Reprinted from *American Laboratory News* January 2002

An automatic fire-suppression system for the laboratory

David Gray

Working with volatile chemicals creates numerous challenges and hazards for scientists. The fumes that emanate from many of the chemicals used in laboratories may be highly flammable and dangerous to inhale. Furthermore, the combination of the vapors from several volatile chemicals may interact and cause even more hazardous situations. To prevent these fumes from accumulating where they are not wanted or needed, work with these chemicals is often done in a fume cabinet (also referred to as an exhaust hood). A fume cabinet is designed to draw fresh air from the room into the hood, across the work surface, and then out into the ventilation system. By causing the air to flow in this fashion, laboratory personnel may work with these chemicals and not be exposed to the hazardous vapors.

While technology may be able to control the risk of fume inhalation, an equally dangerous hazard exists in fume cabinets: fire. Operators take significant precautions to prevent fires; however, the presence of flame sources such as Bunsen burners, along with the inherent volatility of the chemicals themselves, makes the formula for a tragic fire. Each year, dozens of disastrous fires occur in fume cabinets. These fires cause extensive damage to laboratories, destroy research projects, and account for millions of dollars of loss to the industry; more important is the risk to human life. Despite this huge danger, the interiors of fume cabinets have not historically been protected from fire. Typical protection has been the building fire protection system, either a fire alarm system (which does not suppress the fire), or a sprinkler system that employs water as the extinguishing agent. Protection of the interior of fume cabinets, which is where the fire is most likely to occur, has been viewed as too difficult or costly.

The fire challenge

As a fire begins, the flames immediately follow the airflow pattern through the fume cabinet. With the air rapidly being drawn through the enclosure, the fire is drawn into and around the baffles in the cabinet and then into the exhaust system. The speed of the air movement makes detection of a fire for traditional fire detection devices very difficult. Detectors mounted to a single spot may or may not ever see the route the heat caused by the burning chemicals is following. The chemical vapors can also cause certain types of detectors to false alarm or fail. Optical-type detectors that "see" the energy given off by a fire are effective but extremely expensive.

Once a fire has been detected, it has to be suppressed. The suppression portion of the system must utilize the proper fire-suppressing agent for the types of chemicals used at that site. There is no one fire-fighting agent for all applications. In fact, applying the wrong agent can actually cause the fire to worsen. Finally, the agent must be discharged long enough to offset the amount of the agent that will be drawn out of the cabinet along with the air via the exhaust system. Therefore, the discharge of the agent must be forceful and targeted to cover the entire fume cabinet as well as anticipate the air movement. These significant challenges are the reason very few fire protection products even attempt this type of hazard.

Solution

The Firetrace automatic fire-suppression system (**Firetrace**, Scottsdale, AZ) effectively detects the type of fire likely to occur in a fume cabinet. The system is actually a pneumatic tube that can be routed wherever necessary in order to be exposed to all areas in which the heat of the flames might follow. The tubing is made from a proprietary polymer that is rugged, flexible, and sensitive to heat. When the pressurized tube is exposed to excessive heat, the tube weakens and then bursts at the point at which the heat is being sensed (*Figure 1*). In a fume cabinet, the tubing is routed to where the heat from a fire is most likely to be sensed. This is as simple as following the airflow pattern for that hood. Placement of tubing across the baffles (*Figure 2*), at the entrance to the exhaust system (*Figure 3*), and other areas in the hood, ensures that the heat of a fire will quickly be sensed by the system.

Once a fire is detected, the Firetrace system discharges the proper extinguishing agent selected for the types of flammable materials that are contained in the fume cabinet. The system is able to handle any type of extinguishing agent, i.e., a dry chemical powder, a clean agent such as CO_2, or a specialized fire-

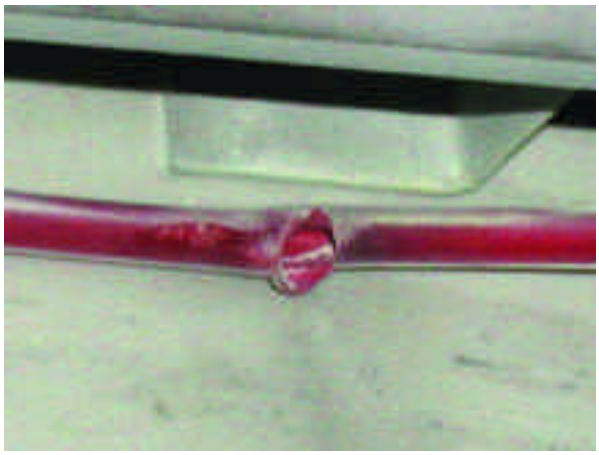

Figure 1 *An actual tubing burst from a fume cabinet fire.*

Figure 2 *Firetrace detection tubing mounted across the baf - fles of a fume cabinet.*

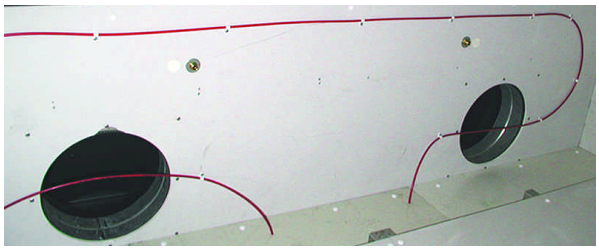

Figure 3 *Firetrace detection tubing mounted across the ex - haust system.*

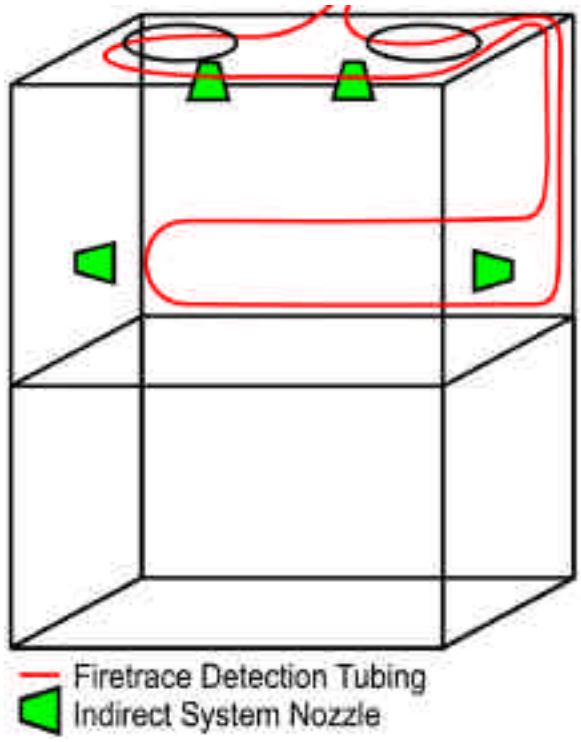

Figure 4 *Sample of a Firetrace system configuration for a tabletop fume cabinet.*

suppressing agent. The fire-suppressing agent flows through a distribution-piping network and then into the fume cabinet workspace itself. The fire is typically suppressed in seconds, but every effort is made to extend the flow of the fire-suppressing agent as long as possible. This provides ample replacement of the agent that is being exhausted through the system by the blowers, and ensures that the fire is suppressed.

Accessories such as electrical contacts and manual discharge stations are available on all Firetrace systems. The contacts can be used to locally annunciate activation of the system, alert the building's fire alarm system, and shut off fans or fuel supplies. The manual discharge station allows personnel to activate the system themselves.

Sample system configuration

*Figure 4*is a schematic of a Firetrace system installation in a tabletop fume cabinet. The tubing (red line) is wound throughout the cabinet's baffles as well as across the exhaust openings. The piping network has distribution nozzles (green triangular shapes) at each of its four terminations (piping not shown). The nozzles are strategically positioned in the cabinet to thoroughly saturate the airspace with the fire-suppressing agent.

Figure 4 is one configuration, and is only used to demonstrate the positioning of the Firetrace system. Each fume cabinet installation is unique and must be carefully evaluated and installed by a certified, experienced fire protection company.

Mr. Gray is Marketing Manager, ***Firetrace,*** *7898 E. Acoma Dr., Ste. 106, Scottsdale, AZ 85260, U.S.A.; tel.: 480-607-1218; fax: 480-607-1316; e-mail: gray@firetrace.com.*