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Moment of Truth: Proper Air Flow Critical To Healthcare Laundries

Introduction

When it comes to quantifying how important proper air flow is to the operation of a healthcare laundry, the numbers speak for themselves. Twenty-five percent of laundries inspected by the Healthcare Laundry Accreditation Council (HLAC) in 2009 were faced with having to go back and take a closer look at their facility's air flow before being accredited by HLAC. Though air flow was not the only contributing reason organizations did not initially pass an inspection, it was statistically significant.[1]

For HLAC, this confirms that proper air flow in a facility can pose one of the biggest challenges to healthcare laundries dependent on the type of improvement needed. Nevertheless, HLAC's efforts to promote proper air flow in healthcare laundry plants heightens industry awareness of its importance and raises the bar for excellence in operations. For laundries, it's an opportunity to correct or improve their processes to ensure healthcare clients receive the highest-quality textile product possible.

Understanding the Importance of Proper Air Flow

Laundry plays a vital role in every healthcare facility's integrated infection prevention and control program. During a hospital stay, patients are literally surrounded and exposed to yards of healthcare textiles, including hospital staff work attire, sheets, blankets, towels, gowns, privacy curtains and more. The need for surgery or long-term care can increase textile exposure significantly for patients. Studies have shown that a textile can be considered a fomite, an object capable of carrying an organism and serving as a reservoir that can be involved in transmission. In one study, Neely and Maley showed that bacteria such as Vancomycin-Resistant enterococci (VRE) and Methicillin-Resistant *Staphylococcus aureus* (MRSA) injected into sterile textiles can survive anywhere from one to 90 days.[2] And while there's no guarantee the mere presence of infectious microorganisms on surfaces and fomites will lead to transmission or infection**, proper laundry processing protocols and guidelines reduce the likelihood that such a microbial transfer will occur by reducing the numbers of microorganisms**

remaining on the surface or fomite. That, in turn, minimizes the possibility of textiles posing as a source of infection or danger to the patient or healthcare worker. Andrew Streifel, MPH, public health specialist at the University of Minnesota in Minneapolis, was involved in epidemiological investigations of three separate clusters of hospital-acquired infections (HAI) resulting from *Aspergillus flavus* contamination of hospital linens in Minnesota, Texas and North Carolina over the past 20 years. "It doesn't happen very often, but it can happen," Streifel says.

Because of this potential infection risk, it is crucial that healthcare textiles be properly processed and delivered to the customer in a "hygienically clean" state. The most obvious method to achieve hygienically clean textiles (textiles devoid of bio-burden and therefore pose little or no threat of infection transmission) is through the laundering process itself, which consists of the proper combination of water, heat, pH, oxidation, chemical sanitizers, and drying and ironing. Additional critical factors that help ensure a hygienically clean textile are the physical layout of the laundry itself and the design/specifications of the facility infrastructure. The primary concern is that clean textiles are not re-contaminated during processing, handling, finishing, storage or delivery. Maintaining a clean, sanitary environment with work processes that help prevent cross-contamination is critical to meeting the high standards of healthcare customers.

An integral but sometimes overlooked component of the environment is air flow within the facility. Proper air flow can help ensure that microbe-laden lint and other particulate contaminants cannot enter the clean textile processing area and settle on shelves, carts or clean, processed textiles awaiting packaging and delivery. Proper air flow is a requirement to achieve "functional separation" in a healthcare laundry facility. Functional separation is a laundry industry term and is best defined as keeping separate the functions of clean textile processing and handling from the functions of soiled textile processing and handling. Proper air flow and functional separation are central components of the HLAC Standards, a voluntary program which incorporates an

independent survey and accreditation program for laundries processing healthcare textiles.

Functional separation principles should also be incorporated into the workflow and traffic patterns, including when textiles are moving through the laundering process, being transported or stored on carts, and loaded onto delivery vehicles. For the purposes of this paper, discussion will focus on air flow and its application to functional separation as a principal factor to ensure production of hygienically clean textiles.

Air Flow and HLAC Standards

The commercial laundry industry has long held that proper air flow and functional separation are important industry best practices for the healthcare laundry. HLAC incorporated these best practices into its Standards introduced in 2006. After four years of surveys and discussions with accredited laundries, HLAC will provide the industry with a more detailed functional separation standard as part of the newly revised Standards tentatively scheduled for release in the second half of 2010. The revised Standard reads as follows:

2.1.3.1. The essential laundry facility design must have a functional separation of areas that receive, store, or process soiled textiles from areas that process, handle, or store clean textiles by one the following methods:

2.1.3.1.1. Physical barrier (e.g., walls or structural partitioning with a means of entry to and from the soiled textiles area) which includes negative air pressure in the soiled textiles area or positive air flow from the clean textiles area through the soiled textiles area with venting directly to the outside; or

2.1.3.1.2. Functional barrier by negative air pressure in the soiled textiles area and positive air flow from the clean textiles area through the soiled textiles area with venting directly to the outside.

This revised Standard more clearly states that proper air flow must be in place even when a barrier wall separates the clean and soil processing departments. The combination of the barrier wall and positive air flow from the clean side further reduces the opportunity for airborne contaminants to pass through opened doorways or float over walls that may not extend fully to the ceiling due to overhead rails, pipes, or ventilation ducts.

Air flow should move in the direction of clean to soil, then vented to the outside.

Though it can pose extra engineering challenges, laundries that do not have a physical barrier wall can still achieve functional separation with a properly engineered HVAC system. This type of system should be combined with a stringent monitoring protocol that notifies managers of a change in pressure or air flow so that timely adjustments can be implemented. HLAC Standards accept a well-engineered functional separation system that relies solely on air flow and no barrier wall, and HVAC consultants can help a laundry develop such a system.

Seek the Experts

"Proper air flow is critical in healthcare laundries to maintain the barrier between soiled and clean areas in the laundry facility," explains Gerard O'Neill, President and CEO of American Laundry Systems, a division of E & O Mechanical, Inc., in Haverhill, Mass. "While there are no federal regulations regarding air flow at this time, 6 to 8 air changes per hour (ACH) is the accepted industry standard. It is critical to maintain a positive-to-negative air flow in the direction of the soiled room. When the air flow is negatively balanced on the soiled side, the air will pass from the clean side to the soiled side naturally. This is basic physics…the air will follow the 'path of least resistance.'"

For in-house hospital laundries, laundry professionals are encouraged to consult the *Guidelines for Design and Construction of Health Care Facilities* 2010 edition written and published by The Facility Guidelines Institute. This 448-page publication is thorough in its technical guidance for healthcare facilities of all types, providing design guidelines for everything from sound absorption to ventilation, including applicable guidelines for clean and soiled textile handling and storage areas. For example, section 2.2-5.2.3.1 states that for the on-site laundry, "equipment shall be arranged to permit an orderly work flow and minimize cross-traffic that might mix clean and soiled operations."[3] The Guideline goes on to describe additional parameters a hospital laundry should consider such as hand-washing stations, storage for laundry supplies, service entrances for loading and unloading of textiles and more. As with previous editions, the recommendations in the 2010 FGI Guidelines are applicable to new construction and/or major structural and/or infrastructural renovations. In other words, existing facilities are not required to retrofit their structural and infrastructural specifications to current guidelines, but if new construction or renovation is undertaken, the recommendations from the most recent edition of the FGI Guidelines will apply.

New to the 2010 FGI Guidelines is the inclusion of the ANSI/ASHRAE/ASHE Standard 170-2008: *Ventilation of Health Care Facilities*. The purpose of this standard is "to define ventilation system design requirements that provide environmental control for comfort, asepsis, and odor control in health care facilities." Because the laundry is considered a supporting department that plays an important role in hospital infection prevention, familiarity and incorporation of ventilation standards can enhance patient safety as well as employee comfort, whether the laundry is in-house or off-site. Detailed pressure, air change rates, exhaust, humidity and temperature specifications are included in **Table 7-1 Design Parameters.** The chart on the next page is an excerpt from that table applicable to laundry areas:

Ventilation Requirements for Laundry Facilities

(Excerpted from ANSI/ASHRAE/ASHE Standard 170: *Ventilation of Health Care Facilities* and the 2010 FGI *Guidelines for Design and Construction of Health Care Facilities*)

Function of Space	Pressure Relationship to Adjacent Areas (d)	Minimum Outdoor ACH	Minimum Total ACH	All Room Air Exhausted Directly to Outdoors (b)	Air Recirculated by Means of Room Units (a)	RH (k), %	Design Temperature (c), °F/°C
Laundry, general	Negative	2	10	Yes	No	N/R	N/R
Soiled linen sorting and storage	Negative	N/R	10	Yes	No	N/R	N/R
Clean linen storage	Positive	N/R	2	N/R	N/R	N/R	72-78/22-26
Linen and trash chute room	Negative	N/R	10	Yes	No	N/R	N/R

N/R=No Requirement; ACH = air changes per hour; RH = relative humidity

Notes:

a. Recirculating room HVAC units (with heating or cooling coils) are acceptable to achieve the required air change rates. Because of the cleaning difficulty and the potential for buildup of contamination, re-circulating room units shall not be used in areas marked "No."

b. In some areas with potential contamination and/or odor problems, exhaust air shall be discharged directly to the outdoors and not re-circulated to other areas.

c. Systems shall be capable of maintaining the rooms within the rage during normal operation.

d. If monitoring device alarms are installed, allowances shall be made to prevent nuisance alarms. Short term excursions from required pressure relationships shall be allowed while doors are moving or temporarily open. Simple visual methods such as smoke trail, ball-in-tube, or flutterstrip shall be permitted for verification of air flow direction.

A key point to remember about temperature and commercial laundries: In Table 7-1 "Clean linen storage" generally refers to an area or room in the hospital where textiles are easily accessible by hospital staff for in-patient room use, therefore adherence to proper temperature controls related to where those textiles reside plays an important role to inhibiting microbial growth on the textiles. For the off-site commercial laundry provider, clean textiles are rarely staged for periods longer than 24 -48 hours in today's just-in-time supply and demand systems. Staging areas, which are generally not situated in a climate-

controlled area in an off-site laundry, should be kept as clean as possible. In addition carts, racks and delivery vehicles should be subject to strict cleaning protocols to help maintain the textile's hygienic integrity prior to delivery back to the customer. For off-site laundries that store clean textiles, adherence to proper storage and climate control guidelines should be followed.

Separate from the general healthcare textile processing area, the surgical pack assembly room should have its own climate control or HVAC system that can control and monitor temperature and humidity levels. For laundries building or renovating a surgical pack assembly room, the Association for the Advancement of Medical Instrumentation (AAMI) ST65:2008 Standard provides the most comprehensive and thorough guidance available, including HVAC guidelines. In the event the HVAC system gets shut down in the pack assembly room due to holidays, weekends or equipment maintenance, surgical textiles should be protected through the use of wrapping, cart covers, or covered shelves.

Filtration is also an important component of maintaining air quality. Effective in 2011 for newly constructed or renovated surgical pack assembly rooms, the facility's area/room used for this purpose will be required to maintain a MERV 7 (minimum efficiency rating value) to ensure a 30% particulate filtration level as well as a 30-60% relative humidity level. If the laundry sterilizes textiles on site, the MERV rating goes up to 14, or 90% particulate filtration. Currently there are no MERV requirements for the general healthcare textile processing area.

Plant renovations or additions can play a critical role in air flow changes. "It can be easy to overlook the impact that new, more efficient equipment or building expansion can have on the current air flow", says Elliot Mata, Laundry Division Manager of ARCO/Murray National Construction Company, Oakbrook Terrace, Ill.
"There is more than one way to design an air flow solution and we factor in all the variables necessary to get to the correct solution," Mata states. Engineers such as Mata have the technical training and expertise to help a laundry sort through the guidelines, such as the International Code Council's (ICC) Mechanical Code. Specifically section

403.3 of that code—Ventilation Rate—requires that an appropriate amount of outdoor air be supplied to the facility based on the square footage and number of employees who occupy the space. "A professional design/builder or mechanical engineering firm can help run the necessary calculations that will help properly identify the mechanical equipment and installation needed to meet or exceed the mechanical code requirements of the local municipality and ensure indoor air quality is maintained," Mata states. "This in turn will help your organization meet and exceed healthcare and laundry industry guidelines, HLAC Standards and most importantly, maintain a comfortable environment for employees."

Factors that Can Affect Air Flow

A host of factors can affect air flow in healthcare laundries and must be taken into consideration to ensure the delivery of hygienically clean laundry for healthcare clients. These include walls, openings, equipment changes, climate and routine cleaning/maintenance. Climate issues, for example, take on added significance when laundries are located in warmer parts of the country. Opening an overhead door to allow fresh air on a warm day can cause a major imbalance in air flow if this is not taken into account and incorporated into the laundry's design. "Be honest with your HVAC contractor," advises Lynne Sehulster, PhD, M(ASCP), health scientist with the Division of Healthcare Quality Promotion at the Centers for Disease Control and Prevention in Atlanta, Ga. "Ventilation systems are designed to certain specifications. If you regularly open an overhead door during the hot months, let your architect or HVAC contractor know this so they can incorporate this into the air flow design and indications for climate control. It's very important to have open, honest communication between the HVAC contractor and the laundry operator." Employee comfort also can be incorporated into a laundry's design through the use of supply fans, negating the need to open an overhead door on hot days.

Routine cleaning and maintenance, such as blow-down to remove lint, can be extremely detrimental if clean linens are not protected. "It's very important to manage particulates in the air, such as lint," Sehulster explained. "Lint can carry bacterial and fungal

contamination to a work surface or textile. For laundries that process surgical gowns, towels and barriers, lint control is critical. Studies have shown that lint on surgical textiles can hinder a patient's recovery. Lint introduced into a surgical wound may be perceived as "foreign material" that may trigger inflammation in the wound" Sehulster states. "During blow-down, clean linens should be protected – above and beyond what the laundry's ventilation and filtration system can provide. When you're cleaning, take extra precautions to ensure your clean linens are put away and covered," Streifel added.

Most importantly, Streifel and Sehulster recommend that all healthcare laundries – even those who are HLAC-accredited – have periodic checks to ensure the air flow system is functioning as it was intended. "The air change rate (ACH) is important to know and should be periodically validated," Sehulster said. "Healthcare laundries should consider having this tested annually to make sure that the laundry's air flow design and specifications are being maintained." American Laundry System's O'Neill states, "I would advise that any laundry with the potential for air flow issues to contact a company that is experienced in designing healthcare laundries to help design an air system that will allow for the proper amount of air changes per hour, adhere to the positive-to-negative air flow concept and also allow for employee comfort within the facility," O'Neill said.

The Veterans Administration (VA) also agrees that proper air flow is important. "Ventilation can play an important role in a textile care processing facility's infection control initiatives," explains Steven C. Parrish, program manager for the Department of Veterans Affairs Office of the Deputy Under Secretary for Health for Operations and Management. "Proper air flow reduces the amount of airborne contaminants thus providing for a safe and cleaner environment for textile processing."

Develop A Monitoring Protocol

A proactive approach to monitoring air flow provides significant benefits to the healthcare client. Methods can vary and include the following:

- Flutterstrips placed in various locations throughout the plant that offer a continuous visual cue as to air flow direction.
- Digital pressure monitoring devices that monitor negative and positive air pressure. Devices should be hard wired into the facility if possible.
- For pack assembly and clean storage rooms, thermostats and humidistats should be installed.

Ongoing monitoring and logging of air flow and pressure data can help a laundry enhance its quality control program as well as more quickly identify an equipment or air flow problem before clean textiles are put at risk.

Summary

Today's healthcare laundry should have a properly-designed and engineered HVAC system that supports functional separation of the clean and soil textile processing areas. Whether the laundry has a barrier wall or not, it's critical that there be positive air pressure on the clean side and negative pressure on the soil side to minimize or reduce the risk of airborne contaminants from entering the clean processing area. Routine air flow monitoring should be integrated into the laundry's maintenance program to help ensure daily compliance and corrective measures. Seek the advice and expertise of engineering experts who can help you work through the various guidelines and best practices and apply them to your facility's unique design. Healthcare laundries that choose to meet and exceed the healthcare and laundry industry ventilation guidelines demonstrate leadership and commitment to patient safety goals. Such laundries become a valued supply chain partner who stands ready to meet the healthcare challenges ahead for the benefit of the ultimate customer – the patient. ♦

Testimonials from HLAC-Accredited Laundries

Westport Linen Services, Baton Rouge, La.
Accredited 2010

Eddie Lefeaux, owner of HLAC-accredited Westport Linen Services in Baton Rouge, La., said his new 48,000-square-foot facility, designed by ARCO/Murray National Construction Co., utilizes supply fans on the clean side to circulate air, maintain proper air flow and keep employees comfortable in the warmest months. When Westport sought HLAC accreditation in 2007, its former facility didn't pass its initial inspection because of air flow issues.

"We needed a negative air flow from clean to soiled," he explained. "We had it, but it wasn't consistent."

To meet the HLAC standard, Lefeaux hired a local HVAC contractor to redesign air flow through the installation of fans on the soiled side, the removal of plastic curtains and the construction of a permanent barrier wall. In all, the project cost the company $12,000 to correct the deficiency, but Lefeaux said it was money well spent.

"We view HLAC accreditation as our report card to our healthcare customers," he said. "It shows that we follow policies and procedures just like a hospital does with the Joint Commission. We live HLAC standards day in and day out. At Westport, we believe we're a true extension of the hospitals we serve."

When it came time to expand their laundry services, Lefeaux hired ARCO/Murray to design his new state-of-the-art facility using HLAC standards.

"Accreditation is very important to Westport, that's why we worked with our general contractor to ensure we met HLAC standards up front in the design of our new facility." ♦

Vogue Linen Supply and Uniform Rental, Elko, Nev.

Accredited 2009

Jim Meeks, owner of Vogue Linen Supply and Uniform Rental in Elko, Nev., says he was immediately interested in seeking HLAC accreditation when the organization began surveying healthcare laundries. "We wanted to know what it took to be accredited," Meeks explained. "So we obtained a copy of the HLAC standards and did a substantial amount of work training our employees and preparing our plant for inspection."

As it is for many healthcare laundries, air flow was an issue that prevented Vogue from receiving accreditation immediately. But armed with HLAC's recommendations, Meeks hired a local HVAC contractor to help him design a process that would ensure negative air flow while maintaining employee comfort. "The problem was we had an open area that allowed air to flow back in," he said.

The solution involved the creation of functional separation through extensive duct work, the installation of a large fan in the soiled linen area that exhausted directly outside and the construction of a 26-foot-high barrier wall that seals off the washroom from the other parts of the laundry. With engineering services, design and construction, Vogue invested $23,000 to correct the deficiency and says the expense was well worth it.

"When we demonstrated the corrective actions, we passed without a problem. HLAC gave us a process and a method to ensure that we're delivering the highest-quality healthcare laundry available to our customers." Additionally, Vogue has a geothermal well with incoming water at 180 degrees. Meeks says that, "we are probably the only certified health care laundry facility in the country that does not heat wash water. All our laundry is washed at 180 degrees giving us a superior product and competitive advantage." During the warmest summer months, Vogue's employees stay cool thanks to a fully air-conditioned plant. In the winter, the radiant heat from the equipment helps keep employees warm at a comfortable 75 degrees, negating the need for heating equipment. ♦

Ames Linen, Cortland, NY
Accredited 2008

Johanna Ames, president and owner of Ames Linen in Cortland, NY, says her family-owned laundry sought HLAC accreditation because they saw it as the "gold standard for our industry and believed that our solid policies and procedures, already in place, would make us eligible."

She was right. Ames Linen passed its inspection without any deficiencies to correct. "We do not have barrier wall in our plant," she explained. Instead, Ames Linen maintains appropriate air flow through the use of large, wall-mounted exhaust fans, which pull air from the clean side to the soiled side. "We also have additional ceiling exhaust fans."

Fortunately, in upstate New York, oppressive heat and humidity is a rare occurrence. When the temperature or humidity peaks for a week or two during the summer, Ames helps keep employees cool by offering them extra breaks and complimentary cold refreshments. As a result, air flow is not compromised.

"We have long been desirous of that 'stamp of approval' from an outside auditor who could confirm our practices," she concluded. In June 2008, Ames received it. ♦

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About HLAC
HLAC has been accrediting laundries since 2006. Accreditation is valid for three years and is voluntary. HLAC remains the only independent organization dedicated solely for developing and implementing a comprehensive standards program that includes survey and accreditation for healthcare laundry operations. Today, HLAC accreditation is viewed as an important credential for those serving healthcare organizations. Visit www.hlacnet.org to view the Standards and learn more.

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Additional Resources
www.ashrae.org
www.ansi.org
www.fgiguidelines.org
www.ashe.org

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