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2016 West Coast Engineering Spotlight

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Protecting patients … the ultimate customer

Special to Plumbing Engineer

When engineering and designing a new building, expansion or retrofit, the team always has the end user and their clients in mind with every detail. Project teams of health care facilities are under a unique set of conditions due to the clients, or patients, who they serve. The vast majority of the occupants in a health care facility are patients who have a depleted immune system and have an established health issue for which they are being treated. These individuals are at a higher risk and the most vulnerable to contract a health care-associated infection (HAI). The first line of defense is a design that helps provide the basis for a strong infection control plan.

Health care organizations perform complex risk assessments to objectively state, document and rank risk. The risk assessment team will implement management plans to combat or attempt to minimize risk. During this risk assessment, patient types are mainly grouped by the type of treatment they are receiving and the different departments they will occupy as well as other factors. (Ex. intensive care unit, surgical unit, emergency department, etc.) Based on these criteria, they are grouped and designated a risk factor: low, medium, high or very high.

Among the groups for a high or very high risk are patients receiving treatment in surgical units, intensive care units (ICU), neonatal intensive care units (NICU) and dialysis. Dialysis patients are often in the highest risk group due to the fact they are dealing with a compromised immune system, more susceptible to infection, and might already be battling an additional illness due to their low immunity.

Dialysis treatment is for those who have lost full function of their kidneys, and they are no longer cleaning blood properly and filtering waste. There are multiple types of dialysis treatments. One common treatment is called Hemodialysis. This treatment requires a highly technical machine called a "dialyzer," which needs both potable water and a drainage line to dispose of the waste. This is where a strong plumbing design can help strengthen a risk management plan.

Some Authorities Having Jurisdiction (AHJs) will allow for one backflow prevention device to protect the house potable water system from contaminants caused by backsiphonage or back pressure. This design leaves the dialysis stations open to cross-contamination amongst each other as the stations are daisy-chained together. Stations or patients are not protected from one another, and this design leaves the patients at risk of infection due to pollutants in the water supply.

Another typical design will have dedicated potable water lines that route from a closet to the dialysis stations. This is a much safer design that will isolate each dialysis station from another. However, this design can leave contaminants in a long run of pipe if backsiphonage occurs. This design also has costly labor and material requirements for the plumbing contractor.

The problem lies in questions of the code, which can leave it up to the AHJ or facilities risk management team to determine the strength of the design. Some might say that both of the designs above will meet code requirements of the IPC 2012 and UPC 2012, and that the second design would be considered a safer design.

IPC 2012 - 608.1 — A potable water supply shall be designed installed and maintained in such a manner so as to prevent contamination from non-potable liquids, solids or gases being introduced into the potable water supply.

IPC 2012 - 608.15 — All potable water openings and outlets shall be protected by backflow in accordance with section 608.15.1, 608.15.2, 608.15.3, 608.15.4, 608.15.4.1 or 608.15.4.2

UPC 2012 603.1 — No person shall install a water-

operated equipment or mechanism, or use a water- treating chemical or substance where it is found that such equipment, mechanism, chemical or substance cause pollution or contamination of the potable water supply.

UPC603.5.17 Special Equipment - Portable cleaning equipment, dental vacuum pumps and chemical dispensers shall be protected from backflow.

The codes leave some questions and gaps in coverage.

Some AHJs have more stringent local codes that make reference to backflow prevention device "at the point of use."

In 2015, a large hospital in the East Valley of the Phoenix, Arizona metropolitan area renovated an entire floor of one of its towers. This project was a complete remodel of the second floor to accommodate a multi-organizational service unit (MOSU). The project provided (24) AIA 2010 compliant, private inpatient MOSU rooms. The hospital required dialysis treatment capabilities in each of its 24 private patient rooms.

The plumbing and mechanical engineering and design team, WSP+ccrd, had to meet multiple challenges providing these dialysis treatment stations:

- Provide the safest design for those patients receiving dialysis treatment.
- Meet or exceed all plumbing code requirements regarding backflow prevention, trap priming devices and special equipment.
- Provide a user-friendly device for the nursing staff.
- Provide an aesthetically pleasing look integral to the harmony of patient room.
- Design around an already cramped ceiling and wall space.

The engineer team decided on an all-inclusive dialysis treatment docking station, the W.D. Manor Dialysis Box (WDMDB). This box comes with all components required to meet or exceed any code requirement. This product also comes with an a optional thermostatic mixing valve for those designs that require tempered water to meet requirements of 75 F - 78 F water for most dialysis machines.

The main component of this product is the testable backflow prevention device that is integral to the box. This device provides the utmost safety of cross-contaminating or backsiphonage by protecting the water source at the point of connection.

"Backflow prevention is required by the building codes for point of use devices like dialysis boxes. Backflow preventers at each dialysis box are the best way to provide a high level of cross-contamination prevention, but without the right amount of coordination it can be unsightly and maintenance prohibitive," said Nolan Rome, PE, WSP+ccrd engineer for the project. "A stick built approach can achieve a result for coordinating the drain box, backflow preventer and trap primer, but has not always been effective trying to get a kit of parts to meet all of the project and owner's needs. The result is not always a repeatable, high-quality solution for the facility staff."

Another benefit of the dialysis supply and drain box is that it comes standard with an isolation valve for testing and certification. All backflow prevention devices are to be tested in accordance with manufacturer specifications, at a minimum of an annual test and certification.

Another advantage of this box is that it can be installed near any potable water source and drainage fixture such as a water closet, lavatory or sink. It does not require a dedicated potable water supply and drain lines and is in fact its own closed system in a box.

In this specific design, for the Phoenix area hospital, the dialysis box water supply was provided from a domestic cold water main line that also served the private bathroom fixtures. The drain was connected to the same main drainage line that served the floor. Utilizing this product in the design provided a savings to the team of approximately $42,000. The savings was due to the elimination of labor and materials that would have been required to install dedicated supply lines from a closet of backflow prevention devices to the individual dialysis treatment stations.

"Prefabricated dialysis boxes that include all of the required parts have provided the best solution to providing the cross-contamination prevention and also a service friendly solution for facility engineers and housekeeping staff," Rome noted. "The prefabricated box includes back flow prevention, trap primers and a drain coordinated to achieve hose insert depths in one clean repeatable location when coordinating with the other devices in a patient headwall. Particularly, prefabricated headwalls which are providing speed and accuracy to construction prefabricated dialysis boxes add one more level of quality to the end product for the owner."

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The strong design on this project not only helped save money for the team, but, more importantly, provided protection for the patients. In the end, the engineer's team reduced patient risk by protecting the water source of the dialysis machine of the patient receiving dialysis treatment.

When a project team is designing a health care facility or clinic, they have multiple customers in mind. The owner, the staff and the patients are all customers. Just as doctors and nursing staff treat a patient with the utmost care, so should the engineering, design and construction teams. ■