IN•TOUCH

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Flexible Polyurethane Foam And Sustainability, Part 1: Sustainability Platform

Through an ongoing effort, the flexible polyurethane foam (FPF) industry meets the challenge of elevating the sustainability of its products and manufacturing processes.

Today, FPF is one of the most environmentally benign and versatile materials ever created. The Polyurethane Foam Association (PFA) uses its communications programs to give end product manufacturers, designers, architects, and consumers better understanding of the product's environmental qualities and advantages.

The FPF Industry Takes A Proactive Approach To Environmental, Health & Safety Practices.

Since 1980, FPF manufacturers, represented by PFA, have proactively and responsibly engaged with regulatory agencies and environmental groups to promote public health and safety. The FPF industry works hard to advance environmental quality, recyclability, fire prevention education and consumer safety.

A Platform on Sustainability

To help PFA members' be responsible stewards of

FPF Industry Milestones in Sustainability And Environmental Progress

- Improved adhesives. Today's are typically either water-based or utilize non-hazardous solvents. Some adhesive formulations, such as hot melt systems, are 100% solids and require no carrier at all.
- Continued research and development of sustainable raw materials, including soy-based polyols.
- Cooperative work with California regulators, NGO's and other stakeholders to design product flammability standards that minimize the use of flame retardants with unfavorable risk profiles
- Elimination of the use of chlorofluorocarbons (CFCs), which had been shown to deplete the earth's vitally important ozone layer, from FPF manufacturing processes.
- NESHAP Compliance Ahead of Schedule. The FPF industry pioneered solutions for reducing emissions of the raw material methylene chloride to meet the EPA's National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations.
- Voluntary Phaseout of PBDEs: In January 2005, PFA manufacturer members voluntarily phased out the use of pentaBDE flame retardants in the manufacture of FPF for use in home furnishings cushioning applications. This process required nearly two years of conversion work. (Note: these flame retardants were not used in mattress products.)

For other flexible foam industry environmental efforts and information about flexible polyurethane foam , visit our website at www.pfa.org/environment.

the environment, PFA has identified eight principles of sustainability as the basis of the Polyurethane Foam Association Platform on Sustainability.

1. **Reduce solid waste.**

FPF products are recyclable. The FPF industry scrap collection and reuse system has developed into one of the most successful examples of recycling in the world. In the United States, nearly all manufacturing scrap is collected and recycled. Each year hundreds of millions of pounds of post-consumer waste FPF are diverted from landfills and recycled as bonded carpet cushion. PFA encourages members to improve the efficiency and widen the scope of post-consumer recycling efforts.

2. Share scientific research about environmentally friendly materials and renewable feedstocks.

PFA organizes technical programs twice a year as forums for relevant research and product innovations. Bio-based raw materials now used within the FPF industry were introduced publicly at PFA technical programs.

3. Support energy saving technologies.

FPF manufacturing technology is an example of energy-efficient production. Through the use of an exothermic reaction, FPF is manufactured with little demand for energy or water. PFA manufacturing members also conserve transportation fuels by compression foam buns to decrease volume and maximize shipping efficiency.

4. Support efforts to improve product safety.

Voluntary third-party analysis and evaluation of FPF products promote a high level of product safety for workers and the consuming public. An industry-accepted labeling program enables end-product manufacturers, retailers and consumers to distinguish between FPF products that comply and those that do not.

5. Encourage sustainability through enhanced useful life.

Support programs that help reduce raw material consumption and waste generation by increasing usable product life and, therefore, improve sustainability.

6. Develop programs to support member involvement in sustainability issues.

Encourage use of PFA's "Community First" program to help manufacturing members share their commitment to environmental stewardship and manufacturing safety, and also engage their employees in this commitment.

7. Consider human rights issues.

Before supporting or adopting new manufacturing practices, consider the impact on human rights issues such as exploitation of workers and child labor.

8. Maintain continuous dialogue with leaders in sustainability.

An effective sustainability program cannot be developed in a vacuum. PFA encourages input from NGOs, academia, customers and others involved in the implementation of sustainability initiatives throughout the year and especially at our technical programs.

FPF And Manufacturing Emissions

The manufacture of FPF involves the use of various chemical raw materials. Isocyanates are an essential, irreplaceable raw material that are required for the manufacture of FPF. In their raw material state, isocyanates present a potential respiratory health hazard, but during the manufacture of FPF, isocyanates are reacted out and do not present a hazard or risk in facility emissions or end products.

One commonly used isocyanate, Toluene Diisocyanate (TDI) has been the subject of a number of peer-reviewed and government studies of the respiratory health of consumers, FPF workers and persons living near manufacturing sites where TDI is used.

In May of 2010, the North Carolina Department of Health and Human Services (NC DHHS) released the results of a long-term study concerning the respiratory health of people living near foam manufacturing plants that use TDI.

The NC DHHS study, which was conducted over seven years with funding from the U.S. Agency for Toxic Substances and Disease Registry (ATSDR), included air monitoring and sampling, collection and examination of blood samples and respiratory health interviews. After taking 80 different air quality samples, NC DHHS found traces of TDI in only one sample. The level was 1 part per trillion, a value significantly below levels of health concern.

Blood analysis of 350 different samples found only one positive indication of possible TDI exposure and the individual who tested positive reported a non-work-related use of a sealant that may have contained a TDI component.

Respiratory health interviews similarly did not indicate any unusual patterns in community health. Independent third-party air monitoring around foam manufacturing plants in North Carolina found no detectable emissions.

The U.S. Environmental Protection Agency (EPA) conducted air sampling in 2009 specifically looking for TDI near seven schools located near factories (not foam manufacturers) that reported large amounts of TDI emissions. The EPA did not detect any TDI concentrations.

FPF And Worker Safety

The flexible polyurethane foam industry understands that worker protection is critical to success. And having systems that protect workers from excessive chemical exposure can

be more effective than simply monitoring ambient exposure levels.

The FPF industry uses a number of best practices to protect workers from accidental exposure and to enhance worker safety. Typical examples of these processes include:

- Engineered ventilation systems
- Production and off-loading shut off controls
- Stack engineering and scrubber technologies
- Spill and emergency management procedures
- Personal Protective Equipment (PPE) for use where needed
- Personal and area monitoring
- Risk management training

For more than 28 years, the Polyurethane Foam Association has surveyed flexible polyurethane foam manufacturers in North America to monitor rates of Occupational Asthma (OA), a respiratory illness that includes sensitization to exposure from isocyanates. Research shows that the incidence of OA among flexible foam workers is consistently lower than national averages for asthma among the general adult population, which is typically about 8%.

The combined results from foam production worker surveys covering 1988 – 2015 indicate that the incidence of self-reported occupational asthma is very low, representing less than 2% of the surveyed worker population from plant production areas as a survey high mark. The incidence of medically confirmed cases of occupational asthma was even lower among the participating manufacturing sites representing more than 90% of U.S. FPF production volume.

In the latest update to the study, the number of self-reported OA cases among FPF production workers had dropped to .35%, and the number of medically confirmed cases was 0.

The very low number of self-reported or medically diagnosed cases of occupational asthma suggests that existing workplace technologies continue to provide effective ways to mitigate possible exposure to isocyanates in the workplace.

FPF and Studies on Product Emissions

During the manufacturing process, the isocyanates in the foam formulation react completely and are not present in the final product. A peer-reviewed study performed by Global Isocyanates Limited (GIL) concluded that TDI was not emitted from FPF samples, nor was any migration of TDI found. The GIL study was performed using two types of high index TDI-based FPF samples, extraction was performed using several different solvents, derivising agents and conditions. The samples selected were chosen because they were the most likely to contain residual, unreacted TDI. Yet, no emissions of unreacted TDI were found.

A 2019 study by the International Isocyanates Institute tested a variety of foam samples using synthetic sweat solutions in six formulations approved by EPA and determined there were no instances of dermal transfer of unreacted TDI in newly manufactured and cured foam.

Previous similar tests support the conclusion that TDI is not emitted from end-product consumer goods made with FPF, such as many mattresses and furniture products. A 1995 study conducted on potential health risks due to emissions from new bedding sets found that isocyanates posed no significant health risk for normal or convalescing individuals. Two 1997 TDI emission studies performed by Dow Chemical scientists reached a similar conclusion. These conclusions align with the research findings of testing conducted by the State of California.

In 1996, the California Environmental Protection Agency (CEPA) commissioned a study entitled, "Determination of Formaldehyde and Toluene Diisocyanate Emissions from Indoor Residential Sources. That study consisted of screening products that were manufactured using TDI under elevated temperature and chamber loading conditions. Tests were conducted to determine if any TDI emissions could be detected along with an assessment of lifetime cancer risks. Test results indicated that none of the products normally found in homes showed any detectable TDI emissions.

In recent years, there has been increased attention to flame retardant (FR) additives used in some FPF cushioning. FR additives are included in the FPF formulation to meet certain end product flammability standards. As concern has been expressed over some FR additives, the FPF industry has responded by voluntarily phasing out pentaBDE additives in 2005.

In 2013, the state of California changed its Technical Bulletin 117 regarding residential furniture combustion resistance, which allowed the industry to reduce or discontinue the use of many other FR additives. The FPF industry continues to explore ways to reduce the use of FRs, or to find replacement FR technologies that are more environmentally sound, such as reactive technologies that become an integral part of the foam structure, rather than non-reactive additives that can separate from the foam.

Summary

- FPF Environmental Safety and Regulatory Compliance: The manufacture of FPF is closely regulated for environmental health and safety issues at local, state and federal levels. In all processes and operations, manufacturers meet demanding emissions and workplace safety requirements.
- PFA Platform on Sustainability: PFA has identified eight principles of sustainability for FPF manufacturing and products, including reducing solid waste, saving energy, improving safety, encouraging sustainability through product performance, evaluation, and communications.
- FPF and Recycling: Recycled content and recyclability are two factors consistently identified with sustainable products. FPF scrap collection and reuse has developed into one of the most successful examples of recycling in the world.
- Product, Neighborhood and Worker Safety and Emissions: Isocyanates are used and consumed in the FPF manufacturing process. Numerous peer-reviewed and government studies confirm that isocyanate emissions are not a concern in FPF products, communities near FPF manufacturing plants, or for workers who follow industry safety procedures.
- PFA and the FPF industry work proactively on sustainability issues, often collaborating with a wide range of government and environmental groups to better understand the science and issues needed to further improve FPF sustainability.
- FPF Environmental Innovations: Exciting innovations in the FPF industry include the development of foams with varying amounts of bio-content.

For full details on PFA sustainability efforts and industry issues, visit www.pfa.org.

Visit the literature section at www.**pfa.org** for a complete, downloadable library of IN•TOUCH Bulletins.

Polyurethane Foam Association

334 Lakeside Plaza, Loudon, TN 37774
Phone (865) 657-9840 | Fax (865) 381-1292

www.pfa.org