Fume Hood Fire Testing: Benefits of Metal Substructure

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Abstract

The Purair Advanced ductless fume hood successfully survived a series of three controlled burns fueled by acetone without structural failure of the hood.

Fume hoods are designed to protect operators, the environment, and equipment from a variety of contaminants. These airborne contaminants are often volatile and highly combustible. With the addition of heat sources such as hot plates and electrical equipment, they can lead to a heightened danger of fire. High quality fume hoods should not only protect the users from potential chemical contamination but should also have built in measures to protect against potential fire hazards. Fume hoods can be constructed from a variety of materials, however the most common units are made of painted metal or polypropylene.

Air Science® Purair® Advanced ductless fume hoods and chemical processing workstations are available in 21 standard sizes in metal or polypropylene construction.

A third-party testing facility performed fire testing on the Purair Advanced series of ductless fume hoods with steel substructure, testing for both fire containment as well as suppression with a commercial FireFoe[1] system installed. It was hypothesized that the fire would be sufficiently contained within the fume hood based on the proper setup and installation in a typical laboratory setting.

The findings of this study indicate that the Purair Advanced series of fume hoods offer an additional level of fire containment to increase safety of operators and researchers.

1 http://www.firefoe.com/

Background

Fume hoods are designed to protect operators, the environment, and equipment from a variety of contaminants. These airborne contaminants are usually volatile and highly combustible. With the addition of heat sources such as hot plates and electrical equipment, contaminants can lead to a heightened danger of fire. High quality fume hoods should not only protect the users from potential chemical contamination but should also have built-in measures to protect against potential fire hazards.

The Air Science® Purair® Advanced line of fume hoods are a series of high efficiency products designed to protect the user and the environment from hazardous vapors generated on the work surface, and to offer an added measure of fire protection.

At the heart of the Purair fume hood product line is the innovative Air Science Multiplex™ Filtration Technology that creates a safe work environment over the widest range of applications.

Fume hoods maintain continuous airflow across the work surface to draw contamination away from the user as well as the work area. Some units are equipped with carbon filtration systems that scrub the contaminated air of toxins, thus releasing clean air back into the laboratory area. Activated carbon filters trap specific contaminants by surface adsorption; chemical treatment of the activated carbon determines what families of chemicals are captured.

Most fume hoods are used in the presence of volatile organics and other combustible chemicals that pose potential fire risk, necessitating a certain level of fire suppression or, at the very least, fire containment in order to be considered safe.

Fume Hood Construction

Fume hoods can be constructed from a variety of materials, however the most common units are made of painted metal or polypropylene. Metal units provide added strength and ensure increased durability in a variety of non-corrosive environments. Polypropylene construction provides a surface that is extremely easy to clean and exceptionally resistant to corrosion. Some new types of fume hoods use a hybrid construction style, incorporating painted metal frames with polypropylene side panels. This construction allows the added strength of metal but also provides the anti-corrosive capabilities of polypropylene.

The Purair Advanced Fume Hood

Purair Advanced ductless fume hoods and chemical processing workstations are available in 21 standard sizes, in metal or polypropylene construction, totaling 42 standard models. The Purair Advanced product line is available in seven standard sizes with a high capacity air handling system that delivers face velocity of 100 FPM. A low airflow alarm warns of insufficient face velocity and the Air Science filter assembly is easy to access and change. In an effort to provide as much operator safety as possible, Air Science manufactures fume hoods that not only provide superior containment but also offer superior fire suppression capabilities. Fire testing has been performed by a third-party testing laboratory and the results suggest enhanced fire containment and even a certain level of fire suppression. The results of that testing are presented herein.

Hypothesis

A third-party testing facility performed fire testing on the Purair Advanced series of ductless fume hoods with steel substructure, testing for both fire containment as well as suppression with a FireFoe system installed. It was hypothesized that the fire would be sufficiently contained within the fume hood based on the proper setup and installation in a typical laboratory setting.

Methods

The methods for this test were fairly simple in design. In a controlled setting, acetone fires were intentionally set within Air Science Purair Advanced fume hoods[2] The fires were controlled burns and replicated in three separate trials. Anecdotal information, general appearance, and failure data was collected on each of the burns and analyzed to determine pass / fail of the units in the test.

2 http://www.airscience.com/news?articlenum=6

Results

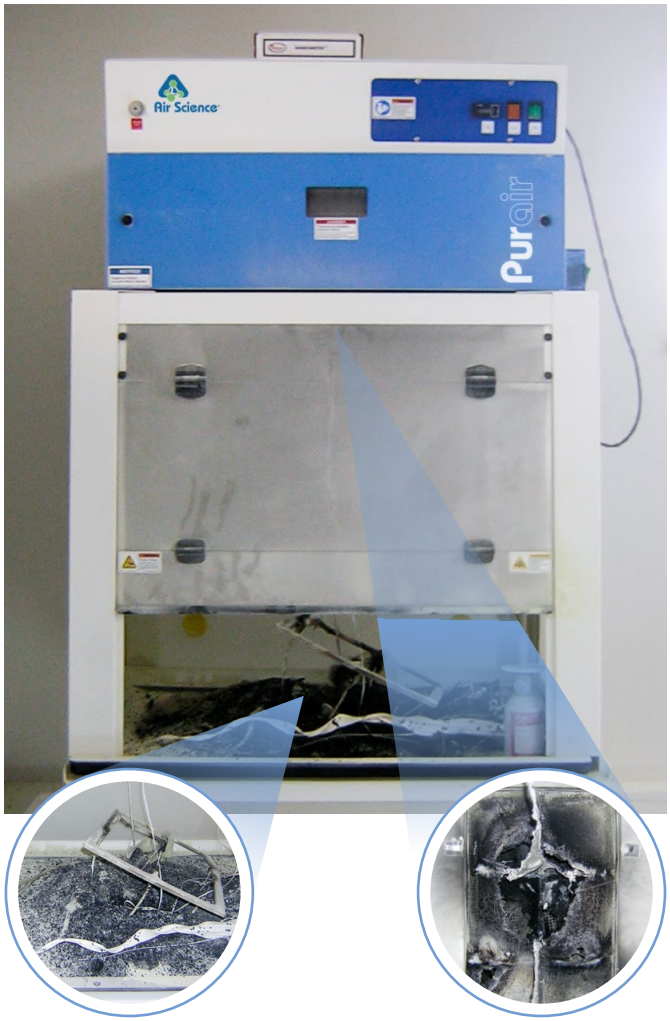
The Purair® Advanced ductless fume hood successfully survived a series of three controlled burns fueled by acetone without structural failure of the hood.

Low resolution screen shot of an online video showing independent testing of the Purair Advanced ductless fume hood. This is the third in a series of three controlled burns fueled by acetone without structural failure of the cabinet. The success of this test is primarily due to the all-metal construction of the Purair Advanced cabinet, versus partial metal structures which may fail when plastic components soften; in some situations polypropylene hoods may actually catch fire. Also, Air Science does not use bonded carbon filters which typically include flammable hydrocarbon binders that elevate the fire hazard. Air Science granular filter components can actually extinguish a fire when the filter structure is compromised due to heat.

To see the video visit http://www.airscience.com/template_video.php?id=1

For more on the benefits of granular carbon vs. bonded carbon visit www.airscience.com/lib/sitefiles/pdf/WhitePapers/Carbon-Filtration-Whitepaper.pdf

Figure 1: An actual Air Science ductless fume hood shown "as is" following an accidental fire at a K-12 school in Arizona while conducting an experiment using flammable materials.



Discussion

The success of the fire testing is primarily due to the all-metal construction of the Purair Advanced cabinet, versus partial metal structures which may fail when plastic components soften; in some situations polypropylene hoods may actually catch fire. Polycarbonate, acrylic and polypropylene have ignition points around 400°C. However, these compounds all have melting points much greater than 100°C (most over 200°C) and these materials only start approaching their softening points at temperatures that exceed 100°C.

The results suggest that under normal operating conditions, Air Science® Purair Advanced fume hoods can withstand fires inside of the cabinet long enough to allow in-lab fire suppression systems to be used to extinguish the fire with minimal damage to other equipment and facilities outside of the fume hood. Additional anecdotal information from an educational facility in Arizona also suggests that carbon filters from Air Science can even assist in extinguishing flames in the fume hoods if the fire is intense enough to split open the carbon filter system. Some bonded carbon filters use a solvent-based substrate which may ignite, however the Purair Multiplex carbon filter used in the Purair Advanced fume hoods will not burn. Conversely, evidence suggests that in a severe fire the Air Science Multiplex filter may aid in fire suppression (see Figure 1).

Conclusions

The findings of this study indicate that the Purair Advanced series of fume hoods offer an additional level of safety to operators and researchers. Air Science emphasizes that, while the Purair Advanced fume hood is not rated for fire containment or suppression, in the event of an accident the Purair Advanced fume hood has shown a remarkable ability to endure a work surface fire without failure. If fire is a real concern, the standard metal framed units are a good option over polypropylene units. The steel support 'super structure' will not collapse and support the weight of the head unit and carbon filters during a fire.

Additional Features of the Purair Advanced Fume Hoods

- At Air Science®, there is never any extra charge for metal frame versus polypropylene construction.
- Air Science offers a fire suppression system as an available option to increase the safety of any Air Science fume hood.
- All fume hood panels are installed with rubber windshield gaskets for an air tight seal.

For full details on the Purair® Advanced series of fume hoods, visit the Air Science website or contact Andre Chambre directly.

Acknowledgements

This study was completed as an independent test on products purchased from Air Science USA LLC.

About the Author: Andre Chambre

Andy Chambre is the founder and CEO of Air Science, LLC and has been associated with the ductless fume hood industry for more than 25 years. He was formerly the US Vice President for Captair Labx and President of Astec Microflow US. He was named President of Filtco Corporation in 2003 and currently also serves as a Director of Air Science Technologies Ltd. in the UK. Mr. Chambre has written numerous articles on fume hood safety and assisted in the development of safety standards by serving on various committees such as the Canadian Standards Association subcommittee on fume hoods and the SEFA 9 Ductless Enclosures Committee.

Sources

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