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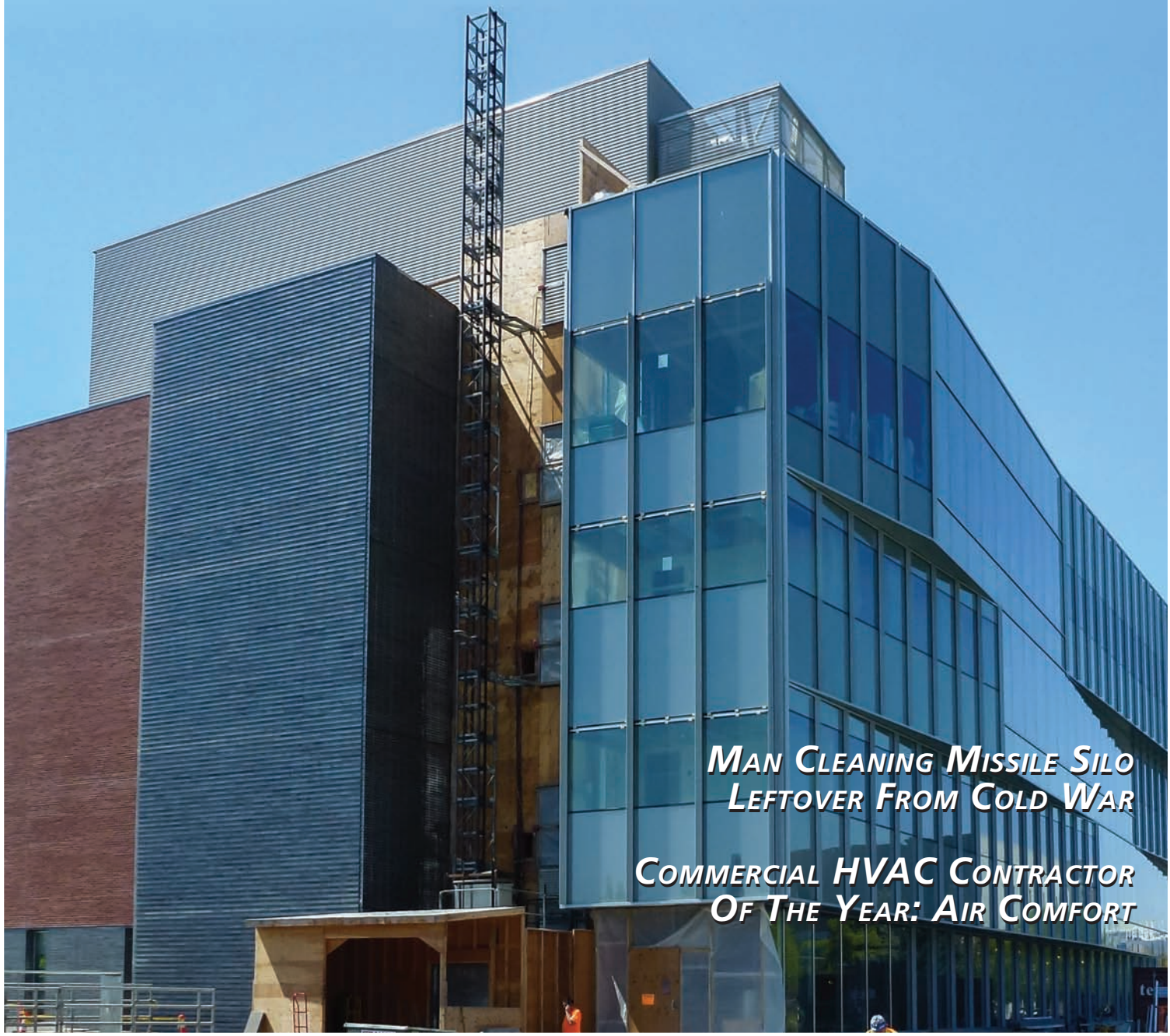
Washington State Biomed Lab Raises the Efficiency Bar



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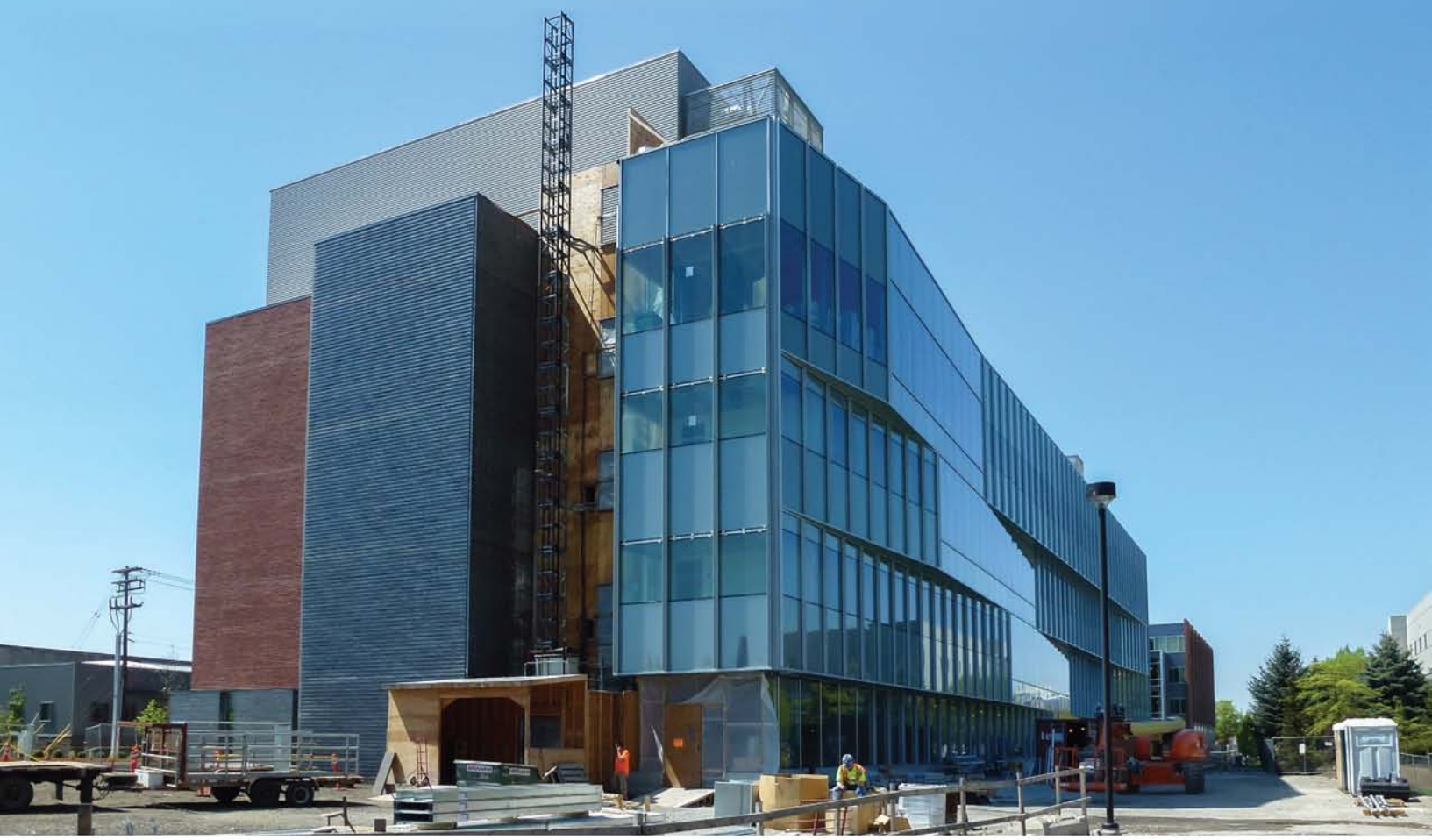
Washington State Biomed Lab Raises the Efficiency Bar



The building's north side features a floor to ceiling glass curtain wall, which created design challenges for perimeter conditioning in these areas

When Washington State University (WSU) administrators made plans for a new biomed facility, the goal to achieve energy efficiency went under the microscope. The WSU Spokane Riverpoint campus Pharmaceutical and Biomedical building, which is targeting a LEED® Silver rating, has already become a model for other schools considering similar facilities.

Health Sciences has been a strong part of Washington State University's course offering since the school's inception in 1891. Aptly named for its location on a sharp bend in the Spokane River, WSU's Spokane Riverpoint Campus is fast becoming the university's hub for the school's College of Pharmacy.

As part of an effort to consolidate Health Sciences faculty and students and to enhance the capacity for research, WSU recently constructed the new building. Nine state-of-the-art laboratories, numerous classrooms, offices and common areas fill the four-story, 125,000 gross square foot structure.

During the 18-month design phase, Affiliated Engineers, Inc. (AEI) Mechanical Project Engineers Joan Sirotak, P.E., and Martin deVrieze, P.E., developed plans for the building's overall Mechanical/Electrical/Plumbing systems. AEI also designed the low voltage and lighting controls design, which added to overall building efficiency. Ken Billington, construction administrator with AEI, oversaw construction and worked with the contracting team to coordinate and complete the installation of the MEP systems.

AEI is a multi-discipline MEP engineering firm with nearly 600 employees, 11 locations nationwide, and two internationally. The company's strong focus on sustainability and modern design has made them a leader in the science, technology and healthcare facility markets, among many others. Billington's own 20-plus year experience in the field includes work for AEI on the Li Ka Shing Center for Biomedical and Health Sciences at the University of California Berkeley, and the Linus Pauling Institute at Oregon State University, among others.

"AEI has performed several design, conceptual and

commissioning tasks for WSU in the past, including design of the new Paul G. Allen School for Global Animal Health building at the Pullman campus," said Billington, who works out of AEI's Seattle office. "The Riverpoint project was challenging, given the rigid temperature and humidity set points, 24/7 operation, and high ventilation rates that were required in a modern and architecturally pleasing building. Spokane's weather conditions, when combined with the sleek building facades, required a good amount of creativity to achieve sustainable operating costs. We feel that the end product resulted in a high-performance, state of the art facility"

No replacement for manpower

With installation expertise and manpower from McClintock & Turk, Inc., the BioMed facility now boasts chilled beams, radiant floors, radiant ceiling panels and a run-around loop ERV system.

"Work started at the BioMed facility in the summer of 2012, and finished in November of 2013," said Gary Solberg, project supervisor and manager for McClintock & Turk, Inc. "It was a fast-track project, for sure."

To keep pace with the rapid construction, Solberg ran two shifts. The 40-person, unionized mechanical company, since its founding in 1946, focuses on commercial, industrial and institutional work in the Northwest. But they've worked on projects as distant as Alaska and Louisiana.

For the majority of the project, McClintock & Turk kept between 15 and 20 employees on the job, including plumbers, pipefitters, welders and apprentices.

"One of our toughest challenges was packing all the mechanical components into limited ceiling space," said Solberg. "The labs have high ceilings, further limiting the available space. Yet we needed to install two separate domestic hot water systems – one for the labs and one for restrooms – and complete systems for fire suppression, plumbing, hydronic heating and cooling, acid waste piping for the labs, and sheet metal ductwork."

Extra credit

Among the design challenges that the building presented, two stand out in Billington's mind. From a conditioned-air delivery standpoint, the floor-to-ceiling glass curtain wall on the building's north side – and lack of area to run ductwork as a result – made conditioning of these spaces a challenge. Radiant panels, both floor and wall-mounted, along with a radiant heated/chilled slab help to condition these spaces.

From an air balancing standpoint, laboratories present a large challenge. With the potential of hazardous chemicals and material in lab space air, pressure in labs needs to remain negative so as not to allow air from labs to infiltrate the rest

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The 125,000 square-foot laboratory building is efficiently heated and cooled by chilled beams, radiant ceiling panels, hydronic baseboard, in-floor heating and cooling and VAV boxes.

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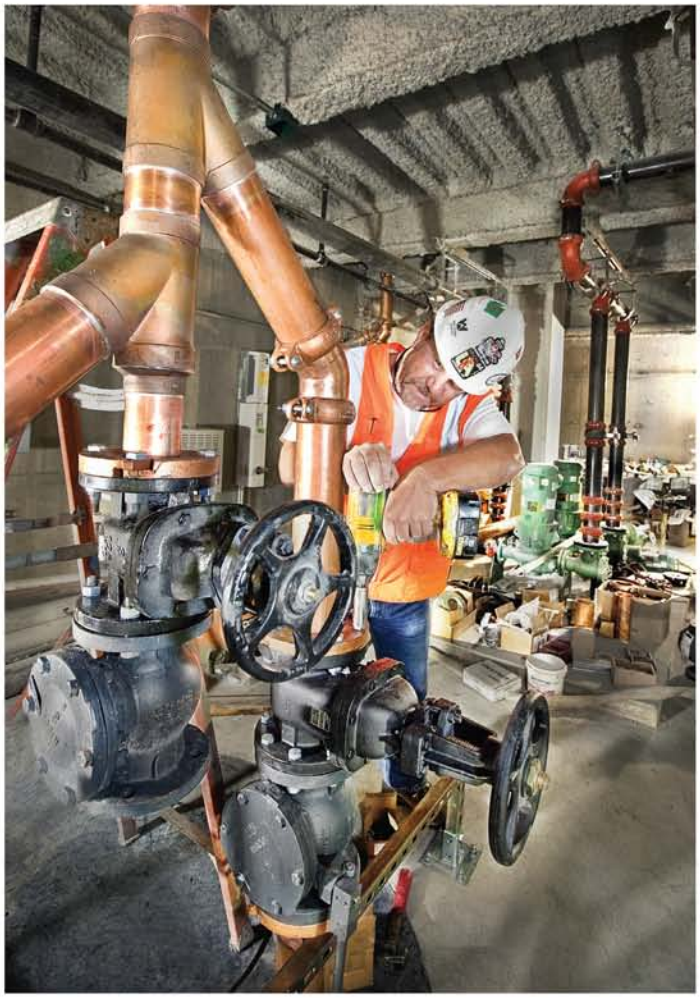
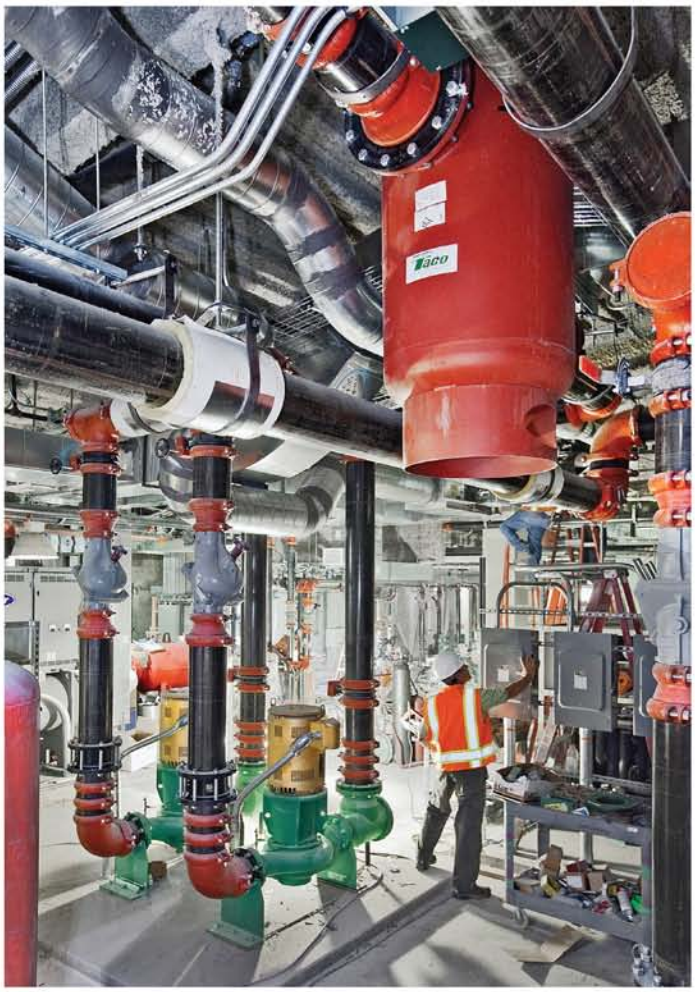




LEFT: Gary Solberg, project supervisor and manager for McClintock & Turk, Inc., assembles piping connected to a below-grade sump pump. RIGHT: The hydronic heating and cooling systems in the new lab building are kept separate; heating in the penthouse, cooling in the basement.

of the building. The south side of the new building at WSU Riverpoint contains open lab areas which incorporate the use of chilled beams and day-lighting controls to minimize energy consumption. The north side of the building contains classrooms, administrative and common areas.

"Offset air tracking was incorporated into the building's design," said Billington. "This ensures proper pressurization independent of supply/exhaust air quantities at any given time due to bio-safety cabinet and fume hood operation in the laboratories. Pressurization remains constant during all operating phases of safety cabinet and fume hood operation." This was especially important in the labs at the building's lowest level.

"An anatomy lab and other specialized lab spaces on this level were subject to even more stringent pressurization and air change rates," he continued.

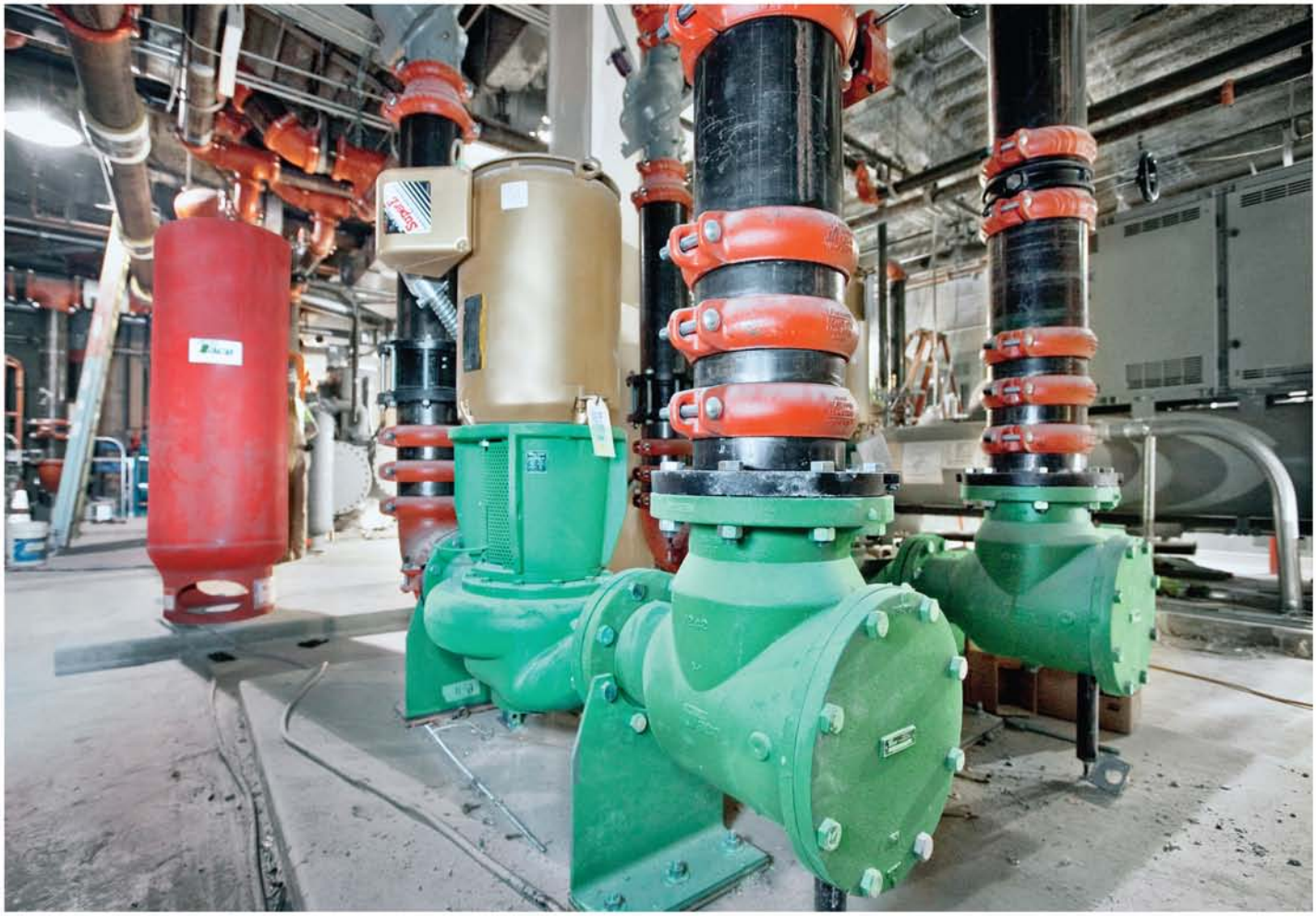
Hand-selected efficiency

During the construction phase, McClintock-Turk worked with Robby Richard and Ian Louthian at manufacturer's representative firm, Suntoya, in Spokane. Hydrotherm boilers, Taco pumps, expansion tanks and accessories, the Orion acid waste pipe system and many other key components were supplied by Suntoya after being included in the project specifications by AEI.

There are two separate mechanical rooms in the building. The penthouse mechanical room is dedicated to heating equipment. Six, three-million BTUH condensing boilers are piped in series. The units are assembled in a lead-lag, and rotate configuration.

Fin-tube baseboard provides supplemental heat to office spaces and meeting rooms. In stairwells, wall-mounted radiators are used. Spread across all floors of the building, 305 VAV boxes supply primary heat to some areas, and supplemental heat to others.

Radiant ceiling panels and in-floor radiant tubing provide heating to the large zones, and the in-floor pipe doubles for cooling purposes. A modulating 3-way valve responds to outdoor and indoor conditions for ideal supply water temperature, and draws water from the boiler or chillers depending on the need.



Chilled water pumps in the basement mechanical room.

The basement is occupied by cooling equipment. Three, 275-ton Carrier Evergreen centrifugal chillers, with cooling towers on the roof, cool the building via the radiant system, over 300 chilled beams and the coils serving the primary air handling systems. The chilled beams, which are a mix of active and passive systems, are located throughout the office and laboratory areas. Radiant ceiling panels are utilized in public areas including the cascading stair on the building's north face.

At full load, the building requires 18,000 MBH in heating mode, and approximately 825 tons of cooling capacity.

Maintaining and recovering energy

In all, the heating and cooling systems in the Pharmaceutical and Biomedical building contain approximately 6,000 gallons of water; a large quantity for a facility of its size. Given copious amounts of insulation, that volume means valuable thermal mass, not standing heat loss. It also means lots of pumping power.

The heating and cooling systems use 23 large Taco vertical in-line pumps. Each pump is outfitted with suction diffusers to conserve space in the mechanical rooms. Taco's in-line pumps feature a close coupled design for improved alignment and increased seal life. Flow rates up to 2500 GPM and heads up to 300' TDH are available for broad application.

"As is the case with most buildings of this type, and despite the number of pumps and the large water volume, the amount of energy required by utilizing pumped energy is substantially less than if fans and air-side equipment had been used exclusively to condition the building," said Billington.

The building's energy recovery loop circulates fluid between two air streams and captures heat from the building's exhaust, redirecting this energy to offset the heat required for building ventilation air. This results in a sensible effectiveness of up to 50% and equates to large savings in overall heating costs.

Due to the potential for hazardous material to exist in laboratory applications, and the physical location of the two air streams being affected, an enthalpy-wheel energy recovery system was not considered. High air exchange created the need for energy recovery and the run-around loop method was chosen

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Washington State University's Pharmaceutical and Biomedical Health Sciences Building is the newest addition to the Riverpoint Campus, in Spokane. A 15 month timeline kept all contractors operating at full speed.

because these types of systems have proven to be well-suited for transferring energy between process loads (exhaust air heat) and required ventilation air, while eliminating the potential for cross-contamination.

Acid waste removal

As with any facility that handles caustic or potentially hazardous chemicals and materials, the Biomedical Health Sciences building required an acid waste disposal system. AEI also designed this plumbing system, which collects liquid from all of the building's lab fixtures on all levels of the building. Neutralization takes place in a dilution tank where it's mixed with water to a safe level prior to being discharged into the sanitary system.

"We've been using Orion acid waste piping since the mid-1990s," said Solberg, who's been with McClintock & Turk for 21 years. "It's been a mainstay for our hospital and laboratory work since we first used it. Back then, fusion joins weren't an option; everything was done with mechanical connections.

Today, McClintock & Turk uses the Rionfuse® electrofusion system. The amps needed and fuse time settings are simply entered into the portable joining machine. Wire coils are molded into the couplings, so that when current is applied, the plain-end fittings and pipes fuse together, turning into a contiguous joint that's stronger than the pipe itself. The polypropylene pipe can also be joined by the traditional socket fusion method.

"Being a graded system, the Orion pipe was installed early on in the project, but there were still plenty of components to work around," continued Solberg. "Applications like this – where many joints are fused high off the ground, and in tight spaces – are ideal for elctrofusion technology. Installers can dry-fit a joint, make adjustments if needed, and then fuse."

"The material used in Orion waste systems [Polyvinylidene Fluoride, PVDF] is compatible with a wide range of temperatures and chemicals, as well as being plenum-rated for flame spread and smoke generation," added Billington.

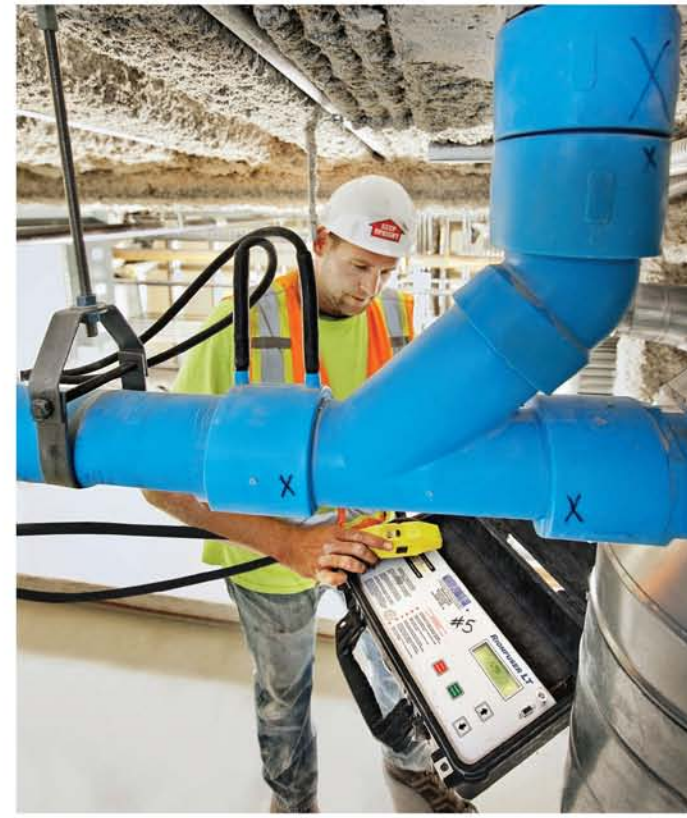
Team work

"It's my personal experience that McClintock & Turk is one of the best contractors to work with in the Spokane/Inland Northwest region," said Billington. "Their attention to detail and problem-solving approach was a great help in keeping the project moving

along. Putting a project like this together in the time frame given was quite a feat."

For WSU, coupling the right contractor with a factory representative that really understands the business and an engineering firm whose experience can bring cutting-edge systems to life resulted in a system that redefines laboratory efficiency.

Occupant comfort, quiet operation, extreme energy efficiency and timely completion are now among the rewards enjoyed by WSU managers, faculty and students alike.



Brian Soles, project foreman for M&T, fuses a wye in the building's acid waste plumbing system.