamental. It is a high-quality, sustainable and uncomplicated healthy technology solution that simplify people's lives. Product development started in 2014 in Germany.

Extreme Convenience

The Cold Plasma disinfection system for air and surfaces sanitization offers maximum cost-effectiveness as no complicated filters have to be replaced. This leads to a maintenance-free device with no follow-up costs.

Four portable devices are available, for community transport, small and large rooms, health care facilities i.e hospitals, clinics and surgical:

- PlasmoCar
- PlasmoAir (Pro & Compact)
- PlasmoHands
- PlasmoLight

It also offers maximum comfort. The Cold Plasma devices can work automatically and continuously 24/7. Or it can be easily switched on and off, at any time.

Sanitization in real time

The risk of infection is reduced after only half an hour. After that, the device disinfects, in real time and very quietly. Pathogens are directly eliminated from rooms and or transport as soon as someone enters the space and exhales. With any of the devices, the cold plasma is generated and distributed evenly and permanently into the room and on surfaces. The disinfection therefore takes place in real time and immediately.

When we look at different technologies available in the market, the air takes time to be filtered and to be blown out again. It is not immediate.

Award-winning Product – PlasmoHand

Giving the high volume of people and places which uses some sort of hand sanitization, here are some facts:

- Dermatologists confirm that alcohol-based disinfectants cause long-term skin damage when used repeatedly.
- Conventional disinfectants generate a lot of plastic waste.
- Large majority of people uses liquid disinfectant incorrectly.
- Classic air purifiers are bulky, loud and maintenance intensive.
- Classic air purifiers do not disinfect in real time because they first suck in the room air and filter it in the device.

On the other hand, the patented plasma-activated aerosol is so effective that it even reaches the areas between the fingers, under the fingernails and the space between jewellery and skin. Unlike alcohols, it does not damage the skin's own flora. The mixture is just as harmless for objects such as mobile phones, keys, credit cards and much more.

The product was awarded 2015 (Shaumburgh) and 2022 German Innovation Award, and in 2021 as the Best Hand Hygiene at Healthy Innovation Awards, Dubai.

Besides electricity and ambient air, PLASMOHAND requires a very small amount of specific process water – about one drop per application. It is atomized into the finest aerosols, whose tiny particles wet the entire hand.

Cold Plasma devices can be used safely in:

- Waiting rooms and clinics
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AI: A GATEWAY TO ENHANCED SUSTAINABILITY IN AUSTRALIAN HEALTHCARE

Michael Dowling

Director of Technology, Operational Intelligence

The integration of artificial intelligence (AI) in the healthcare sector offers significant potential for enhancing sustainability and operational efficiency in Australia. The evolving role of AI is increasingly crucial in the context of reducing energy consumption and improving the environmental performance of healthcare facilities.

Healthcare facilities in Australia are notable contributors to the country's carbon emissions, accounting for approximately 7% of national emissions (1). This is a substantial figure, especially considering the energy-intensive operations of healthcare facilities due to requirements for specialised equipment, lighting, heating, and cooling systems.

Despite the critical role of healthcare in emissions, current investment in environmentally sustainable healthcare infrastructure in Australia remains limited, constituting a small fraction of overall healthcare spending. This situation presents a risk of perpetuating high-emission practices in the sector.

The Australian healthcare industry is now focusing on creating a more sustainable lifecycle for its facilities. Incorporating AI to benchmark and improve environmental performance is a key strategy. These AI-driven systems assess and optimise critical factors like energy consumption, water usage, waste management, and indoor environmental quality.

However, a significant portion of healthcare facilities in Australia have yet to adopt advanced sustainability measures, hindering the sector's progress towards the sustainability targets. In response, bodies like the Australian Medical Association (AMA) and Doctors for the Environment Australia (DEA) are calling for the Australian healthcare sector to reduce its carbon emissions to net zero by 2040, with an interim emission reduction target of 80 per cent by 2030 (2).

Some cities in Australia are taking proactive measures. For instance, a city might require new healthcare facilities to meet specific sustainability criteria by a certain year, or aim for a net-zero carbon footprint for all new healthcare facilities by 2040.

The key to enhancing sustainability in Australian healthcare may lie in leveraging AI technologies. Industry experts and technology leaders suggest that AI can revolutionise the way healthcare facilities operate in Australia. It aids in aligning construction with environmental goals and optimises systems like HVAC for efficiency. Continuous monitoring by AI helps in early detection of issues, preventing expensive failures and extending the lifespans of plant and equipment.

Many healthcare facilities in Australia have implemented AI-driven optimisation, demonstrating that even older buildings can achieve high sustainability standards with the right technological interventions.

Experts emphasise that AI in healthcare facility management is a support tool, not a replacement for human oversight. It enhances the effectiveness of facility managers, enabling them to focus on more critical tasks rather than constant monitoring.

A gentle approach to introducing and enabling AI in an Australian healthcare facility could start by optimising a thermal energy chiller plant. This is a high-consuming component of the building which often runs for long hours, sometimes days on end. AI, coupled with some gentle governing parameters, could be used to improve the efficiency of this plant and equipment, with expected results between the 5%-20% range and in some cases higher.

By continuously learning about a facility's operational dynamics, AI helps in making incremental improvements in areas like energy consumption and environmental control. This results in better sustainability ratings and reduced operational costs for Australian healthcare facilities.

In addition to energy efficiency, enhancing a healthcare facility's sustainability in Australia offers multiple benefits. It aligns with broader Environmental, Social, and Governance (ESG) goals, reduces operational and maintenance costs, and can attract stakeholders who prioritise environmental responsibility.

In summary, AI's role in the Australian healthcare sector is becoming increasingly significant, offering tangible benefits in efficiency, sustainability, and overall environmental impact.

References:

1 "Healthcare in Australia contributes to seven per cent of all national carbon emissions" - Sydney Children's Hospitals Network

2 «AI transforming Australian healthcare industry» - Australian Medical Association and Doctors for the Environment Australia

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OCCUPATIONAL HYGIENE'S ROLE WITHIN THE MULTI-DISCIPLINARY TEAM (MDT)

Managing infection risks during construction, renovation and maintenance activities in healthcare facilities

Michael Taylor

WSP

The development of infection control standards, procedures and protocols need to be defined and followed at the outset of any works due to the serious health risks for patients, health care workers, and visitors from construction, renovation and maintenance activities. Without the proper precautions, these activities can disperse dust particles contaminated with bacteria and fungi, as well as distribute hazardous materials such as lead and asbestos fibres.

Construction-related infections caused by *Aspergillus*, *legionella* and other pathogens have led to serious infections and deaths in the health care facilities. Health related infrastructure management requires the integration of clinical, hospital engineering services, professional, trades, and health and safety leaders to balance the multivariate risks present in these critical care environments.

Often the tools and language used by each of these groups are similar, but not identical, leading to blind spots in risk management during construction and renovation activities, with the clinical focus of infection control specialists generally not extending to cover the risk management strategies employed by principal contractors.

Similarly, the engineers and tradespersons delivering these projects are not positioned to directly manage the infection risks resulting from their works. Key to the success of these projects, is the formation of a multidisciplinary team, comprising of stakeholders from the principal contractor, hospital, and including occupational hygienists to provide an integrative link between these groups. A best practice infection control approach to major projects, should seek to establish and imbed a multidisciplinary team early and at relevant stages of a healthcare facility's lifecycle.

Occupational hygiene, also known as industrial hygiene, is in itself a multidisciplinary field focused on identifying, assessing, and controlling workplace hazards to protect the health and well-being of workers and building occupants. It involves the recognition, evaluation, and management of hazards, and ergonomic factors that can potentially impact workers' health. These varied hazards may be workplace specific, such as the presence of chemicals used in work processes, physical hazards such as noise or vibration, or of specific importance in healthcare settings, biological hazards, such as fungal spores, dust and waterborne bacteria such as Legionella, or from the potential that workers visiting site may be carrying viruses such as SARS-CoV2.

The primary objective of occupational hygiene is to prevent or minimize occupational illnesses, injuries, and adverse health effects by implementing appropriate control measures, guided current research and standards, and in healthcare construction projects would typically focus on:

Worker Safety

Conventional occupational hygiene in construction setting most frequently involves the identification and control of hazards such as dusts containing respirable crystalline silica noise hazards and vibration. However in hospital renovation projects often involve potentially hazardous materials such as asbestos, lead, mercury or chemicals used in clinical labs such as formaldehyde.

Patient Safety

Whilst most hygiene projects focus on protecting workers, the presence of a vulnerable population of patients requires heightened management of hazards, as this population is inherently at a greater risk by being immune compromised, including the elderly, and the very young or those suffering from pre-existing illnesses such as having undergone bone marrow or solid organ transplants, patients receiving dialysis, patients taking immunosuppressive medications and oncology patients receiving chemotherapy. A specific focus on occupational hygiene measures directed towards protecting patient health during renovation can mitigate or eliminate and prevent the spread of contaminants, dust, or airborne particles.

Infection Control

Beyond the control of dusts and implementation of stringent infection control practices, such as negative air containment around work zones, additional focus should be given to hygiene measures for workers and site visitors to control and contain the introduction or spread of infections.

Minimizing Disruption

Proper occupational hygiene measures can help minimise the impact of renovation on hospital operations, by ensuring works are able to continue without costly delays caused by inadequate planning at the project outset. Poorly contained worksites resulting in patient infections may be not only hugely expensive, but highly damaging to the hospital and to the principal contractor. According to a report published by the Australian Commission on Safety and Quality in Health Care in 2019, it was estimated that the annual cost of HAIs in Australia ranged from $1.2 to $2 billion. This estimate includes both direct costs (such as additional treatments, medications, and longer hospital stays) and indirect costs (such as loss of productivity and increased disability-adjusted life years).

In a review conducted by Alvarez-Moreno and Combariza in 2019[1] of measures recommended by a 7 international authorities and guiding bodies, only 4 highlighted the importance of engaging a multidisciplinary team at the project outset, and only 2 identified the importance of ensuring that infection control and infection prevention measures are verified through ongoing monitoring. However the strategies employed to quantify environmental dusts and validate the suitable condition of materials in construction and renovation project frequently are not comparable to methods used by hospital infection control professionals. By completing an infection control risk assessment with agreement from stakeholders at the outset of works, the potential for catastrophic and avoidable breaches in infection prevention and control protocols drastically decreases.

Timing of works and trades is also frequently overlooked when completing multistage projects. The segregation of dust generating activities from other key tasks is often not considered, resulting in items such as ductwork being delivered uncontained to site whilst materials such as gyprock or timber is being cut or handled. Similarly, the timing of earth works to patient and visitor movements should be planned to minimise the potential for soil and dusts to enter the hospital and clinical areas. Studies have also demonstrated that the benefits to patient outcomes can be achieved by completing demolition and other large dust generating events in winter and autumn months when dust is less likely to be generated.[2]

Where these controls are not implemented well, or entirely overlooked, numerous studies have highlighted the severity of the outcomes. An overview of relevant publications from 1975 onwards demonstrates that at least 49 serious outbreaks have been documented which can be directly attributed to ongoing construction and renovation resulting in 547 infections, and 197 deaths from avoidable contact with environmental and airborne contamination from fungal spores.[3] From a projection of these cases and wider unpublished events, it has been estimated that 5000 deaths occur each year due to construction-related infections in healthcare settings[4]. A Canadian Communicable Disease Report determined that renovation activities account for approximately 50% of the sources of healthcare-associated *Aspergillus* outbreaks, with nearly 50% of these infections resulting in mortality.

There remains significant opportunity to further imbed holistic infection control into the design, construction and maintenance of Australian healthcare facilities, using world leading technologies such as DNA-tagged molecular air mapping systems (Safetraces) and real-time dust monitoring emplacements to ensure containment barrier integrity.

SafeTraces is a company that provides specialised alternatives to tracer gas studies, by using DNA tagged molecules in aerosol sprays to quantify the movement of air, operation of ventilation systems, and traceability in food safety and manufacturing settings. This technology has significant opportunity to visualise the movement of air throughout a building and could be applied to determine the likelihood of aerosols being maintained in rooms with poor airflow, or migrating from uncontrolled generation points to patient occupied rooms. Whilst completing construction of renovation works, often the placement of containment and alterations to access points and entryways will appreciably change airflow. These changes can be mapped and quantified to determine if additional controls were required to isolate the work area from occupied spaces.

Whilst DNA based tracer studies provide high resolution insight into air movement, they are unable to provide real-time insight into the indoor air quality whilst works are ongoing. More recently, real-time, particulate and VOC monitoring equipment has been developed, with a specific occupational hygiene focus. The use of real-time monitoring for dusts inside the work zone can not only be used to protect worker health,

but placement of monitors outside and more distant from the work zone can be used to reduce patient impacts.

By monitoring dust levels in real-time, occupational hygienists can evaluate the effectiveness of control measures in place, and If dust concentrations exceed acceptable levels, prompt action can be taken to inform infection control staff, modify work practices or implement additional controls. The data collected from these devices can also be used to provide important information if outbreaks occur, with traceability into the timing of dust generating works, and the suitability of controls at that time, allowing for delineation of cases based upon when they are diagnosed.

Occupational hygiene has grown beyond the more conventional protection of workers within high-risk industries. The application of powerful investigative and monitoring tools, infection control risk assessments, and formation of multidisciplinary teams before major works begin can not only result in projects delivered more efficiently, but also protect and save lives in hospital and healthcare settings.

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STOP THE SPREAD OF AIRBORNE VIRUSES IN YOUR HEALTHCARE FACILITY

HEPA Filters: What you need to know.

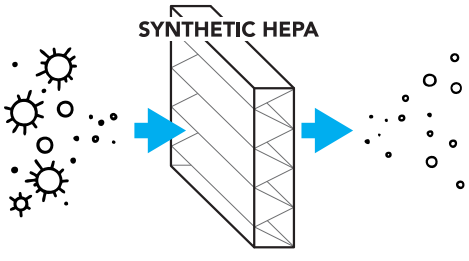
At its most basic level, an air purifier is only going to perform as well as the filters inside. When you are dealing with filtering viruses from the air, you need to select an air purifier with a medical-grade HEPA filter. Medical-grade refers to top-tier H13 or H14 efficiency-rated filters that will capture a minimum of 99.95-99.99% of particles @ 0.3 microns (PM 0.3) or larger. These are the same filters relied upon in infection control isolation rooms and operating theatres.

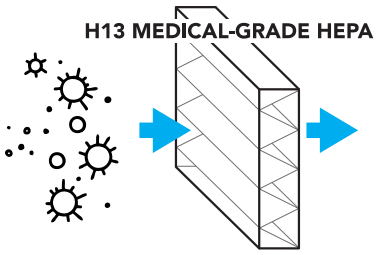
HEPA Filter Types

HEPA air purifiers commonly use either a synthetic pleated HEPA type filter or medical-grade, EN1822-rated HEPA paper.

HEPA 'type', commonly synthetic filters are made from polypropylene media with an electrostatic charge, the charge improves filter efficiency so the filter media will let through fewer particles. Synthetic filter media is used for 2 reasons; it's lower cost to manufacture and it creates less pressure drop, so the fan in the air purifier can be smaller.

The electrostatic charge on the filter media essentially magnetises the filter material to hold and capture more dust and particles, however, the caveat is the charge dissipates over time and causes the efficiency to reduce. In tests performed on synthetic filters we have seen a reduction from 99.95%, down to less than 75% during six months of use.





Synthetic filters usually cannot be certified as some ultrafine particles will penetrate the filter and therefore fail the stringent EN1822 efficiency tests. By contrast, HEPA paper, also known as glass paper, maintains the same very high efficiency for the life of the filter.

Key Points

- The majority of air purifiers are not medical-grade filters (H13/H14 efficiency) and contain synthetic filters with lower E11 - E12 efficiencies.
- Buyer Beware: synthetic HEPA-type filters using materials like polypropylene do not maintain the stated efficiency for the life of the filter, HEPA paper is the only material guaranteed to maintain efficiency for the life of the filter. Synthetic filters use an electrostatic charge on the filter material which assists efficiency but over time the charge is lost and so is the efficiency.
- Bigger is better: the larger the size of the filter surface area (usually measured in m^2) increases the efficiency of the filter due to a larger contact area. When comparing air purifiers look for the largest filter in size.
- Air purifiers that direct airflow in all directions tends to recirculate their air at lower speeds making them less effective.

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LEGIONELLA IN WARM WATER SYSTEMS
Taming an Invisible Beast

Les Szabo

NSW State Manager, HydroChem

Legionnaires' disease and the control of Legionella bacteria in potable water systems is a risk particular to healthcare facilities for two main reasons:

1. Hospitals require the delivery of warm water for the use of patients at hand basins and showers.
2. Patients in hospitals pose a higher risk to the development of illness than the general population.

Warm Water Systems

Hot water delivered from either instantaneous or stored water boilers is usually maintained and delivered to outlets at approximately 60°C. At this temperature there is a risk of scalding. As a result, it is a general requirement in hospitals that the water delivered at outlets is mixed with cold water to deliver water no higher than 45°C.

Unfortunately, maintaining water at a safe level to prevent scalding is the ideal temperature to promote the proliferation of Legionella bacteria. The genus Legionella which comprises over 50 different species, has evolved to survive in the natural environment in soil, rivers, and lakes. Legionella cannot fulfil its lifecycle without invading a host, taking nutrients from the host, and then multiplying. Typically, a warm swamp-like environment is the ideal location where Legionella can multiply in the presence of other microorganisms like slimes and amoeba.

In nature, the temperature variations between seasons and overnight helps to mitigate the rate of bacterial multiplication, however in our highly controlled environments we often create a constant temperature range that is perfect for certain microorganisms. Legionella will generally remain dormant below 20°C and will die above 60°C. The ideal temperature for proliferation is the same as the target temperature for warm water systems.

Susceptibility of Patients

Given that Legionella have evolved over millions of years and survive in the natural environment, it is highly likely that most of us have been exposed to the bacteria without becoming ill. Legionnaires' disease is predominantly identified in patients with weakened immune systems or other underlying health conditions. The proximity of such patients in the hospital environment increases the likelihood of an outbreak should the bacteria contaminate the water distribution system.

Compliance

The control of warm water to prevent scalding is mandatory in all states and territories of Australia. The regulators recognise the increased risk of Legionella bacteria and, as a result, water hygiene within the hospital environment is also either regulated or stipulated through guidelines issued to the health care industry, including aged care.

For operational managers within healthcare facilities, often the major impetus for taking steps is driven by the requirement to ensure compliance to regulations to the letter of the expectation. Prima facie, this will satisfy the duty of care and mitigate any claims of negligence. In my experience, the

first step taken by operational managers is often seeking to meet the requirements stipulated. At times, this step is taken without the understanding of how each individual component fits together to achieve an outcome.

Case Study

I will now step you through a case study involving a small Sydney hospital with a recirculating warm water system where the aforementioned approach resulted in the following actions being implemented:

- A Legionella risk management plan (RMP) developed by a general corporate-style risk management firm.
- A chlorine dosing unit installed on the warm water system.
- Sampling initiated with an independent party.

Sampling Without a Protocol

Prior to having the RMP prepared, the hospital had engaged an independent microbial testing contractor to take samples and analyse for Legionella and Heterotrophic Colony Count (HCC) of the water distribution system.

As there was no formal sampling protocol to follow, this resulted in:

- The water sampling technician taking samples from the most easily accessible outlets – as opposed to those identified as a higher risk.
- An inordinate number of samples taken from basins - that present a relatively low risk of dissemination compared to showers which may produce aerosols (which can be inhaled)
- An unwarranted focus on Heterotrophic Colony Count (HCC) - which does not present a Legionella health risk per se and is not stipulated as mandatory.

In addition to the testing undertaken by the independent contractor, the Health Department undertook periodic sampling and testing on an unannounced frequency.

The hospital was receiving positive Legionella detections at every round of testing by either party.

Disinfection system maintenance

The hospital installed a chlorine dosing system purchased through the HVAC water treatment contractor. The unit was provided by a reputable manufacturer and was being maintained by the hospital's inhouse plumber. With reduced staffing levels, and lack of training or support, this meant that the dosing system was often going into fault due to blocked injectors, chemical dosing tanks running empty, ORP probes not calibrated and dosing pumps losing prime.

To keep the system operating the supplier recommended a new chemical dosing pump be installed, although the existing pump was still operating correctly. This resulted in the purchase of a piece of equipment which was not necessary. Unfortunately, this did not solve the issue that there was no

continuous or reliable source of chlorine being dosed to the system. Effectively training staff on how to overcome a loss of prime or cleaning the injector using a weak acid may have gone someway to rectifying the loss of disinfection.

Incoming Water

The water supplied to the hospital is via Sydney Water mains delivered to the site boundary before being held in two bulk storage tanks. The RMP contained a photo of the storage tank and a schematic of the plantroom with no legend. There was no critical assessment of the arrangement.

Poor Outcomes Despite Ticking the Boxes

Despite attempting to satisfy the requirements of local regulations, the outcomes for the hospital were poor. That is, the sampling of outlets continued to return both high HCC and adverse Legionella detections.

We can breakdown the simplified process described above to address Legionella risk as a flow chart:

When asked to review the current RMP and outcomes at the hospital, we first noticed something very common in the industry. The actual order of actions undertaken did not follow the flowchart. In this instance, the sampling occurred first, followed by the installation of a chlorine dosing unit in response to poor results and only recently had the RMP been completed. One may describe this approach as putting

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the “cart before the horse”. It is a common occurrence as facility managers are trying to satisfy all the requirements of the regulations in one fell swoop.

At this hospital, the problem was further compounded by the fact that each action was undertaken in isolation without strong lines of communication.

The proper implementation of the required steps fell through the gaps. The gaps occur at the arrows of the flow chart and are a result of each party lacking “skin in the game”.

HydroChem was engaged in March 2022 to review the RMP document competed in October 2021. The remit was to improve the outcomes of testing, being the poor Legionella detection rate.

A new RMP was not commissioned so HydroChem provided a desktop review of the RMP as well as a site audit to review the dosing equipment and sampling protocols.

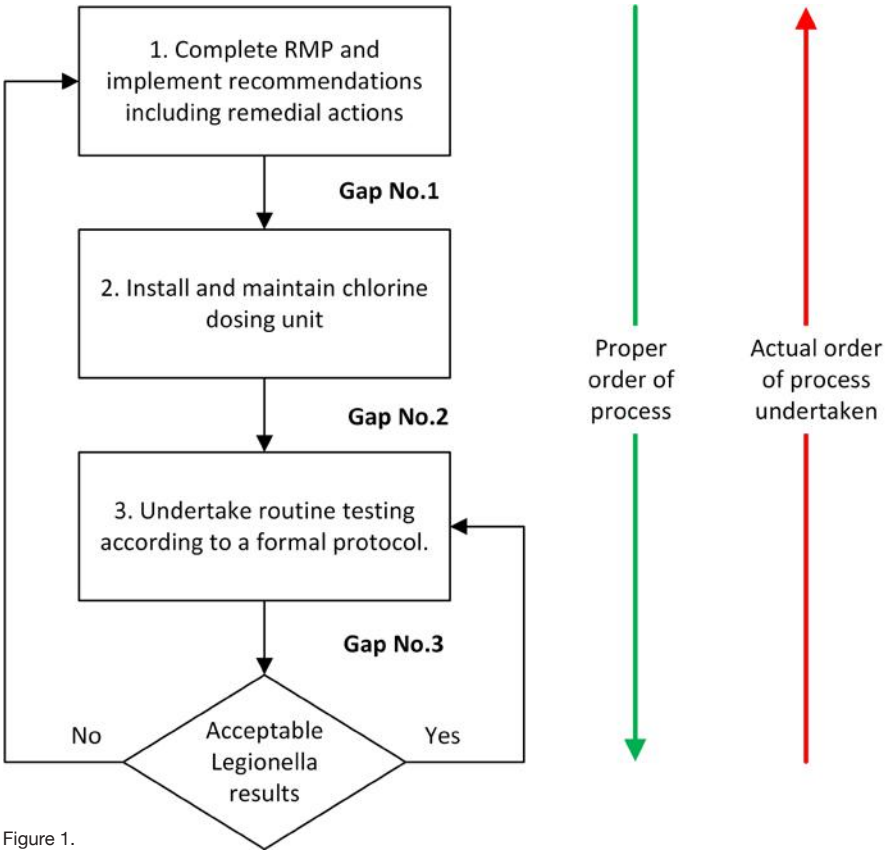

Figure 1.

A Risk Management Plan is Just a Document

The RMP developed by the firm comprised 30 pages, the first full page being a statement of limitations, the focus of which was acknowledging that the firm was relying on information provided by the client and that they accept no liability for completeness.

The completion of remedial actions was not verified by the RMP. There were no records of responses to high Legionella or HCC detections prior to retests.

The document listed several hazards to investigate, which are available from the guidance material provided by regulators, however there was very little in actual validation of the current state of each hazard at the hospital.

Moreover, most of the recommendations were motherhood statements highlighting that the hazard ought to be reviewed and considered.

There was no empirical data establishing:

- The current mains water system supply and water quality.
- The efficacy or maintenance of the chlorine dosing system.
- A suitable sampling protocol.

The RMP recommended that suitably qualified contractors be engaged to determine the abovementioned items.

GAP No. 1 – Sampling Protocol

HydroChem commenced the review by addressing the generic recommendations of the RMP. A site audit was undertaken, and a detailed schematic of the water distribution system prepared included as Figure 2.

Testing of the mains water and storage tanks revealed that there was nil disinfectant being maintained in the storage tanks. Although Sydney Water treats mains supply water, the level of disinfectant at the boundary will vary depending on the distance from the treatment plant, as well as the condition of pipework leading to the building. Storage tanks will also allow the water to sit idle and dissipate the free disinfectant level over time. Any fouling in the tanks may contribute the presence of bacteria.

Interestingly the Australian Drinking water Guidelines do not provide a limit for either Legionella or HCC, meaning that Sydney Water do not provide testing of these parameters.

The independent contractor was sampling 10 locations per month. However, due to the lack of a sampling protocol, these were taken from ad hoc locations. It was also common for the hand basins to be tested. This is often the case as it’s easier for a water sampling technician to take a basin sample because they’re less likely to get wet in the process (or bother patients).

HydroChem suggested that a protocol of 8 samples per month would meet the local regulatory requirements and provided a satisfactory overview of the water distribution system health.

HCC testing could cease as this is not mandatory in NSW nor according to the EnHealth guidelines (which are generally accepted as “best practice”). HCC sample results and follow

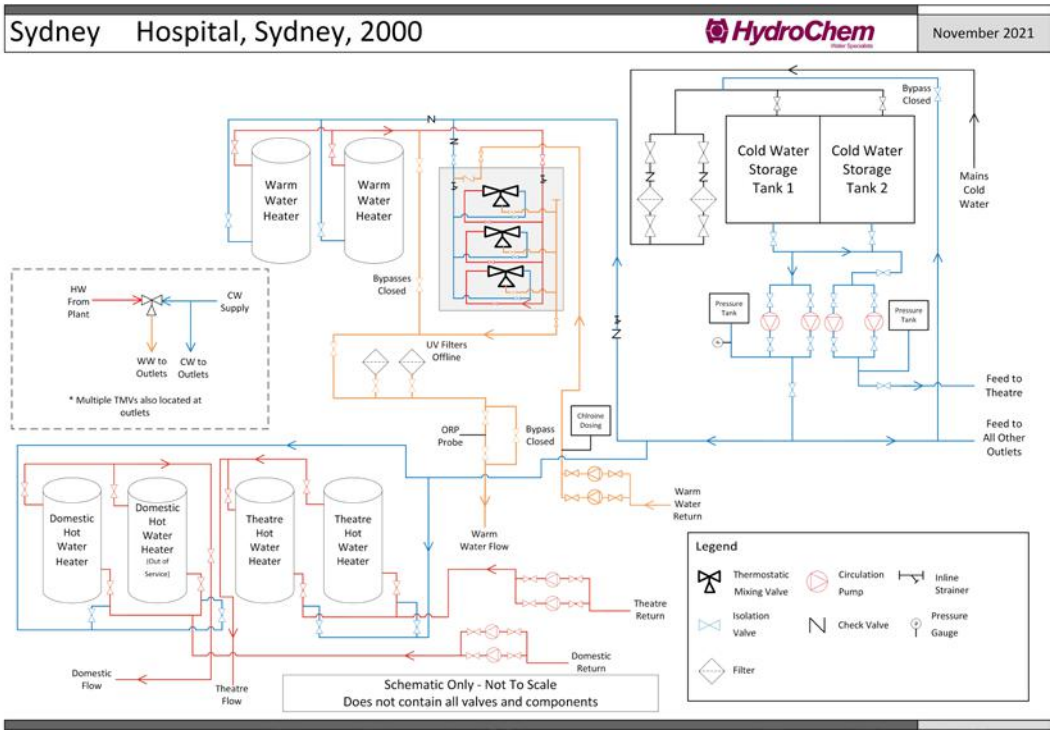

Figure 2.

We also identified that the sampling probe and injection point were installed sub optimally. The probe was reading water coming from the water heaters and the chlorine was injecting disinfectant prior to the heaters. This resulted in a "false" loop. Chlorine tends to "flash off" and become inactive when heated meaning that the probe was reading a reduced level of chlorine, which in turn dosed more chlorine into the heating loop. Simply switching these two locations meant that the probe could read the level of disinfectant circulating in the water distribution system through the hospital returning to the dosing unit and then dosing chlorine on its departure from the heater and leading back through the hospital. The result being an improved level of control through the outlets and a quicker response by the probe.

up actions detracted from the major hazard - being Legionella. Furthermore, the sampling protocol ought to be distributed across all floors and focussed on showers not basins.

Hand basins do not present a risk of creating aerosols which is the pathway for infection. Most people only utilise hand basin for a few seconds which means that the water may be stagnant for extended periods. By comparison, showers are commonly operated for at least 5 – 10 minutes, flushing sufficient water to allow the residual disinfectant to take effect. Hand basins tend to form significant biofilms at the outlet and at the aerators, giving a false representation of the wider recirculating system.

Accepting that healthcare providers (as most industries) have competing financial pressures, our goal was to get the "best bang for the hospital's buck". Funds spent taking more samples than needed and testing for something unnecessary were better redirected toward other measures that helped in achieving acceptable Legionella results.

Gap No.2 – Providing Disinfection to the Warm Water System

Reviewing the chlorine dosing system revealed that the unit was not calibrated. This meant that despite showing sufficient disinfectant levels, there was nil chlorine present in the recirculating warm water. This loop at 45°C was the ideal location for the multiplication of bacteria. It also should be relatively simple to treat as it is essentially a closed loop.

The site plumbers had little training or support in the operation for the dosing system. This meant that attempts to adjust the system were unsuccessful.

Given that the hospital plumbers had experienced several situations where the chlorine tanks had run empty or the pump losing prime, a unit with remote telemetry was proposed. Whilst still retaining the existing dosing pump, a controller was installed that allowed alarms sent via SMS or email. This meant that any failure in the treatment system could be identified immediately, and steps taken to rectify them quickly. HydroChem were engaged to undertake monthly services of the chlorine dosing system, reducing pressure on the site staff, and ensuring that the system was calibrated and operating properly.

Gap No.3 – Focussing on high-risk outlets

Sampling was adjusted to focus on showerheads and to distribute the samples across all floors of the hospital. Monthly testing revealed that there was a delay in the movement of the treated warm water to all outlets and hence a reduced level of chlorine in some areas. This was relayed to the engineering team for review. Plumbers were engaged to balance the control valves throughout the system to ensure that water flow is shared equally across the whole system.

Improved outcomes

After the review several steps were implemented and in summary these included:

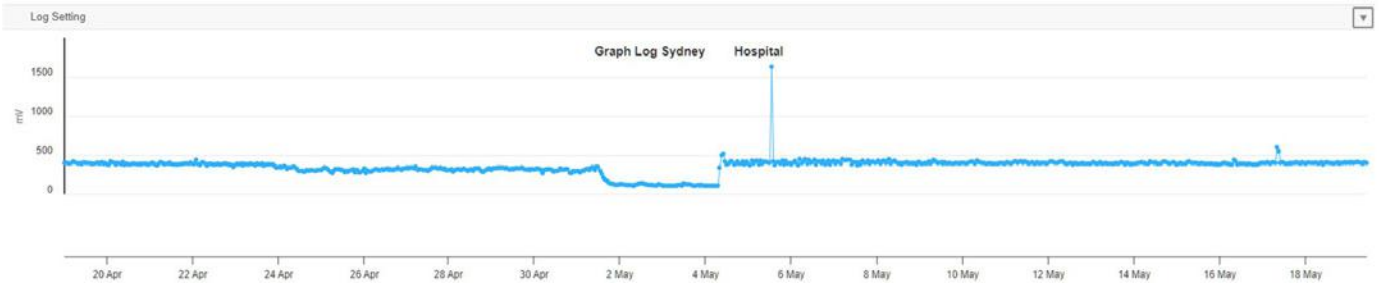

Figure 3.

- Implementation of a monthly maintenance program for the dosing system commenced July 2022.
- Reversing the dosing point and probe sampling point.
- Ceasing testing for HCC.
- Taking samples from locations on each floor and focussing on showers.
- Testing free chlorine at each outlet during sampling.
- Installation of a dosing unit equipped with remote telemetry.

Following these changes, the hospital had 10 months of nil Legionella detections. Chlorine was maintained at all outlets even when utilising the older controller. The site staff were able to contact HydroChem when they noticed any issues on the controller display and prompt a service visit to rectify.

A new dosing controller was installed recently which allows the disinfection system to be reviewed from a computer or mobile phone as well as receiving alarms when the levels drop below a critical point. The engineering department receives these alarms as do HydroChem. Disinfections can be initiated remotely as a remedial action prior to retests.

Figure 3 shows a history of the disinfectant levels at the hospital.

Forming Trusting Relationships

Probably the most effective change in the Legionella risk management process at this hospital was the way in which HydroChem were engaged with a clear remit. From the viewpoint of the Engineering Department, they had satisfied the requirements of the local regulations in a general sense, however there were gaps between each of the mitigation steps.

When invited to review the process, HydroChem were given a very clear remit.

- “Reduce the number of Legionella detections”

Given that we had prior experience with people working at the hospital, it was not lost on us that HydroChem had to deliver a result. Strong relationships and maintaining a good reputation are paramount in our industry. I would not have accepted the project if I did not have confidence that we could affect a successful outcome. My confidence is built on real world experience and an in-depth knowledge of controlling Legionella bacteria in plant water circuits. We have no choice but to put “skin in the game” coming in at this point of the process.

How to Get the Most out of Your Legionella Management Process

Some simple steps that will help achieving satisfactory control of Legionella include:

1. Start at the beginning. Have a risk management plan completed.
2. When choosing a provider, ask for references for the individual who will be walking the floor of your facility. Make sure the person engaged to conduct the risk management plan is a water hygiene expert – as opposed to someone who provides generic risk management advice across broad categories of knowledge.
3. Request a detailed scope of deliverables not merely “in accordance with a standard”. Make sure it includes the elements you will need, namely: an assessment of the incoming water, a schematic of the hot, cold and warm water systems, a sampling protocol. There is plenty of guidance material available and good consultants will help point it out.
4. Engage an experienced water treatment provider for any disinfection work. Look at their prior experience in dealing with potable water treatment specifically. Ensure they will be involved beyond simply inspecting the site every month. Make sure they will be there when things go wrong.
5. Whether you chose to sample inhouse or engage a sampling/laboratory provider, make sure you have familiarised yourself with the recommended methods and follow them. Again, a good consultant or water treatment company ought to be able to provide guidance.
6. Keep in consistent communication with the people managing each step. There should at least be a quick review of actions and results each month. You should speak with your sampling and water treatment provider at each service. Ideally the RMP consultant is included periodically.

Confusing compliance with risk management when trying to tame an invisible beast is fraught with risk.

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RISK, RESILIENCE, AND HEALTHCARE-ASSOCIATED INFECTIONS: THE IMPORTANCE OF INNOVATION IN INFECTION CONTROL

Timothy Smith

Allied Bio Services

Abstract

Healthcare-associated infections (HAIs) pose a significant challenge to public health, resulting in millions of hospital bed days each year in Australia alone. Effective infection control measures are crucial in mitigating the spread of germs and diseases in healthcare settings. However, traditional disinfectants often fail to address the complexities associated with usage and the persistence of recontamination. This paper explores the interplay between risk, resilience, and HAIs, highlighting the crucial role of innovation in infection control practices to minimise the risk of HAIs and enhance patient safety.

Keywords

Healthcare-associated infections, HAIs, infection control, innovation, risk assessment, resilience, healthcare systems, patient safety, technology, collaboration.

Introduction

In 2023, healthcare leaders face immense pressure to provide quality care in the face of complex challenges, such as an aging population, the lasting workforce impact of the COVID-19 pandemic, and the fact that one in ten acute adult inpatient is being treated for has at least one HAI.[1] These challenges underscore that healthcare innovation is a necessity– and it's a risk not to be open to new solutions.

Innovation plays a pivotal role in advancing infection control practices and reducing the burden of HAIs. By embracing technological advancements, promoting research collaboration, and fostering a culture of innovation, healthcare systems can enhance their resilience and response capabilities. The integration of innovative solutions, alongside robust risk assessment and mitigation strategies, can transform infection control practices, improve patient outcomes, and ultimately safeguard public health. It is imperative for healthcare organisations, policymakers, and industry leaders to prioritise and invest in innovation as a fundamental pillar in combating HAIs and creating a safer healthcare environment.

Effective risk assessment is fundamental in identifying potential sources of infection and implementing preventive measures. However, traditional infection control methods have limitations in addressing dynamic and evolving risks as they tend to focus on visual cleaning audits and hand hygiene compliance. Innovation in risk assessment tools, such as predictive modelling and real-time surveillance of biological contaminates, holds promise in identifying high-risk areas, facilitating broader intervention strategies, and enhancing patient safety.

Resilience in healthcare systems has typically been seen through a lens of the integration of electronic health records, telemedicine, and artificial intelligence, enhance communication, coordination, and data-driven decision-making. These technologies do strengthen healthcare infrastructure and enable resource optimisation. However, building environmental resilience that makes a healthcare facility safer for the nursing and cleaning staff is equally critical to improving patient outcomes and overall efficiency of a hospital operation.

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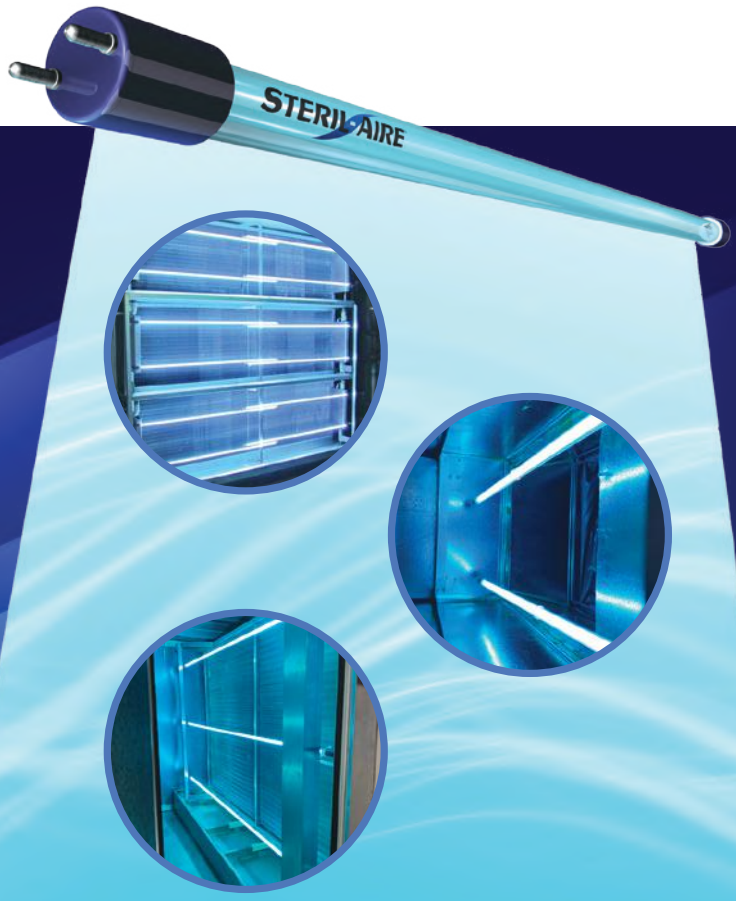

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Innovation in Infection Control Practices

Innovation in infection control practices encompasses various domains, including disinfection techniques, personal protective equipment, and antimicrobial stewardship. Advancements in disinfectant technologies, such as antimicrobial long-lasting coatings and self-cleaning surfaces, hold promise in reducing microbial colonisation and transmission. Additionally, wearable biosensors and smart monitoring systems facilitate early detection of infectious agents, enabling timely interventions and minimising transmission risks.

Innovation is crucial in addressing the limitations of current disinfection practices and improving patient safety. Novel approaches that combine efficacy, ease of use, and sustained protection are essential for reducing the risk of HAIs. For instance, the development of self-disinfecting surfaces and materials that continuously eliminate pathogens could be a game-changer in infection control.

Emerging technologies such as continuously active disinfection coatings, ultraviolet germicidal irradiation, and vapourised hydrogen peroxide systems offer promising avenues for innovation in infection control. These technologies provide enhanced disinfection capabilities, increased durability,and improved effectiveness against a wide range of pathogens. Furthermore,innovative disinfectants that are user-friendly, eco-friendly, and exhibit prolonged antimicrobial activity help address the shortcomings of traditional disinfectants. Each of these technologies offer differing degrees of benefits vs. the operational impacts of deployment.

Impact of healthcare associated infections on patients

Quantifying the impact of healthcare associated infections on patients has been challenging, as much of the available data is opaque in nature. Some reports have estimated as occupying ~2,000,000 public beds nights each year, the equivalent of 58 public hospitals being fully occupied. Whilst NSW Health's Clinical Excellence Commission estimates ~165,000 HAIs occur across the Australian public health network each year.

One of the most comprehensive assessments was undertaken by Monash University.[2] Published in the Antimicrobial Resistance & Infection Control (AJIC) it estimated the burden of the five most common healthcare associated infections (HAIs) in Australian public hospitals. They used data from an Australian point prevalence survey to estimate the burden of HAIs amongst adults in Australian public hospitals using an incidence-based approach, introduced by the ECDC Burden of Communicable Diseases in Europe.

There model suggested an estimated 170,574 HAIs occur in adults admitted to public hospitals in Australia annually, which aligns to the figures published by Federal and State Health Departments. Monash University was able to quantify the projected impact, estimating that these infections resulted in 7,583 deaths – ***this makes HAIs the 5th leading cause of death in Australia***. They posed that Hospital acquired pneumonia is the most frequent HAI, followed by surgical site infections,and urinary tract infections. They found that blood stream infections contribute a small percentage of HAIs but contribute the highest number of deaths (3,207), more than twice that of the second largest, while pneumonia has the higher impact on years lived with disability.

The impact on patients is profound, beyond the increased risk of mortality these infection scan affect patients in various ways:

Health Complications: HAI scan cause significant health complications, ranging from mild to severe. These complications can result in pain, discomfort, organ damage, and, in severe cases, sepsis.

Prolonged Hospitalisation: Patients with HAIs often require extended hospital stays for diagnosis, treatment, and recovery. This leads to increased healthcare costs, delayed discharge, and potential disruption in the patient's daily life and work responsibilities of both the patient and their family members.

Reduced Quality of Life: HAI scan have a detrimental impact on the overall well-being and quality of life for patients. Persistent symptoms, prolonged treatment regimens, and the need for isolation measures can lead to physical and emotional distress. Patients may experience anxiety, depression, social isolation, and a decreased ability to participate in regular activities.

Financial Burden: The economic impact of HAIs is substantial, both for patients and healthcare systems. Patients may face additional healthcare costs, including extended hospital stays, diagnostic tests, medications, and follow-up care. Healthcare systems bear the financial burden of managing HAIs, including increased resource utilisation, infection control measures, and potential legal consequences.

Long-Term Consequences: Some patients may experience long-term consequences even after successfully treating the initial infection. These may include chronic pain, impaired organ function, compromised immune systems, and an increased susceptibility to future infections.

Preventing and managing HAIs is essential to minimise their impact on patients. Robust infection control practices, adherence to hand hygiene protocols, appropriate use of antibiotics, sterile techniques during procedures, and regular surveillance are critical in reducing the incidence of HAIs. Furthermore, patient education about infection prevention measures can empower individuals to actively participate in their own healthcare safe

The drivers of healthcare associated infections

One major focus for infection prevention Australian hospitals is hand hygiene compliance among healthcare workers.

Failure to adhere to proper hand hygiene protocols, including handwashing and the use of hand sanitisers, can lead to the transmission of pathogens between patients, healthcare providers, and surfaces. Healthcare organisations prioritise hand hygiene education and reinforce its importance to mitigate the risk of HAIs. This has resulted in a national compliance level of 85% and above, meaning limited gains in this area can be achieved.

Inadequate environmental cleaning and disinfection practices also play a significant role in HAI transmission. Surfaces and equipment that are not properly cleaned and disinfected can harbour infectious bioburden, increasing the likelihood of contamination.

There is substantial data that shows up to 40 per cent of nosocomial infections are transferred via contaminated surfaces (fomite). Themeta-analysis of 177 medical journals[3] found that several major nosocomial pathogens are shed by patients and contaminate hospital surfaces at concentrations sufficient for transmission, survive for extended periods, persist despite attempts to disinfect them (because disinfectants aren't being left on the surface long enough) and can be transferred to the hands of patients and healthcare workers. The report found that evidence is accumulating that contaminated surfaces make an important contribution to the epidemic and endemic transmission of *C. difficile*, vancomycin-resistant enterococci, methicillin-resistant *Staphylococcus aureus*, *Acine* to *bacter baumannii*, *Pseudomonasaeruginosa* and *norovirus* and that improved environmental decontamination can contribute to the control of outbreaks.

Increased cleaning with a hospital-grade disinfectant doesn't necessarily result in a safer, cleaner environment. Furthermore, it is operationally time consuming, ineffective, environmentally unfriendly and increases the risk of wear and tear on equipment, fittings, and fixtures. Traditional cleaning practices typically involve a small amount of disinfectant being sprayed onto a cloth,which is then wiped over the surface with the disinfectant drying in a matter of seconds.

The challenge is that hospital grade disinfectants don't work that quickly.

Traditional Disinfectants need to be saturated on a surface and left for 5 to 10 minutes to achieve a 3+ log (99.9%) reduction because they are only working when the surface is wet. However, in the real-world they are only left on a surface for a matter of seconds before being wiped away. This dramatically impacts the efficacy of the disinfectant, potentially delivering as little as a ~25% reduction in germs. Furthermore, even when used correctly, a Traditional Disinfectant only provides momentary protection at the time of disinfection – meaning the surfaces are re-contaminated the second someone coughs, touches, or sneezes on the surface.

Ventilation is another key driver in healthcare-associated infections (HAIs) by influencing the transmission of airborne pathogens within healthcare settings. Proper ventilation and filtration systems are essential for maintaining a safe and healthy environment for both patients and healthcare workers. The challenge is that older buildings were not designed with ventilation in mind. Compounding this is the fact the majority of HVAC filters within a healthcare facility are only designed to filter debris, dust and pollens, with limited to no stopping power against bacteria and viruses.

Another key driver is the inappropriate use of antibiotics. Overuse, misuse, and unnecessary prescription of antibiotics can lead to the emergence of drug-resistant pathogens, making infections more difficult to treat. Healthcare providers must promote antimicrobial stewardship programs to ensure appropriate and judicious use of antibiotics, reducing the risk of HAIs and antibiotic resistance.

The two areas where the dial can be moved the easiest within a healthcare setting is surface disinfection and enhancements to ventilation. Furthermore, an increase in public visibility into the total number of infections and organisational wide infection reduction KPIs would have a substantial impact in combating HAIs, reducing the occurrence of HAIs ensuring a safer healthcare environment for both patients and healthcare providers.

Why is it so hard to innovate within a hospital?

Innovation within a hospital setting can be challenging due to various factors that create a complex environment. Here are some reasons why it can be difficult to innovate within a hospital:

Regulatory and Compliance Requirements: Hospitals operate within a highly regulated environment with strict compliance standards. These regulations are in place to ensure patient safety and quality of care. However, they can also create barriers to innovation as new ideas and technologies must meet rigorous regulatory approval processes, which can be time-consuming and resource intensive.

Risk Aversion and Fear of Failure: Healthcare professionals, including hospital administrators and clinicians, often have a strong aversion to risk and a fear of failure. This cautious mind set isrootedin the responsibility to prioritise patient safety and avoid potential harm. As a result, there may be resistance to adopting new technologies or approaches that have not been extensively proven or validated.

Resource Constraints: Hospitals typically operate with limited resources, including financial, human, and technological resources. These constraints can make it difficult to allocate resources for innovation initiatives, such as research and development, pilot projects,and staff training. The focus may primarily be on delivering essential healthcare services rather than investing in innovative ideas.

Complex Organisational Structure: Hospitals are complex organisations with multiple departments, hierarchies, and stakeholders. Decision-making processes can be slow and bureaucratic, making it challenging to implement innovative ideas quickly. Interdepartmental collaboration and

coordination may be required, which can introduce additional complexities and delays.

Cultural Resistance to Change: Hospitals often have established traditions, practices, and cultures that resist change. Healthcare professionals may be comfortable with familiar routines and may be sceptical or resistant to adopting new technologies or workflows. Overcoming this resistance and fostering a culture of innovation requires strong leadership and a supportive organisational culture.

Despite these challenges, it is crucial for hospitals to embrace innovation to improve patient outcomes, operational efficiency, and overall healthcare delivery. By addressing these obstacles and fostering a culture that values and supports innovation, hospitals can create an environment where new ideas and technologies can thrive, ultimately benefiting both patients and healthcare providers.

A promising innovation in disinfection – Continuously Active Disinfection (CAD).

Originally, CAD was a focus of materials, not chemicals. Copper- and silver-infused items, such as bedside tables, bedrails, IV poles, linens, and curtains were brought to the market as solutions to contamination of objects and a passive way to break the chain of infection for indirect and direct contact.[4] Ultimately, there were challenges with this type of equipment, the cost of implementation and efficacy due to slow pathogen kill times – 99% reduction over a 24-hour period.

Innovations in liquid disinfecting technology has emerged. They provide continuous activity against a broad range of pathogen by creating a protective coating that delivers a more efficient kill time than CAD materials – 99.9% in under 2 hours. Unlike a traditional disinfectant that only works when wet, this technology remains active even when it has dried decreasing the risk of organism transmission in the environment. Human error is dramatically reduced, as there is less reliance on cleaners applying the disinfectants as per the manufacturers' guidelines, instead the limitation becomes how well the coating adheres to the surface.

This innovation is typically based on a spike polymer, these types of polymers are not a new technology, they were originally created in the 1950's to assist with mould prevention. The challenge has been that these spikes were weak and the adhesion of the coating to surfaces was poor, making them only relevant for no touch/low touch surfaces. The technology has evolved to be effective against a broad range of pathogens with most of these types of products now remaining active on a surface for up to 24 hours before needing to be re-applied.

Though less expensive than metal-infused surfaces, 24-hour disinfectants are substantially more expensive than a traditional short-acting disinfectant that are currently used throughout the healthcare sector.

However, there is one solution on the market that provides 15-week continuous active disinfection. This is ideal for high traffic areas or areas of high pathogen transmission risks, such as emergency department waiting areas, outpatient waiting areas, outer areas of procedural and surgical rooms, nurse stations, intensive care units and oncology wards.

Clinical results of 15-week Continuously Active Disinfectant.

3 Month Australian Hospital Trial:

- **Method.** Baseline bioburden measurements (Letheen Broth swabs and ATP swabs) were taken through the hospital. A transparent antimicrobial surface coating was then applied to all touched surface across the entire hospital including Emergency Department, waiting areas, reception areas,cafeteria, patient rooms, nursing stations,visitor &patient elevators, renal, rehab, oral care, recovery, bathrooms, and staff areas. Post application bioburden measurements were taken 30-, 60- & 90-Days post application.
- **Results.** The application process seamlessly integrated into the hospital's discharge cleaning process and delivered a 17-fold hygiene improvement over manual cleaning continuously for 3+ months. The Hospital had been undertaking high-frequency cleaning using a hospital- grade disinfectant as well as Disinfecting Wipes. An improved Cleaning Audit result was achieved across all 3-months following a single application along with an 11.2% reduction in Staff Sick Leave being observed.

12-month International Hospital Trial:

- **Method.** A transparent antimicrobial surface coating was applied to patient rooms and common areas in 3 units at two hospitals. Longitudinal regression models were used to compare changes in hospital-onset multidrug-resistant organism bloodstream infection (MDRO-BSI) and Clostridium difficile infection (CDI) rates in the 12 months before and after application of the surface coating. Incidence rate ratios (IRRs) were compared for units receiving the surface coating application and for contemporaneous control units. Environmental samples were collected pre- and post-application to identify bacterial colony forming units (CFUs) and the percentage of sites positive for select, clinically relevant pathogens.
- **Results.** Statistically significant reductions in HAIs and environmental bioburdens occurred in the units receiving the antimicrobial surface coating, suggesting the potential for improved patient outcomes and persistent reductions in environmental contamination. Across both hospitals, there was a 36% decline in pooled HAIs (combined MDRO-BSIs and CDIs) in units receiving the surface coating application (IRR, 0.64; 95% confidence interval [CI], .44–.91), and no decline in the control units (IRR, 1.20; 95% CI, .92–1.55). The results were published in Clinical Infectious Diseases Medical Journal as a major article.

Conclusion

Addressing the challenges posed by HAIs requires a comprehensive approach that embraces healthcare innovation. Allied BioServices plays a critical role in providing biotechnological solutions to improve infection control and reduce HAIs. By incorporating long-lasting antimicrobial disinfectants,leveraging data analysis, and utilising monitoring technologies, healthcare facilities can effectively break the chain of infection, enhance patient safety, and improve the overall quality of care. Investing in innovation and collaboration between industry experts and healthcare professionals will continue to drive advancements in infection control and safeguard public health.

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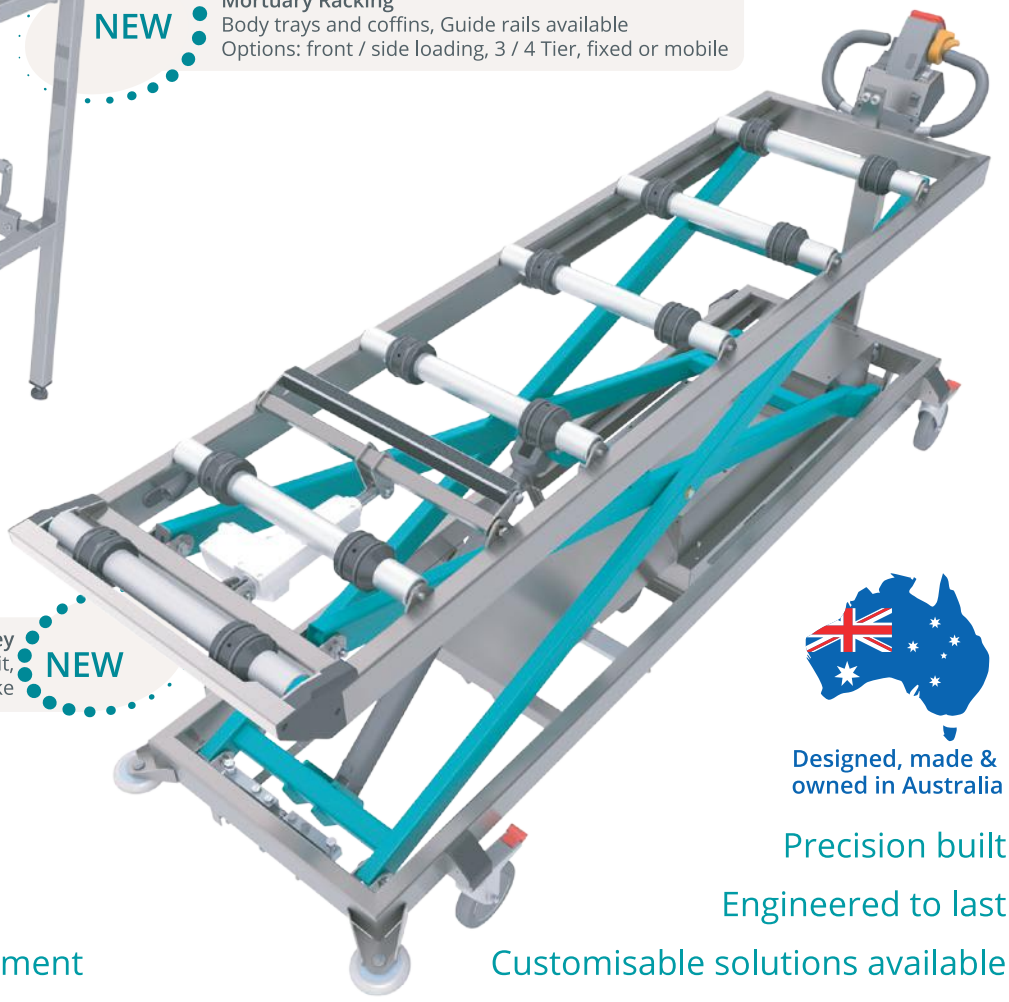

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FIRE SAFETY AND COMPLIANCE IN AUSTRALIAN HEALTHCARE FACILITIES

Kristy Keech

Australian Essential Services Compliance Pty Ltd

Australia is a first-world country that places prioritised importance on the safety and well-being of its citizens. With the healthcare industry being an essential component of ensuring the well-being of the Australian public, it is vital to ensure stringent safety measures are put in place in the healthcare built environment, especially regarding fire and life safety within buildings. Fire safety compliance in healthcare facilities is critical due to protect vulnerable patients, as well as highly valued equipment, sensitive documents, and working staff in these facilities.

Engineering and Maintenance departments, or those responsible for the facilities, have a constant challenge to keep up with various planned and reactive maintenance requirements, and compliance aspects within the built environment. Modern managers have more than ever a common duty of law and duty of care to ensure the buildings are safe, maintained, and compliant with the relevant standards.

As requirements vary state to state, having a base level of understanding of what's required in your state is important. It's likely an individual or a responsible entity (such as the owner, occupier, employer or manager of a building) will have a common law duty of care to maintain fire protection systems and equipment, and to be able to correctly demonstrate that they have met their responsibility.

This article will examine fire safety and compliance aspects in Australia's healthcare sector, focusing on the importance of safety standards, preventive procedures, fire safety equipment, training, and the role of governance in ensuring safety in this highly sensitive sector.

The Importance of Fire Safety Standards in Healthcare Facilities

Healthcare facilities, including hospitals, aged care homes, and specialised medical institutions, are occupied by many patients and personnel who have varied capacities to respond to an emergency at any time. Some patients may have highly limited mobility, or have a reliance on assistive technology and wearable medical technology. Healthcare

professionals themselves are preoccupied with medical procedures and maintaining patient health and safety within their remit.

To ensure the utmost safety beyond the care of clinicians, Australia has developed stringent safety standards for healthcare facilities. These standards provide a comprehensive systematic framework for the design, management, and operation of healthcare facilities. The primary goal of these standards is to safeguard the lives and property of all building occupants, with special emphasis on the protection of vulnerable patients. Ultimately, ensuring that people within a healthcare facility can deliver or seek medical care in a safe facility and environment.

If Fire Safety Standards are not met, the consequences can be critical. Not only could life be at risk, but damage to medical facilities can incur millions of dollars of damage and loss of necessary equipment. On top of this, indirect consequences include impacts on medical and patient services.

Understanding the Regulations

In Australia, fire safety and compliance are regulated at different levels – national, state/territory, and local. Understanding varying regulations is key to ensuring facilities are operating legally and safely. Some of the critical regulations include:

1. **National Construction Code (NCC):** The NCC is a document that outlines the minimum fire safety requirements for the design, construction, and performance of buildings across the country. It aims to provide consistent regulatory requirements across all states and territories to ensure that new buildings and infrastructure comply with a set of acceptable fire safety standards.
2. **State and Territory Regulations:** Each state and territory has its own legislation and guidelines related to fire safety and compliance. These include regulations concerning building and construction, emergency management, and fire services.

Some of these acts and regulations include:

- New South Wales: Environmental Planning and Assessment Regulation 2021
- Victoria: Building Regulations 2018
- Queensland: Building Fire Safety Regulation 2008
- Western Australia: Development Regulations 2012
- South Australia: Development Regulations 2008
- Australian Capital Territory: Building Regulations 2008
- Northern Territory: Fire and Emergencies Regulation
- Tasmania: Building Regulations 2016 & General Fire Regulation 2021

Within most Australian states there are legal obligations to submit annual compliance certificates to governing bodies such as Qld Fire and Rescue, Local Councils, and other authorities.

3. **Local Councils:** Apart from national and state-level regulations, local council requirements also play a crucial role in fire safety compliance. Councils may have specific guidelines for maintaining and operating buildings or local laws requiring property owners to maintain adequate fire protection measures.

By continuously revisiting and updating these standards, Australia maintains an increased level of fire safety in

healthcare facilities and ensures the incorporation of best practices and emerging fire protection technologies.

Preventive Measures to Minimize Fire Risk

Healthcare facilities incorporate numerous fire risks due to the use of various electrical devices, oxygen systems, and flammable chemicals, among others. Hence, it is essential to address these risks with diligent preventive measures.

Key preventive steps include:

- Regular facility inspections: Regular inspections identify potential fire hazards and allow for the implementation of corrective actions, such as fixing or replacing faulty equipment.
- Timely maintenance: Routine maintenance and servicing, for both fire protection equipment and general facility systems, play a critical role in fire preparedness.
- Safe storage of chemicals and flammable materials: Ensuring that chemicals and other flammable materials are safely stored in purpose-built containers or storage rooms can reduce the risk of fires.
- Clear evacuation routes: Healthcare facilities must have clear and unobstructed evacuation routes to enable an orderly evacuation of occupants, especially those with limited mobility.

Fire Safety Equipment in Healthcare Facilities

Various fire protection systems and equipment must be installed and maintained to ensure healthcare facilities are adequately protected. Some of these include:

- Fire alarms: Healthcare facilities must be equipped with fire detection and alarm systems that quickly alert occupants in case of a fire.
- Fire sprinkler systems: Sprinkler systems play a crucial role in containing fires, mitigating their impact, and potentially saving lives.
- Fire doors: Fire-resistant doors provide a crucial barrier to help contain the spread of fire and smoke throughout a building.
- Smoke control systems: These systems manage smoke spread by maintaining pressure differentials, guiding smoke to specific locations, and providing safe evacuation routes.
- Portable fire extinguishers: Fire extinguishers are necessary for initial fire suppression and are placed throughout the facility for easy access.
- Emergency and exit lighting: Fire emergencies can cause power outages, making emergency and exit lighting essential to guide occupants during evacuations.

Training and Awareness for Healthcare Staff and Patients

The healthcare staff represent the first line of defence in responding to a fire emergency. Consequently, they should receive regular training in fire safety, emergency response protocols, and evacuation procedures. This includes:

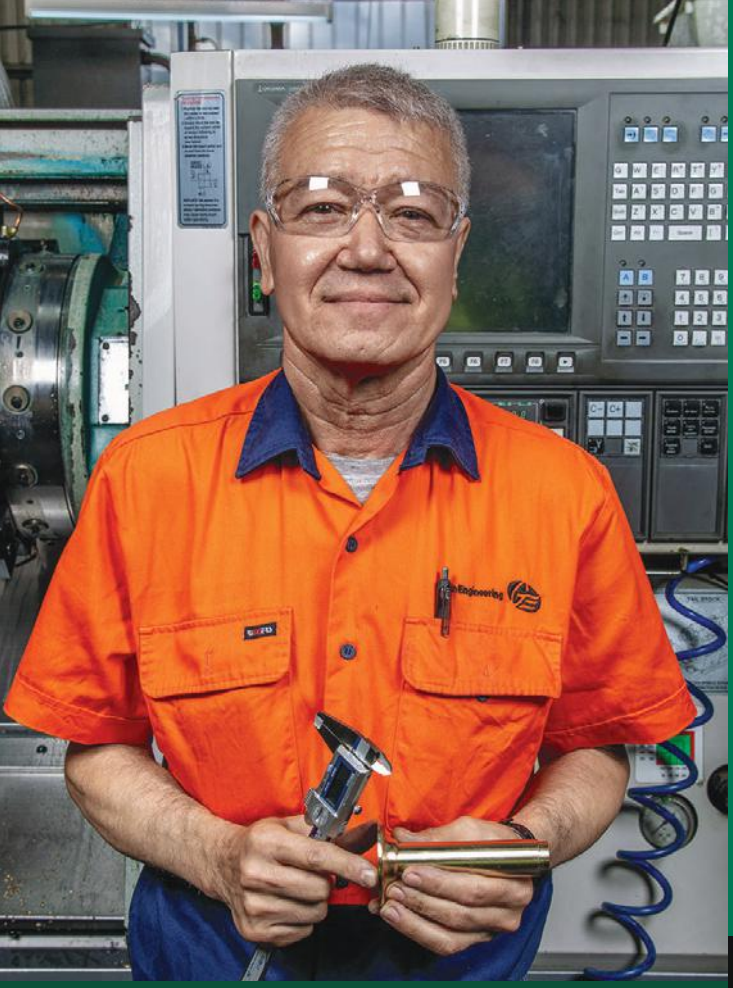
- Orientation programs: New staff must be given an orientation on fire safety and emergency procedures to ensure their familiarity with the facility's fire protection and evacuation plans.
- Hands-on training: Staff should receive hands-on training in using fire extinguishers and other firefighting equipment so they can respond effectively during an emergency.
- Fire drills: Regular fire drills provide staff and occupants with practical experience on how to evacuate the building, highlighting any deficiencies in the process that need addressing.
- Patient education: Patients should be educated regarding fire safety measures and evacuation procedures in place at the facility, particularly those with longer stays who might need special assistance during an evacuation.

Responsibilities of Stakeholders

The responsibilities of ensuring healthcare facilities meet all regulations and requirements vary across key stakeholders. It's important that each stakeholder upholds their responsibilities to the highest standard, for healthcare facilities to operate in their safest capacity.

1. Building Owners and Managers: Building owners and managers have primary responsibility for ensuring that their properties adhere to fire safety regulations. They must obtain necessary approvals, implement fire safety measures, undergo regular inspections, and maintain fire protection equipment.
2. Fire Service Providers: Fire service providers, like professional fire inspectors and technicians, have a responsibility to perform inspections, testing, and maintenance of fire protection systems diligently. They must adhere to the Australian Standards and ensure that their services comply with relevant regulations.
3. Certification Bodies and Regulators: Certification bodies and regulators maintain a level of fire safety oversight by ensuring that buildings and amenities are compliant with fire safety standards. They also educate stakeholders on the importance of compliance and provide guidance on interpreting and applying regulations in a practical manner.

Fire safety and compliance in Australia's healthcare facilities are critical to ensuring that patients, staff, and property are protected in the event of an emergency. A combination of stringent regulations, robust preventive measures, effective firefighting equipment, staff training, and strong governance and compliance programs help to maintain a high level of fire safety in this critical sector. By paying close attention to fire safety practices, healthcare facilities can sustain a safe, secure, and healthy environment for Australia's most vulnerable population.



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Galvin Engineering and RMC Reliance Valves, two iconic Australian manufacturers with a rich legacy in the Australian Plumbing industry, have partnered up to introduce the new lead free CliniMix® Healthcare Thermostatic Mixing Valve range. This collaboration marks a significant milestone, as two stalwarts in the Australian manufacturing landscape join forces to create solutions that exemplify reliability, trust, and Australian ingenuity.

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With an illustrious history spanning over 90 years, Galvin Engineering has established itself as a name synonymous with quality and reliability. Combined with the 70-year legacy of RMC Reliance Valves, this partnership brings together a wealth of experience and a shared commitment to delivering products of exceptional value.

Peter Adam, CEO of Galvin Engineering, has expressed his enthusiasm for a strategic partnership with RWC. “Galvin Engineering has a long-standing commitment to delivering high-quality products and building trust with its customers. This partnership is seen as a logical and strategic step that will strengthen Galvin Engineering’s presence in the Australian Thermostatic Mixing Valve (TMV) market. The goal is to ensure that customers continue to receive the highest level of quality and service.”

Nicole Sumich, EVP & President, Asia Pacific for RWC, manufacturer of RMC Reliance Valves, echoed the sentiment, “We are thrilled to partner with Galvin Engineering to deliver plumbing solutions for health, education, aged care, and correctional facilities. Our Australian-made RMC valves have been leading this space for nearly three decades and this partnership ensures the continued availability of these trusted, reliable products that meet the highest standards, reducing supply chain risks while supporting local manufacturing for a safer, more sustainable future.”

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As both companies bring their storied histories, expertise, and passion for excellence to the table, the CliniMix® Healthcare TMV range stands as a testament to what Australian manufacturing can achieve when like-minded pioneers collaborate. This milestone partnership reaffirms the strength of the Australian manufacturing industry and its unwavering dedication to delivering products that stand the test of time.

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Sentiolux launches revolutionary nurse call system, **Acelo**, designed to minimise interruption in healthcare facilities via a ‘plug and play’ system

In a post-COVID world, where healthcare staff numbers continue to cause concern, waiting lists are long and beds are scarce, technological innovation is more important than ever.

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Aside from helping staff to provide optimal care, Acelo gives managers core data such as staff to patient response times per handset – detailed insight that enables them to perfect working practice efficiency.

CEO of Sentiolux, Mark Burrell, said, “Acelo future proofs residential care communications’ systems, maximising estate adaptability, reducing capital expenditure and eliminating downtime.

“If you want to move devices from one department to another, or change care protocols, or, as patients change rooms, reconfigure their priorities; it takes seconds. All communications are logged and audited, so Acelo is also a matchless management tool.”

Acelo is the future of efficient patient care, enabling all major sectors of healthcare facilities to interlink and structure their work to ensure optimal healthcare in uniquely challenging times.

For more information about Acelo, please contact Sentiolux on enquiries@sentiolux.com.au

CARBON & ENERGY REDUCTION

THE IMPACT AND BENEFITS OF DIGITAL INNOVATION EXPLAINED

David Pownall

Vice-President of Services at Schneider Electric UK & Ireland

David Pownall, Vice-President of Services at Schneider Electric UK & Ireland, explains how digitisation of power management, and deployment of 'intelligent' building management systems in healthcare facilities, can bring considerable benefits for healthcare Estates and Facilities managers – not only supporting their drive towards Net Zero, and cutting cost and emissions, but also helping them get the optimal performance, efficiency and reliability, from their equipment.

The energy crisis continues to put businesses and public sector organisations under huge economic pressure. Healthcare is one of the most energy-intensive, with NHS Trusts and healthcare facilities already consuming vast amounts of energy, and the World Health Organization forecasting that energy costs will rise over the next five years. Late last year, Sheffield Children's NHS Foundation Trust reported that it was expecting a 130% rise in its energy bill for 2022-23, compared with 2021-22, while Nottingham University Hospitals NHS Trust said it was preparing for a 214% increase in electricity and gas costs for the same period.

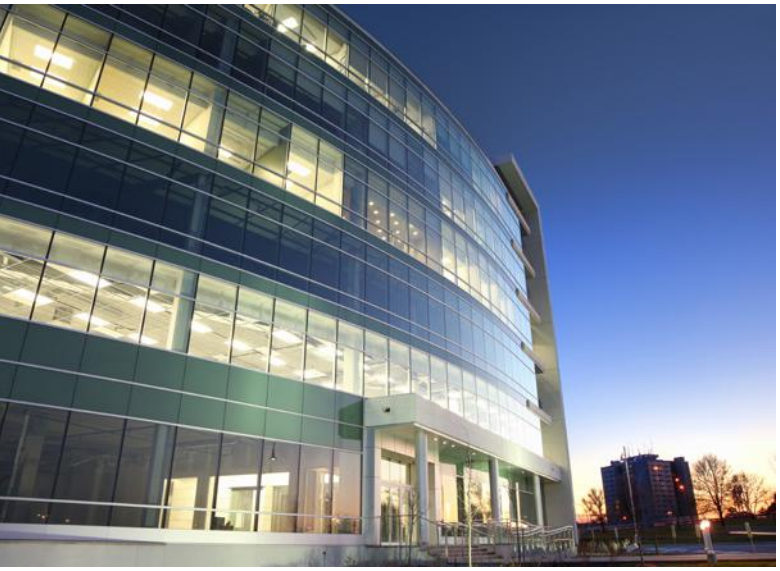
Alongside these soaring costs, the UK is also living in the shadow of blackouts and outages due to energy scarcity and extreme weather. In 2019 lightning strikes caused outages at Ipswich Hospital, where battery failure caused the back-up generator to fail. The energy risks facing the NHS are myriad. Running alongside is the overarching imperative to ensure that the service reaches its Net Zero goals; for direct emissions, it aims to reach Net Zero by 2040, with an ambition to reach an 80% reduction by 2028 to 2032. Combined, this means that NHS Estates & Facilities managers must embrace more efficient, resilient, and sustainable energy management approaches without compromising patient care.

Moving forward, Building Management Systems are being integrated with greater analytics capabilities and remote accessibility.

Always-on resiliency

With the need for an always-on, resilient energy supply, alongside increasing amounts of power-hungry medical equipment, NHS hospital Trusts have complex and specific utility requirements. Answering the needs of a digitalised healthcare service requires digitalised power management, energy efficiency, maintenance, HVAC, and building management approaches. For example, today's intelligent Building Management Systems (BMS) enable healthcare Estates managers to analyse asset and power health in real time, enabling them to diagnose and prevent problems before they occur using predictive maintenance capabilities. As the brain of the building, a BMS can monitor and control almost every aspect of the building's energy performance.

For example, a hospital's heating, ventilation, and air-conditioning (HVAC) system can



IoT-based solutions equip facilities teams with an improved view of the condition of building products, systems, and high-risk assets.

account for 30% or more of the total energy consumed. As energy costs skyrocket, improving the efficiency of HVAC, lighting, and other systems, can significantly reduce energy consumption and costs. This can include automation of energy-draining factors such as lighting, where occupancy sensors turn off lighting for unoccupied rooms. Installing variable speed drives on chillers and fans reduces energy consumption by enabling ventilation to respond to the requirements of each space based on occupancy and air quality (CO2) sensor data, for example.

Optimising BMS and HVAC systems can help immediately reduce energy consumption. A building that currently consumes 300 kWh/m2/year can expect to reduce consumption to as little as 180 kWh/m2/year using automation and control while reducing associated emissions to help the journey to Net Zero.

New-builds and retrofits

Hospitals already have many of these components in place. This makes it relatively simple and cost-effective to retrofit systems that combine them all underneath a single umbrella, and enable them to analyse asset and power health across their estate. Once they have this centralised visibility of the whole network, they gain a variety of benefits. For example, software analytics takes data from BMS and power distribution systems to notify Estates and Facilities managers of common issues such as leaky valves, failing circuit breakers or – as with the Ipswich hospital example above – flat batteries. This enables maintenance teams to address issues before they become a problem. Digitisation can also significantly lower continuing energy expenditures, and enable hospitals to find previously undetectable inefficiencies, like IT hotspots or depleted batteries, by monitoring systems all the way down to device level, and processing the resulting data through cloud analytics.

As the NHS identified in its Net Zero strategy, 'engineering solutions to upgrade our buildings represents a total of 473 ktCO2e in potential emissions savings'. The strategy also identifies that 'a wide range of interventions focused on air-conditioning and cooling, building fabric, space heating, ventilation, and hot water could … [save] some £250 million per year'.

Adoption on both new-builds and retrofits

That the adoption of BMS solutions in healthcare settings has increased as tangible ROI has been demonstrated. While there is the option to incorporate the latest Building Management Systems into greenfield sites, such systems can also be easily deployed as a retrofit in hospitals, clinics, and other medical and administrative buildings. These digital services can be installed quickly, and will typically generate energy savings of 10 to 20% for a commercial building of 10,000 m^2 with a consumption of 180 kWh per m^2/year. Indeed, identifying and upgrading inefficient or outdated building equipment and systems through retrofit projects across the healthcare estate is are core to the NHS's Net Zero strategy.

The University of Nottingham is a case in point. Schneider Electric worked with the University's Facilities Management team to upgrade its voltage network and integrate a new BMS and digital services architecture. This ensured that the new system was compatible with new and existing buildings. The combined system uses automation and control to optimise heating and cooling throughout the campus. It has reduced energy consumption and expenditure, while driving cost savings, thanks to a better understanding of energy usage. This has resulted in a 5% reduction in energy consumption, and a 3% reduction in energy costs. In addition, the system has enabled the University to improve its control of renewable technology by 75%, reducing emissions in line with its decarbonisation plans.

An optimised digital ecosystem

Moving forward, Building Management Systems are being integrated with greater analytics capabilities and remote accessibility. Leveraging IoT technology, these systems are becoming more sophisticated, and enable applications that go well beyond energy efficiency.

Most hospitals will already have a BMS solution in place, but few are maximising technology to create an optimised ecosystem. Legacy solutions, including some building management systems, building energy management systems (BEMS), and smart lighting or HVAC systems, can save hospitals and clinics upwards of 20% on their energy costs annually. However, newer, IoT-based systems incorporating AI extend those benefits to deliver hyper-efficient, resilient, sustainable estates that deliver a superior level of patient care.

IoT, or Internet of Things, refers to interconnected networks of Internet-accessible devices to collect, store, and transmit data to other connected devices. IoT-enabled

platforms deepen the value of intelligent building technologies by delivering unprecedented visibility into healthcare facility performance. This can include using BMS data and systems within a 'digital twin' of a building's assets and systems, enabling continuous, automated diagnostics to monitor and detect any performance anomalies. Going further, IoT-based, open, interoperable platforms drive energy efficiency and smart, connected healthcare systems, but they also drive improved outcomes across patient experience, system resiliency, and sustainability targets.

Powering benefits way beyond cost

The average hospital uses 2.5 times as much energy as other commercial buildings of similar size. There are ample opportunities for IoT-enabled platforms to help reduce energy-related costs in healthcare settings, and in some cases vendors will guarantee a minimum level of energy savings, reducing the investment risk for the decision-maker. However, the benefits go far beyond cost-saving. For example, IoT-based solutions equip facilities teams with an improved view of the condition of building products, systems, and high-risk assets. This insight can reduce maintenance time by proactively addressing a facility's failures, supporting better decision making, and reducing risk. This proactive approach ensures resilient power availability – the most foundational aspect of facility operations. In fact, our research shows that 87% of healthcare facility executives view improving resiliency as a significant factor in IoT investment decisions.

Medical equipment requires a substantial, reliable source of power. Maintaining high-quality, clean power is vital to ensuring that sensitive healthcare equipment always performs properly; a reactive approach to asset performance management exposes hospitals to critical risks. In contrast, IoT-based asset management and predictive maintenance systems support real-time, data-driven repair and replacement decisions through predictive analytics. Rather than facing downtime due to unexpected repairs, maintenance crews are alerted to potential problems before critical shutdowns.

Monitoring the electrical network

At the same time, power management systems optimise power system performance and reliability by monitoring the electrical network and identifying issues with availability and quality. Without IoT, this information may be inaccessible and siloed. Real-time monitoring, alarming, and power quality information, provide root cause analysis to help avoid critical conditions that can cause equipment failures and downtime. Meanwhile, technologies such as microgrids, power automation, power events analysis, and condition-based maintenance also play a significant part in guarding against outages.

Underpinning efficiency with sustainability

We should also not forget the overarching need for the NHS to reach its ambitious decarbonisation targets. As the NHS identified in its Net Zero strategy, 'Intelligent, real-time energy monitoring and control, including the use of artificial intelligence, would contribute up to 2.3% of the total required reduction in carbon emissions'.

Investment in IoT platforms enabling integration of building energy management systems (BEMS) and BMS can support the NHS's sustainability mandates. Crucially, these systems provide a platform for consolidated measurement and monitoring, enabling estates leaders to quickly and accurately report on crucial facets of their Net Zero progress.

While the energy crisis has shone the spotlight on cost implications, healthcare EFM teams, while familiar with IoT-based solutions, need to have a clear understanding of just how far beyond cost-saving the benefits of these systems can go. There is a growing ecosystem of participants that combine IT innovation, facilities, and energy expertise, and business strategy, in support of healthcare Estates and Facilities managers and owners. These trusted advisors can help navigate the digital transformation with guidance on technology selection, implementation and management, and long-term strategies that encompass hyper-efficiency, resiliency, and sustainability -- the pillars of an NHS estate fit for the future.

First appeared in *Health Estate Journal*, the monthly magazine of the Institute of Healthcare Engineering and Estate Management ('IHEEM')

About David Pownall

David Pownall joined Schneider Electric UK & Ireland as Vice-President of Services in 2019. Having previously headed up EMEA customer support and maintenance delivery at Rockwell Automation, David brings a wealth of experience in delivering customer value and improving business performance in industrial settings. Prior to this, David also held positions in the Services departments of ABB Robotics UK and MOTOMAN Robotics.

With over 20 years of Services experience, David believes that cutting-edge technology on its own is not enough to solve the industry's biggest challenges. It is a combination of data-driven insights, innovative applications, digital services, and consultative partnerships that will enable the next level of resilience, agility and sustainability in industry , infrastructure, and buildings. Energy efficiency, sustainability & digital service must become an integral part of project design.

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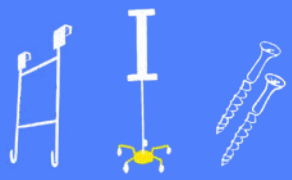
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MAKING MALAYSIA'S PUBLIC HEALTHCARE SYSTEM 'GREENER'

Dr Khairul Azmy Kamaluddin, Ts Noor Muhammad Abd Rahman, and Dr Muhammad Syukri Imran Abdullah

Dr Khairul Azmy Kamaluddin, Ts Noor Muhammad Abd Rahman, and Dr Muhammad Syukri Imran Abdullah discuss the advancement of sustainability programmes by the Malaysian Ministry of Health (MOH) to reduce carbon emissions within the country's public healthcare sector.

The Malaysian public healthcare sector has aligned itself to the country's national sustainability development programme roadmap, which allows for the adoption of green technologies and practices across public services, including the public healthcare sector. The country is moving forward towards more sustainable practices and lifestyles to address issues of climate change and unsustainable consumption, as well as inefficient water resource management.

This article provides an overview and updates on the advancement of sustainability programmes by the Ministry of Health (MOH) in Malaysia to reduce carbon emissions, particularly in the public healthcare sector. Major adaptations by MOH include energy-efficient building, adopting renewable energy resources to offset power demand, and waste reduction, as well as a green building initiative programme. MOH will continue to commit towards sustainability and make planetary health and the climate agenda a priority in its actions.

From energy efficiency to 'green' building initiatives

The year 2015 marked a new milestone in Malaysian healthcare facility management (FM) practice, when the Sustainable Energy Management Program (SEMP), Reuse, Reduce and Recycle (3R) Program, and Indoor Air Quality (IAQ) management, were first introduced. Under the new FM contract, the FM companies acted both as facility managers and Energy Service Companies (ESCOs). As ESCOs, the companies are involved in a range of energy management services, such as energy audits and energy consumption monitoring, as well as implementing renewable energy and energy efficiency projects.

The SEMP model applied in government hospitals is based on a regional certification system or ASEAN Energy Management Scheme (AEMAS), which adopts ISO 50001:2011. To further strengthen the efficient management and conservation of energy, MOH has imposed a hospital energy policy on all government-run healthcare facilities since 2016. The introduction of the policy was a crucial step in kickstarting the green building agenda for the public healthcare sector.

Figure 1

There are already around 60 Energy Managers hired by the FM companies to implement the hospital SEMP with the aim of achieving the highest Energy Management Gold Standard (EMGS) rating. As of June 2022, all government hospitals and institutions under the FM contract have met the minimum certification requirement. At least 55 hospitals have managed to achieve the highest 3-Star rating offered by the energy standard. This has led to national recognition of several hospitals by the government through the national energy award (see Fig 1).

Carbon management hierarchy

Up to December 2021, the estimated total monetary savings achieved from the SEMP programme amounted to about

RM 210 million (£35.6 m). This translates to 500 GWh in electrical energy savings, or about 360 kt in reduced carbon emissions. MOH has been adopting strategic options in the carbon management hierarchy – starting from improving working processes, being energy-efficient, and moving towards using renewable or alternative energy sources.

The Green Building Initiative is an ongoing effort by MOH to decarbonise its healthcare facilities. The 'greening' effort

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emphasises efficient use of building energy and water supply, the use of renewable energy, adopting waste reduction measures, enabling re-use and recycling practices, good indoor environment quality management, and consideration of the environment in the design, construction, and operation, of buildings. There are currently already 14 government hospitals in Malaysia that have registered under the US Green Building Council LEED 'green building' certification programme. The programme provides a framework for hospitals to shift from 'business as usual' towards improving efficiency, lower carbon emissions, and creating healthier places for staff and patients.

Four hospitals achieve LEED Gold

Four Malaysian hospitals have been awarded LEED Gold certification, while another two have managed to achieve Platinum level under the globally recognised LEED standard (Fig 2). Hospital Langkawi, on Langkawi Island in Kedah, was the first government hospital to register itself under the LEED green building certification programme (existing building operation and maintenance category, EBOM), and received Gold certification in 2020 (Fig 3). The hospital has set the pace and precedent for other government hospitals to pursue the green building pathway, which is part of a 2030 MOH masterplan to decarbonise government healthcare facilities. Prior to this, two private healthcare establishments had been certified 'green' to the regional Green Building Index (GBI) Malaysian green building certification system.

Energy projects

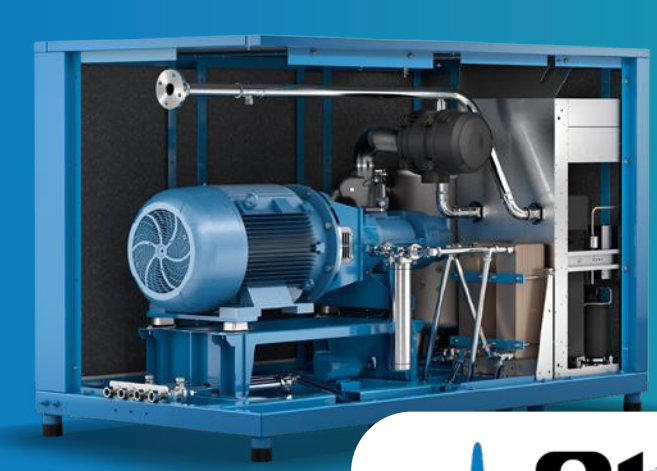
Malaysia's Ministry of Health (MOH) has implemented a significant number of energy projects to further decarbonise and reduce the health service's carbon footprint. Major key energy projects include upgrading inefficient and ageing chillers to magnetic bearing chillers or solar chillers, switching to LED lighting, installing solar thermal hot water systems, and small-scale solar PV, as well as solar tube chimneys for daylight harvesting. These energy schemes were either undertaken via conventional methods, or through the Energy Performance Contracting (EPC) process. Figure 4 shows the first EPC project, which was implemented at the Teluk Intan Hospital in 2017. To date 11 energy projects and 32 EPC-based projects have been completed, while another 12 projects are still ongoing. Figure 5 shows part of a solar thermal hot water system that was commissioned at Miri Hospital in Sarawak in 2020.

In addition to these schemes, other mechanisms have also been also deployed to implement energy projects in healthcare facilities, utilising both internal and external funds. An example of external funding was the energy efficiency funding provided by the Malaysian Energy Ministry (MESTECC). MESTECC has been actively implementing energy efficiency projects in the country involving retrofit work at 50 government-owned buildings, including hospitals, with energy efficiency technology worth RM 200 (£36.6 m). It has been widely accepted that hospital buildings have been identified as one of the highest energy users in the country, which explains and justifies the scale of effort at a national level to retrofit energy efficiency technology in such buildings. Another approach to make available and expand the use of renewable energy in the healthcare sector is to allow independent energy providers (IPPs) to build and operate facilities to generate electricity – particularly solar PV systems (SPS) – within hospital property boundaries, and sell it to the hospital concerned

Figure 2

Figure 3

Figure 4



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at a competitive rate. Such arrangements are enabled via a solar power purchase agreement guide that provides a framework and structured renewable energy agreement to enable solar PV installation programmes in healthcare facilities. Such developments will not only help the transition towards renewable energy sources, but will also be crucial in helping Malaysia achieve its goal of being 'carbon neural' by 2050.

The 'next generation' of maintenance staff and managers

The ever-changing healthcare environment requires focused training for the next generation of facilities management staff in healthcare facilities. A Certified Healthcare Facility Manager (CHFM) training programme has therefore been introduced into the Malaysian healthcare facility management sector through collaboration with local universities. The training programme was designed to ensure that FM companies in the healthcare sector – both public and private sector – have the knowledge, skills, and professionalism, to carry out FM activities efficiently. The modules and training content were designed and endorsed by the Advisory Council for Certified Healthcare Facility Management (IAC-CHFM), and recognised by MOH in 2015. The content also includes modules on sustainable facility and energy management, in line with the sustainability goals of MOH. Subsequently, the training programme is now being regulated by the Construction Industry Development Board (CIDB) Act (Act 520) as part of the Contractors Registration requirement under healthcare FM (F02) group (CIDB, 2017). Currently, over 150 professionals – primarily employees of the FM companies, as well as another 100 MOH engineers – have successfully completed the CHFM course.

Hydrogen-based power solutions – the next step?

A more recent sustainability initiative for healthcare facilities in Malaysia is the application of a hydrogen gas electrification system for a rural healthcare clinic. There are a significant number of rural clinics isolated from the national power grid that rely on generators for power, resulting in a limited ability to provide healthcare services to rural communities using modern technology. However, 2022 marked another milestone for Malaysian healthcare facilities, when a hydrogen fuel cell system was successfully commissioned and tested in a Borneo Sarawak rural clinic – providing a 'green and clean' uninterrupted power supply. The system is linked to a solar PV system where access power from the solar PV passes through the electrolyser during the day to generate and store hydrogen gas, as shown in Figure 6. The hydrogen will power the fuel cell during the night to give the clinic the power it needs.

The cost to deliver and provide such infrastructure to rural healthcare facilities is still high, but expected to become competitive over a long-term energy supply scenario. Hydrogen fuel cell technology is an emerging technology in the Malaysian healthcare sector, and perhaps one day it will

Figure 5

Figure 6

become widely available in both rural and urban healthcare facilities, given the positive development of the technology both locally and abroad.

Challenges and the way forward

Around the world, many government mandates for sustainability already exist, as governments stipulate that buildings need to be more energy-efficient and sustainable. However, financial and time constraints, as well as lack of knowledge and awareness, are barriers that need to be continually addressed. Future retrofitting projects for government healthcare buildings require substantial funding to achieve energy efficiency and green building goals. Building technology systems for smart buildings, electric ambulances, waste to energy generation, and passive building retrofits, are among a number of future initiatives set to be implemented. Business models such as Energy Performance Contracting will continue to be an attractive choice for the MOH to decarbonise its healthcare facilities, and will continue to be expanded. Complementing this is the Replacement Through Maintenance programme (RTM), which allows FM companies to replace ageing medical equipment without going through the normal procurement hassle.

Human resource challenges

There are also ongoing challenges in terms of human capital development, as there is increasing demand for experienced Facilities managers and technical / engineering personnel. The CHFM training programme will continue to play its role in upskilling both the existing and emerging workforce with the right skills and competencies. Sustainability workshops, roadshows, and user engagement from MOH at ground level – particularly with clinical and other hospital staff and administrators – will need to be conducted to gain support for the sustainability practices.

The energy consumption of a hospital building can be better managed and monitored via comparison with a target or benchmark, or that of another similar-sized building. MOH has been looking into this challenge by conducting important hospital energy benchmark studies. The initial study by MOH has shown that the government hospital building energy index is 172 kWh /m2 / year. However, recent energy research collaboration led by the Engineering Services Division at the MOH has established an energy benchmarking model based on multiple linear regression. This enables hospital buildings to assess their energy consumption against a predicted value. The study has also indicated that energy consumption in Malaysian hospitals is largely influenced by parameters such as air-conditioned floor area, the number of operating theatres available, the quantity of high energy-consuming medical equipment, and the energy consumed by lighting. The obvious conclusion, therefore, is that that energy efficiency initiatives and sustainable practices should focus on these areas to further reduce hospital carbon footprints.

The carbon accounting 'challenge'

Another element that remains a challenge to the MOH is carbon accounting of its hospital facilities. However, efforts are ongoing to apply GHG protocols, collect data, and submit this to data to top management personnel, as soon as possible. A carbon neutral healthcare facility (2021-2050) blueprint is in development that will outline steps for carbon neutral facility planning, and an optimal carbon reduction strategy, without compromising the quality / availability of healthcare services. In parallel, there is ongoing work to reduce GHG emissions through energy efficiency measures, reducing demand for energy, switching to 'greener' fuels, and outsourcing to a greater degree to more efficiently run services. Additionally, MOH is looking to increase its collaboration with industry, universities, and local and international experts, on key strategic areas – namely green practice awareness, skills, knowledge, and research, and reducing emissions by enhancing energy efficiency.

Conclusions

Government healthcare facilities in Malaysia have experienced significant transformation since 2015, when MOH integrated sustainability programmes into the hospital FM contract. Efforts to decarbonise the healthcare sector are still ongoing, and it remains a monumental task – but many advancements and progress have been made. However, much catching up is still needed, particularly in expanding the current initiatives and pushing for more green, low carbon, and alternative energy source projects. Benchmarking of all GHG scopes is still ongoing to identify emission 'hotspots' in the healthcare system. Only then can a meaningful transition pathway towards decarbonising and Net Zero emissions be developed for Malaysia's healthcare facilities.

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Dr Muhammad Syukri Imran Abdullah P.Eng

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FULL STEAM AHEAD

"A Healthcare Sustainability Outlook"

In previous editions we discussed topics of thermal efficiency and the fact steam remains relevant in hospital infrastructure (refer to Vol 43 & 44) due to its unique heat carrying properties. The continuing debate remains around the source of its generation (i.e traditional carbon emitting fuels) and what alternatives will be available in the short to medium future against other alternatives. So let's explore this alittle more:

What do we know now:

On the eve of the most recent release from the IPCC (1), unequivocally proving that human influence has already created, centuries long irreversible changes to our natural environment, further pressure adds to healthcare facilities to play their part. Adding to this, Australia is considered as one of the top emitter's per-capita (2) with the heath sector estimated to contribute around 5% of the country's total emissions.

The Australian government announced in 2015 that by 2030, they expect to reduce greenhouse emissions to 26-28% below 2005 levels. Unfortunately, Australia remains well behind the 2020 projected targets being noted as an insufficient contributor (3) on a global stage with 75% of the electricity grid still generated by coal fired power (4). Whilst it's expected that some reliance on traditional power stations would continue, there remains a lack in confidence that the Australian power network will achieve close to a renewable position in the near future, especially with non-committals to global reduction agreements and planning.

Further reference can be gained via the healthcare engineering roadmap released in the UK (5) where one consideration is for those with steam plants in very poor condition servicing minimal non-critical applications, to be removed as part of a wider de-carbonation program. However this report further identifies the continuing need for steam in hospitals, certainly those with high thermal loads and outlines many areas to improve thermal efficiency in existing infrastructure. This can start with a steam plant thermal audit with review of distribution efficiency along with potential energy recovery opportunities to reduce OR offset fuel usage initially. Further to this, additional opportunities exist around boiler tuning with advanced controls and generating LTHW or domestic water on demand via efficient heat exchange as other enablers for energy reduction.

So what's the future look like?

CHP (Combined Heat and Power) and renewable off sets can combine to reduce energy intensity along with hydrogen energy systems or green hydrogen fuels advancing quickly. If steam generating fuels can become carbon neutral OR renewable offsets considered in the process of steam generation, combining with an efficient steam distribution system, then the major thermal needs of a hospital can be met in a net zero fashion. This future is real and a more likely realisation then Australia's power network becoming vastly renewable before a major call for action on climate change.

Putting faith in advancing clean fuels along with existing technology, provides for a sustainable outlook whilst supporting the thermal needs of a hospital. Steam continues to provide a versatile heating medium for the likes of sterilisation and critical air streams without interruption or large infrastructure modifications. Spirax Sarco is already advancing new technology into field trials so becomes a period of "watch this space" as Healthcare sustainability for the longer term, remains a priority for all involved. Get in contact with a Spirax Healthcare engineer to discuss what can be done now on your sustainability pathway.

(1) IPCC, 2021: Climate Change 2021: The Physical Science Basis. (2) Healthcare without Harm – Climate smart green paper Sep2019

(3) Climate Analytics & NewClimate Institute 2021, Climate Action Tracker (4) Merched 2015, Toward sustainable energy usage – A case study for Australia (5) Heape, S & Lowndes, S 2021, A healthcare engineering roadmap for delivering net zero carbon, United Kingdom.

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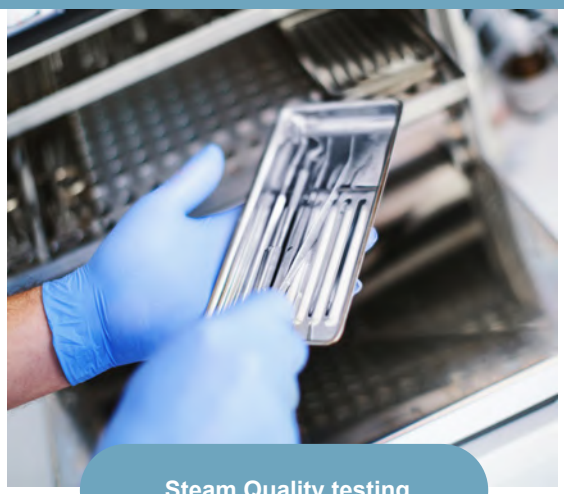

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