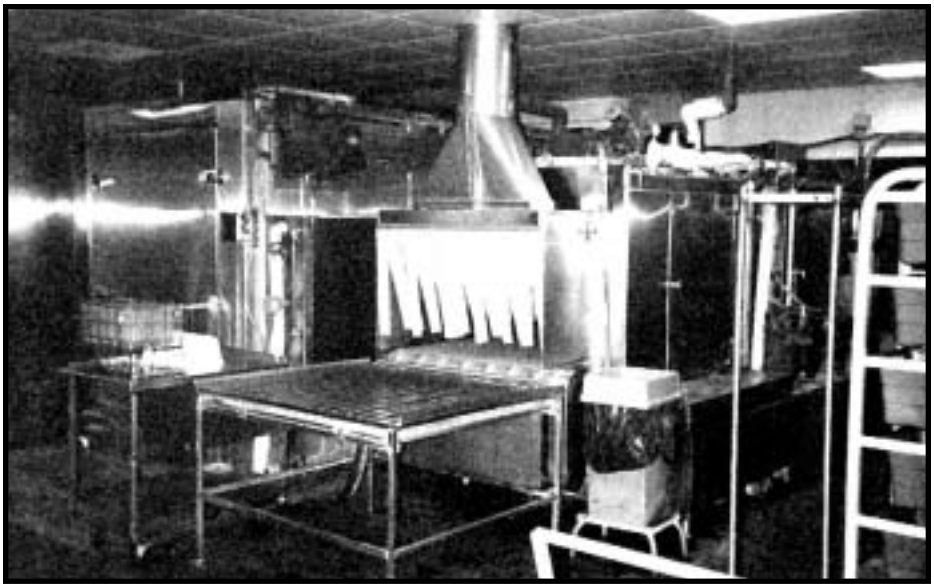
A Safety/Design Response

Cage wash caustic/odor exhaust. A case study.

The commanding edge in fan technology
Strobic Air Corporation

Strobic Tri-Stack™ systems remove exhaust fumes from cage washing facility at University of Illinois animal research lab

"… the Tri-Stack is a vast improvement" over the previous "hodge podge" system.



One of three automated cage washing systems. Works 12 hours per day at 180°F.

Animal research is a sensitive subject, and if you're involved with it you understand its controversial nature. Consider Dr. Taylor Bennett's problem: Dr. Bennett is the director of the Biologic Resources Laboratory at the University of Illinois, Chicago, where, "on any given day, there are up to 14,000 animals in the facility ranging from turtles to large primates," he says. When you have this many animals, you also have a lot of animal cages. There are thousands of them at the University's biological research facility in all sizes and configurations from 5" x 8" x 11" for housing mice to cages which are about 4' square.

Each of these cages needs to be washed and sanitized, and this is the heart of the problem faced by Dr. Bennett and his staff: exhaust fumes from the cage washing facility at the laboratory were literally "raining" caustic residue onto the building's roof, accelerating its deterioration. There were other problems as well, because the facilities system had evolved into a "hodge podge" over the years, according to Edward J. Kedzie, an architectural mechanic at the Engineering and Construction Group/Facilities Management at the University. Bennett added that the system, with its individual centrifugal belt-driven fans for exhausting the cage washing facility, had become a "maintenance nightmare in addition to being aesthetically and physically unappealing."

The cage washing facility is used every day of the week. Bennett said that some cages have to be washed daily while others may require washing weekly and some every two weeks. This is accomplished by three automated cage washing systems which use 180°F water and work anywhere from 12 hours a day during the week to about four or five hours a day on the weekends. In addition to hot water, powerful detergents are required. Bennett said that some cages receive an acid pre-wash to cut grease and mineral deposits associated with animal urine, and then go through an alkaline detergent cycle. From there a cage might be put through a pre-rinse cycle or an acid-soak cycle, a wash cycle, a first rinse, and a final rinse.

Maintaining comfortable temperature and humidity in the cage washing area has always been a problem. This was solved through use of the centrifugal fans ducted to each of the units with mushroom cap diffusers on the roof. "On cold days you couldn't see the back end of the building," Bennett said, since the mushroom type diffusers just "pushed all that moisture back onto the roof, they didn't allow the moisture to get up into the air to be dissipated."

The problems of pollution, roof deterioration, and fan maintenance had to be solved, and Bennett drafted a proposal for the University's Physical Plant Group, which went to Kedzie. Bennett's objectives were stated, and Kedzie was tasked with providing the solutions.

Kedzie's recommendations were both practical and unique: he suggested use of Tri-Stack roof exhaust systems from Strobic Air Corp. in Harleysville, PA. Two Tri-Stack systems were installed on the roof of the laboratory building. One system - the BS-1 - provides 7200 CFM at 3" static pressure, and is used exclusively to exhaust the cage washers. The

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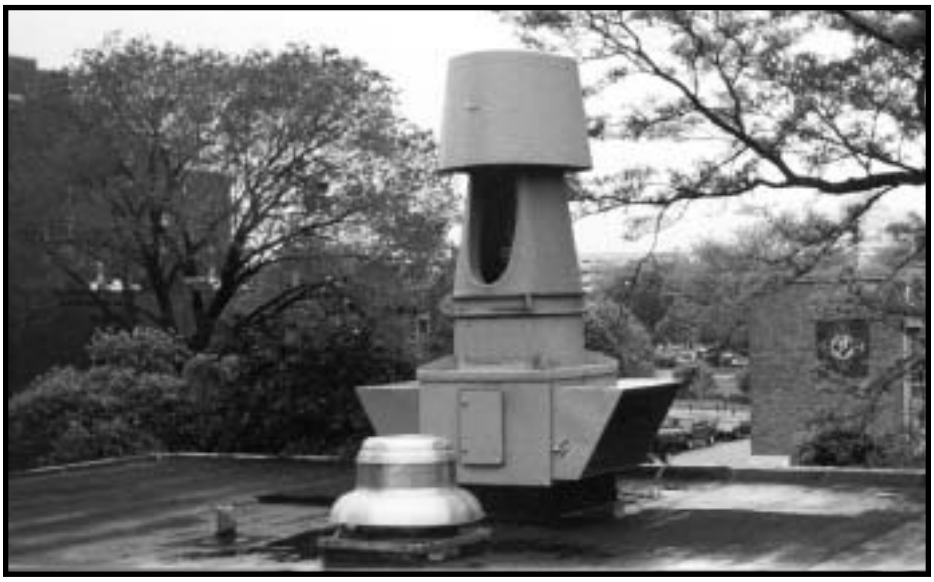

Tri-Stack system is maintenance-free and provides an exhaust plume equivalent to an effective stack height of 35 feet.

other system - Tri-Stack BS-005 - is used for exhausting the necropsy area of the building and is a smaller system. Both systems are mounted on the building's two-story roof, about 40 to 50 feet apart. While less than 12 feet high, they provide an exhaust plume equivalent to an effective stack height of 35 feet in a 15 mph wind.

The Tri-Stack systems eliminated the university's roof deterioration problem, maintenance headaches, and odiferous exhaust, although, as Kedzie put it, "maybe I was more sensitized to it by walking along at the ground level." Both Bennett and Kedzie added that neighbors had not really complained about exhaust odor in the past. In addition to solving exhaust problems, the Tri-Stack systems also maintain accurate temperature and humidity control at the cage washing facility, advantages that were not possible with any degree of accuracy with the original centrifugal fans.

Because of the gradual evolution of the exhaust system at the washing station, the system was "not a very good situation and the Tri-Stack is a vast improvement," according to Kedzie. He learned about Tri-Stack at a local ASHRAE chapter where he met Dan Hobbs from BTU Engineering, Chicago, IL. Hobbs said that there were odors emanating from the cage washing facility exhaust, and that the moisture was being "dumped right on the roof" which virtually ruined it. As part of the new system, the ductwork in the cage washing facility was also replaced to provide positive pressure in the room.

When asked about the system performance, Kedzie said that while energy consumption hasn't been reduced significantly (because the system is exhausting substantially more air), there were considerable savings in maintenance because of the Tri-Stack system design and construction, which include maintenance-free, direct drive sealed bearing motors that are located out of the air stream and are not affected by caustic effluent.

The Tri-Stack system represents a radical departure from standard centrifugal, belt-drive fan operation for many exhaust applications. The system's direct drive, sealed bearing motors have 200,000 hour life times, and are virtually maintenance-free. Their low roof profile eliminates the need for time and cost sensitive installation of spring isolators, inertia bases, flexible connections and guy wires. Besides doing away with maintenance-prone parts, the Tri-Stack principle of operation reduces the system static pressure by about 2inches water gage. This permits energy savings of up to 44 cents per CFM at 10 cents/kilowatt hour. Tri-Stack exhaust systems are offered in modular "building block" configurations ranging from 2000 to 250,000 CFM. Stack heights are typically 60% less than conventional stack. Plume dispersion is constant full volume at outlet velocities from 3000 to 6600 FPM. The systems also conform to ANSI/AIHA Z9.5 standards, and are UL listed.

The University of Illinois is the largest medical school in the country, and the largest university in the city of Chicago. It is considered one of the top 100 research institutions in the U.S. The student body at the university is composed of about 28,000 people, of which about 7000 are professional and graduate students. The Biologic Resources Laboratory was established in 1957 as the university's Medical Research Laboratory. It was one of the first centralized animal facilities on a university campus in the U.S. In 1970 the facility was expanded by 60,000 square feet to its current size of about 105,000 square feet. This space is dedicated to housing animals, along with procedural space, laboratory space, and support space which includes the cage washing room.

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