Accel® Solutions

Ensuring Environmental Integrity

Fast-track Research Lab Meets Stringent Biosafety Requirements

University of California at Irvine

"We know how the Phoenix valves work and we can maintain the negative pressure from space to space."

Bill Cowdell
Director of Quality Assurance
University of California at Irvine

Background

When the University of California, Irvine (UCI) decided to add a biosafety level 3 (BSL-3) lab for researching bioinfectious agents, a life sciences facility was planned for the campus. Because of the heightened interest in this research area, UCI placed the project on a fast-track schedule of just under two years. This was accomplished by the university's use of the design-build process, which typically reduces construction time by up to a year.

The facility's design requirements and construction roster presented a variety of HVAC challenges that UCI was able to resolve by working with Yardley-Zaretsky Inc., the commissioning agent, and the Phoenix Controls system.

The Challenge

UCI and Yardley-Zaretsky faced three major challenges on this project: safety, risk management and a tight schedule.

First, safety was of utmost importance. The high-risk research dictated the need for stringent BSL-3 lab ventilation requirements. Biosafety cabinets (BSCs) had to be ventilated properly to prevent airborne contamination during laboratory manipulations. Also, secondary containment barriers were needed at the room level. These include zero air leakage construction, controlled access to the laboratory and a dedicated exhaust ventilation system that controlled pressure and moved air in only one direction–from clean to dirty areas.

Second, many government agencies working through the Centers for Disease Control and Prevention (CDC) act in an oversight capacity to ensure the mitigation of risk while conducting research with highly controlled biological agents. Susan Weekly, UCI's Biosafety Officer and a former CDC employee, would work with the commissioning agent to conduct containment tests at each stage of construction. UCI also had to meet safety protocols–decontamination of maintenance personnel and lab rooms, and containment in emergency scenarios, such as fan failure.

Third, the tight schedule in the design-build process required the ventilation system to have quick start-up and test and balance times.

Fortunately, the George Yardley Company, the supplier of the Phoenix Controls system, did not have to convince UCI on which airflow control system to install. "We've used Phoenix valves on eight projects during the past eight years," said Bill Cowdell, Director of Quality Assurance. From his perspective, using our Accel® II valves in the BSL-3 space "made it even better…We know how the Phoenix valves work and we can

Benefits of the Phoenix Controls BSL-3 solution:

- Accurate offset control
- Fast turndown over a wide range
- Ease of start-up

maintain the negative pressure from space to space." Moreover, the team's visit to an existing BSL-3 lab in San Diego highlighted the problem of controlling pressurization when Phoenix valves are not used.

The Solution

The BSL-3 lab is a 1400-square-foot suite of four research/animal rooms with a central common room. Three Class II, type B2 BSCs are located in the research rooms. Each BSC is equipped with a two-state fan switch to save energy when not in use. Cage racks in the animal rooms are hard-ducted to the exhaust system. A glovebox provides added safety containment for highly hazardous manipulations. There are two airlock entries, one for personnel and the other for equipment.

Stable, accurate flow rates were especially important for this BSL-3 lab where a change of just 10 CFM affects pressurization of the entire suite. All rooms in the lab are negatively pressurized to prevent airborne contamination from reaching the surrounding environment. An extremely low, 20 CFM offset between the supply and exhaust airflow is required to maintain the proper pressurization when the doors are closed.

"We like to design for flexibility in the future, because our research work changes over time."

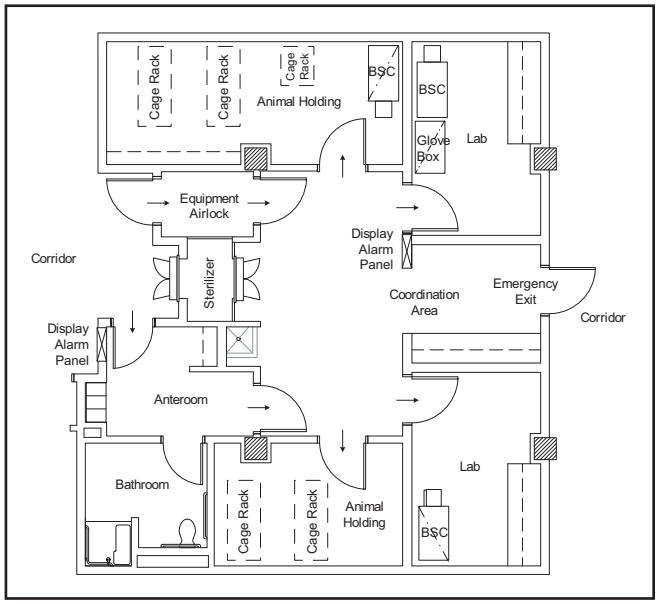
Bill Cowdell

The secure entry for research personnel is from a corridor, through a small anteroom/changing room with showers and toilet. The anteroom reduces the migration of airborne droplets into the corridor. With such a low offset airflow when the doors are closed (20 CFM), the design team needed to increase the offset airflow to maintain 30-40 fpm through an open door. This velocity required an airflow control device that could control the airflow accurately at 50 and 700 CFM, a turndown rate of 14:1, in less than one second. The Accel II valves' ability to accurately meet the 14:1 turndown rate requirements at such high speeds was vital. [The maximum turndown rate of a regular variable volume airflow (VAV) box is just 4:1.]

The valves used throughout the suite and for the three BSCs are set as two-state devices. While the pressurization is controlled through fixed volumetric offsets between supply and exhaust airflows, the differential pressure between rooms is monitored and displayed at the local panel. Typical differential pressures within the lab range from -0.03 to -0.05 inches of water column (wc). While all aspects of the laboratory airflow are controlled by the Phoenix Controls system, all information is seamlessly integrated with the Johnson Controls building management system. The system alarms to multiple locations when necessary.

The ventilation system was placed on the roof above the suite so that facilities personnel do not have to enter the lab. Two exhaust systems, each with its own bag-in/bag-out HEPA filter, provide system redundancy and minimize interruptions to lab operation. Each exhaust system is run biweekly.

The bag-in/bag-out HEPA filters ensure environmental safety. Bubble-tight dampers installed in the ventilation system will activate in an emergency to isolate the suite and prevent airborne contamination. Service ports within the suite allow for decontamination of individual lab rooms.



Layout of the BSL-3 lab at the University of California, Irvine.

Thanks in part to the ease of start-up and the testing and balancing of the ventilation system with Phoenix valves, this project was completed in less than 24 months. "It came in on time and below budget," Cowdell said.

The Results

The building opened in 2003. Since then, other portions of the building have remained free from contamination risks. Weekly especially credits the multi-stage testing during construction that, she says, "adds a confidence level to other people who inhabit the building."

Future plans for the building include adding a vivarium in the basement and installing Phoenix cage rack valves. As Cowdell put it, "We like to design for flexibility in the future, because our research work changes over time." Accel II valves are part of this flexible design. When a researcher requested that a glovebox be moved to another room, this was easily accomplished by local valve adjustment.

With their BSL-3 lab operative and additional research planned for the campus, UCI has already attracted three prominent research scientists.

For additional information and a listing of our global offices, please visit our Web site at www.phoenixcontrols.com or call (800) 340-0007.

MKT-0214 MPC-1416