

Adapting to Environmental Progress:

The Flexible Polyurethane Foam Industry's Record of Innovation and Success



For decades, flexible polyurethane foam (FPF) manufacturers, represented by the Polyurethane Foam Association (PFA), have worked closely and responsibly with regulatory agencies and environmental groups to ensure public health and safety.

PFA Manufacturing Members Are Technological Innovators

With an impressive history of technological transformation to adapt to new conditions, the PFA manufacturers have consistently risen to meet the challenges posed by advancing scientific knowledge and environmental policies.

Innovation takes time

With every new challenge, PFA manufacturers have found successful ways to modify FPF manufacturing processes, equipment and raw materials to comply with – and often exceed – stringent new standards.

Most changes in FPF manufacturing involve significant investment in research and/or mechanical modifications during the conversion process.

Technological solutions are not always apparent and may require perseverance and an adequate amount of time for research, laboratory and full-production trials, and continuous physical testing.

Many changes in raw material selection or manufacturing technology actuate more changes down the line in the precisely balanced FPF manufacturing process.

Even when an immediate solution is not available, PFA members have demonstrated that they are innovative problem solvers who, over time, are able to get the job done.

CASE STUDY #1: Industry Pioneered Solutions to Meet New NESHAP Standards

In 1998, the Environmental Protection Agency issued the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulation aimed at reducing air pollutant emissions, with a focus on reducing emissions of methylene chloride, a raw material, then used throughout the U.S. by the FPF manufacturing industry as an auxiliary blowing agent to cool foam and assist in the foam-blowing reaction.

The FPF industry came up with several solutions that were developed and used in various forms by PFA foam manufacturing members:

- Liquid CO₂ processing using CO₂ that has been captured from the atmosphere
- Rapid cooling
- Acetone-blown foaming process (provides for reduction of ABAs in some formulations)
- Variable pressure foaming technology – a major change in mechanical processing
- Specialty modifiers

By the time of NESHAP's October 1998 implementation, PFA manufacturers had already eliminated and replaced more than 90 percent of the methylene chloride used in FPF manufacturing. Today, the U.S. foam industry has completely eliminated the use of methylene chloride, as well as CFCs (see Case Study #2 on reverse).



More than 1.2 billion pounds of flexible polyurethane foam are produced every year in the U.S. and used to provide comfort, support, and durability in hundreds of consumer products. The processes used to manufacture the foam, regulated at the national, state and local levels, are sophisticated and designed to be environmentally safe.

CASE STUDY #2: Triumph over CFCs

The Montreal Protocol, which was adopted in 1987, mandated that industries eliminate chlorofluorocarbons (CFCs) from manufacturing processes by the year 2000. U.S. producers of FPF began at once to seek alternatives to CFCs. The FPF industry's preemptive actions resulted in dramatic reductions of CFCs.

FPF industry research developed four effective primary alternative methods and agents:

- Methylene chloride (no longer in use today)
- Chemical additives
- Forced cooling
- Liquid carbon dioxide (CO₂) systems

By 1992, well ahead of the required schedule, PFA members, representing the majority of the FPF industry, had achieved a 98 percent reduction of CFCs without any disruption in supply or compromise of product quality by initiating the use of alternative foam chemistries and mechanical equipment.

A PFA-drafted document was the basis for a handbook on removing CFCs and adapting manufacturing processes. This handbook was distributed worldwide.

CASE STUDY #3: PBDEs Eliminated from FPF Manufacturing

In January 2005, PFA manufacturer members reported they had almost completely phased out the use of pentabrominated diphenyl ether-based (PentaBDE) flame retardants in the manufacturing of foam grades for use in home furnishings cushioning applications.

Working together with raw materials suppliers, FPF manufacturers were able to reformulate using substitute FR materials. The process required almost two years of conversion work. Not all grades of non-PentaBDE foam could be reproduced using a single FR additive. Some grades required blending of multiple raw materials and mechanical adjustments in foam processing technology. Conversion from use of PentaBDE required a complete reformulation of entire combustion-modified product lines. It was an extremely challenging task, consuming thousands of hours and untold financial resources. Conversion away from PentaBDE by the foam industry is now complete.

The Will to Effect Change for Safety and Health

Through many years and many highly complex changes that have required extended efforts for solutions, the FPF industry and the PFA have demonstrated their proactive abilities to adapt to new safety and health information and work closely with regulatory agencies.

We participate in programs of the U.S. Fire Administration, the Fire-Safe Cigarette Coalition, and the Fire Prevention Alliance.

The industry benefits from strong and consistent leadership, a highly effective trade association, and advanced technical capabilities. PFA members continue to work with suppliers and manufacturers to develop new methods to make the process and end-products better.

Looking to the future, PFA members are further addressing the need for greener products, as well as new formulations that may reduce some of the nation's dependence on petroleum.

About the Polyurethane Foam Association

The Polyurethane Foam Association (PFA) is the trade association of U.S. flexible polyurethane foam (FPF) manufacturers and their suppliers. PFA is focused on the education of foam users and allied industries, addressing technology, safety and the responsible environmental and health record of FPF.

The PFA was formed to find and achieve successful solutions to important issues of flammability and fire safety. Together, the members of PFA account for approximately 70% of all domestic FPF production.

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