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Government-Issue Retrofits

Chiller upgrades can require research and some upfront expense, but as it adds to the savings column in halls of justice and scientific centers, the government is making a federal case of (and for) it.

Level 3 veterinary lab gets leg up with mixed-flow impeller system

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George Mellen, P.E., who is responsible for mechanical and electrical systems design at the laboratory facilities of Iowa State University in Ames, IA, needed to identify the best method of exhausting the university's recent conversion of an existing biosafety level 2 (BSL-2) laboratory at its College of Veterinary Medicine. The lab was upgraded to the BS-3 level. Since health and safety issues were paramount, Mellen was concerned with the laboratory's existing centrifugal exhaust fans (one dedicated exhaust fan system and roof-mounted stack for each workstation).

PREVENTING RE-ENTRAINMENT POSSIBILITIES

In a previous position for a similar application, Mellen had used mixed-flow impeller laboratory workstation fume hood exhaust systems for another university's laboratories. His concerns for the upgrade at the College of Veterinary Medicine included high-efficiency performance, elimination of exhaust re-entrainment possibilities, quiet operation, and prevention of toxic, noxious, or odoriferous workstation exhaust in the neighborhood. To meet these requirements, Mellen specified roof- mounted, low profile Tri-Stack™ mixed-flow impeller exhaust systems from Strobic Air Corp., a subsidiary of Met-Pro Corp.

For this upgrade, Mellen worked closely with KJWW Consultants, an HVAC and electrical/mechanical design consulting firm. KJWW is also working with the university on another BSL-3 laboratory for the biosecurity unit of its Veterinary Diagnostic Laboratory. Mellen said that Iowa State is very active with infectious disease research work, particularly with animals.

"If a sick animal is found, it may be brought to the Veterinary Diagnostic Laboratory for analysis to help determine what, if any, disease it has, so that a plan of action may be taken," Mellen said. He also pointed out that this type of work has been performed for many years at the university, and that the decision to upgrade to BSL-3 laboratories was driven by the need for research on emerging human and animal disease agents. BSL-3 capabilities enhance the Veterinary Diagnostic Laboratory's ability to provide safe and rapid diagnostic services in the event of an animal disease outbreak or agroterrorism event.

"The main reason for the upgrade to BSL-3 status is to provide the university with a higher degree of isolation and safety, and research on a wider variety of infectious disease agents," Mellen said.

Construction on the first of the BSL-3 laboratories has been completed and uses a single Tri-Stack system for exhausting the critical environment facility, which will be maintained at .05 psig pressure to comply with applicable good practice, codes, and standards. In this application, Mellen pointed out that two ante-rooms connected to this facility are also under successively greater negative pressures. A second BSL-3 laboratory is also under construction at the College of Veterinary Medicine.

TWO KEY FACTORS

As to specifying mixed-flow impeller technology exhaust systems for BSL-3 laboratory projects, since the biocontainment laboratories are considered "critical environments," preventing re-entrainment of room and biological safety cabinet exhaust was obviously a major consideration.

As Mellen pointed out, there were two key factors: "First, we wanted to get the room and biological safety cabinet exhaust plumes up high enough so that there was no chance of it being ingested with other makeup air systems (re- entrainment prevention); and, second, mixed-flow impeller technology allows us the opportunity in the future to install heat recovery systems which should help save thousands of dollars in heating costs," he said.

Since preventing re-entrainment is critical in most laboratories, the use of mixed-flow impeller systems was especially attractive to Mellen and Iowa State management. Mixed-flow impeller fans operate on a unique principal of diluting contaminated laboratory exhaust air with unconditioned, outside ambient air.

A typical mixed-flow fan moving 80,000 cfm of combined building and bypass air at an exit velocity of 6,300 fpm can send a combined exhaust air jet plume upward as high as 120 ft in a 10-mph crosswind. This extremely high velocity exceeds ANSI (American National Standards Institute) Z9.5 Standards by more than twice the minimum recommendation of 3,000 fpm. The jet plume disperses exhaust pollutants - and odors - high enough into the atmosphere to meet applicable pollution abatement laws and eliminate odor.

Elimination of exhaust re-entrainment possibilities, quiet operation, and prevention of toxic, noxious, or odoriferous workstation exhaust in the neighborhood were key requirements in the upgrading of the College of Veterinary Medicine's lab at Iowa State University. A roof-mounted, mixed-flow impeller exhaust system was selected to meet the lab's needs.