ENVIRONMENTAL RESPONSIBILITY

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The owners, officers and managers of Hickory Springs Manufacturing Company, headquartered in Hickory, NC, take the Company's position as a leader in the flexible polyurethane industry seriously. Expenditures in manpower and capital necessary to comply with applicable local, state and federal environmental regulations demand a significant portion of the Company's operating budget. At every plant location, Hickory Springs works hard to be a good, responsible neighbor.

Innovation and improvement are keys to success. Unlike many foam competitors, who rely on suppliers for advancements in foam technology, Hickory Springs fully staffs a Foam Technology Department. This team of experienced chemists, engineers and technicians has a primary function of research. Hickory Springs will continue to endeavor to discover and develop new foams and processes well into the 21st century and beyond.

Hickory Springs follows the philosophy of continuous improvement in all areas of its business operations. Environmental corporate stewardship is no exception.

Hickory Springs - First Bio-based Foam

Hickory Springs Manufacturing Company, producer of flexible polyurethane foam for the furniture, bedding and other industries, today announced the introduction of a breakthrough foam product that will mean far less reliance worldwide on the need for non-renewable petrochemical resources in foam manufacture.

Based in Hickory, NC, the 62-year-old privately-held business has devoted over 45 years to creating new foam products. Hickory Springs' extensive research and development has a history of innovation, including fire retardant Code*Red foams and a line of value-added high resilience EnduroPlush foams.The Company's six foam plants were among the first in the nation to eliminate the use of CFCs and methylene chloride as auxiliary blowing agents.Based on human health concerns, Hickory Springs was also an industry leader in the elimination of PBDE fire retardants.

Hickory Springs' latest development comes at a time of rising petroleum prices and concerns about raw material availability. This new product marks the Company's first foray into the creation of a flexible polyurethane foam that replaces a portion of its petrochemical-based ingredients with a reactive material made from a sustainable, renewable resource, while providing cushioning that is comparable, if not better, in terms of quality and performance to oil-based foam formulas on the market today.

The product, which features a basic raw material derived from a patented process, will be marketed under the trade name of "Preserve". The name is a nod towards the foam's reduced reliance on petroleum.

Vice President of Foam and Environmental Technology Bobby Bush sees this innovation as part of larger responsibility both for Hickory Springs and the industry in general. "Our goal is to find new uses for resources and to avoid the waste that has been part our industry's history. Not only is Preserve, which incorporates bio-based polyol as an active ingredient, an attempt to lessen our dependence on oil, it is also an opportunity to steer our industry's thinking away from its short term mindset. This gesture may be small in impact, but we feel that Preserve is the initial step in what should be an arduous but fruitful move by the foam industry away from dependence on a product in short supply."

While the concept of implementing renewable biomass products into foam formulas is not new, this product has remained tantalizingly out of reach due to constraints in both economy and technology. Working with Cargill, a $70 billion global agricultural conglomerate and the manufacturer of the bio-based polyol, Hickory Springs has become the first slabstock foam manufacturer to commercialize flexible polyurethane foam made, in part, with a renewable resource.According to Director of Marketing and R&D Dimitrios Dounis, Preserve resulted from "significant innovation and break-through advancements in this technology. We have now taken a major step toward positioning our industry for sustainable growth.This new process and product allows us to remain ahead of rising threats to our industry."

Hickory Springs has successfully replaced up to 20% of foam's petrochemical-derived polyol with a bio-based polyol made from soy beans.At this level there is no degradation of foam physical properties and, in fact, some of foam's performance characteristics are improved.

Flexible polyurethane foam is the reaction of three basic ingredients.Two are derived from oil: polyol comprises about 60% of the foam recipe; TDI makes up about 30%.Though small in content at 2% to 4%, water is a very important ingredient.The remaining materials, used in relatively small quantities, consist of surfactants, catalysts and fire retardants, if required.

Hickory Springs' new Preserve foam uses soy-based polyol at the rate of up to 20% of total polyol.That represents as much as 12% of total foam chemistry.Work continues with the existing bio-based polyol, and in the development of next-generation polyols, to increase bio-polyol content level.

In the company's research and development with 1.8 pcf density bio-based content foam, physical property improvements, so far, include: 1) slight increase in support factor; 2) a tighter (less variation) firmness (IFD) range; 3) better foam hand; 4) slight improvement in Cal - 117 flammability test performance; and 5) improved dynamic flex fatigue test (a.k.a. pounding test) results.Other physical improvements will be most likely be verified as testing and data analysis continue.

While we are excited about what this means for Hickory Springs, we are especially excited for our customers. Preserve foams provide improved stability (in supply and pricing), comfort, durability and a great marketing story. Preserve is now in limited production at the Company's Conover, NC plant.

NO CFCs
NO METHYLENE CHLORIDE

Hickory Springs pioneered the application of acetone as an alternative auxiliary blowing agent (ABA) in the production of flexible polyurethane foam. Previously, chlorofluorocarbons (CFCs), 1,1,1-trichloroethane and methylene chloride served as ABAs to the US foam industry. Hickory Springs began work to eliminate methylene chloride from its foam formulation over fifteen years ago.

THE ACETONE ALTERNATIVE

With some foresight, Hickory Springs' Technical Director, the late Graham Walmsley, discovered and developed the use of acetone as an ABA in 1989. Hickory Springs completed the necessary alterations at its foam plant in North Carolina and began full-scale trials the following year. This plant began using acetone in 1990 and has been completely reliant on acetone as its only ABA since 1996. Meanwhile, Hickory Springs retrofitted its other foam production plants and, as of early 1998, has utilized acetone as its sole ABA corporate-wide. Hickory Springs uses NO methylene chloride (a suspected carcinogen), NO ozone-depleting 1,1,1-trichloroethane and NO ozone-depleting CFCs in the production of flexible polyurethane foam.

Hickory Springs holds patents involving the use of acetone in flexible polyurethane foam production. Patent rights to the acetone process are available to other foam manufacturers through a licensing agreement. Presently, three other foam producers hold licenses and practice the company's environmentally-friendlier acetone technology.

Internationally, Hickory Springs has cooperated with consultants hired by the United Nations to assist Third World countries' cessation of CFC use in the production of flexible polyurethane foam. According to anecdotal evidence only, the use of CFC is common in foam product in China and other Asian countries where the black market for CFC thrives.

PBDEs

Hickory Springs was the first US foam company to eliminate the use of fire retardants containing pentabromodiphenyl ether and octa bromodiphenyl (PBDE). Intra-company research to identify viable alternatives began in earnest in mid-2003 and culminated with the November 2004 announcement that Hickory Springs was PBDE-free corporate-wide.

Based on alarming studies of bioaccumulation in human tissue and negative reports from the European Community, Hickory Springs initiated its own review of PBDE findings and set a goal to remove this product, which had been the industry's workhorse fire retardant since the mid-1980s. An article that appeared in the LA Times in October 2003 highlighted this effort (see link) and further illustrated Hickory Springs' role as an industry leader.

FLEXIBLE POLYURETHANE FOAM
Background information and technical description of the benefits of acetone as an ABA

Flexible polyurethane foam has been in existence since the mid-1950s. Because of its performance characteristics, it has a wide variety of uses. Foam is practically everywhere in our lives. It serves as cushioning in upholstered furniture and mattresses. It protects carpet by providing a resilient underlay. Automobile and airplane seats contain foam. Packaging and medical applications are also common. Foam is universal and ubiquitous, found, in one form or another, in almost every room of the house.

Flexible polyurethane foam is the product of an exothermic reaction that creates a resilient cellular matrix that can then be cut to size for its intended use. Since the late 1950's, auxiliary blowing agents have been used in the manufacture of polyurethane foam. Two main characteristics of flexible foam are density and firmness (or softness). Auxiliary blowing agents help control both of these characteristics. By vaporizing at an appropriate temperature, the auxiliary blowing agent produces additional bubble growth and, thereby, reduces the density of the foam. Additionally, auxiliary blowing agents remove some of the heat generated from the highly exothermic chemical reactions occurring during foam formation. The same vaporization decreases the temperature of the reaction-mass proportional to the latent heat of vaporization of the blowing agent. Basically, auxiliary blowing agents cost-effectively give needed control over critical parameters.

No engineering controls have successfully been used by the industry to reduce blowing agent emissions because of the inherent problems of high ventilation and bimodal release mechanisms. The foam is made in a continuous process in which blocks or "buns" of foam about 7 feet wide and 4 feet high are removed in lengths up to 200 ft. The foaming reaction is highly exothermic, and consequently foam formulations used must be restricted to safe levels, which keep the foam density high. Auxiliary blowing agents evaporate during this exothermic reaction, reducing the temperature, reducing the foam density and softening the foam. CFC-11 was the original and preferred auxiliary blowing agent, but concern over ozone depletion in the stratosphere and increasing costs caused a progressive changeover to the use of methylene chloride. Classification of methylene chloride as a possible/probable carcinogen has created a need for further alternate auxiliary blowing agents. Methyl chloroform (1,1,1- trichloroethane) has been identified as an alternative, but it also is associated with ozone depletion.

While much discussion and some experimentation are taking place to recover and recycle blowing agents, no proven technology exists which effectively controls emissions from flexible slabstock foam production. Hickory Springs now believes chemical substitution of acetone for CFC-11, methylene chloride and methyl chloroform as an auxiliary blowing agent is a preferred method from process, cost and environmental perspectives.

Acetone as an Auxiliary Blowing Agent used in flexible polyurethane foam
- Reduces emissions by 50%
- Has low toxicity- Is not a potential carcinogen
- Has no acid rain potential
- Has controllable flammability
- Has very low atmospheric activity
- DOES NOT DEPLETE OZONE

ENVIRONMENTAL CONSIDERATIONS (technically speaking)
Chemical substitution is recognized as an accepted method for addressing the difficult problems of toxic air emissions, ozone depletion, employee exposure to hazardous chemicals and disposal of hazardous waste. Acetone should be considered as a substitute blowing agent wherever possible.

A. Acetone Is Essentially Non-Toxic

1. Acetone is a normal by-product of fatty acid metabolism in humans, and is naturally present at detectable levels in most tissues and fluids of the human body.

2. National Toxicity Program (NTP) Studies [Dietz(1989)] show that acetone is mildly toxic to rats and mice when administered at very high doses in drinking water for 13 weeks. "Minimal toxic doses were estimated to be 20,000 ppm acetone for male rats and male mice and 50,000 ppm acetone for female mice. No toxic effects were identified for female rats [at doses up to 50,000 ppm]. The testis, kidney, and hematopoietic system were identified as target organs in male rats, and the liver was the target organ for male and female mice. NTP has recommended against conducting chronic studies because "the prechronic studies only demonstrated a very mild toxic response at very high doses in rodents," and further because of "the absence of any evidence supporting the carcinogenic potential of acetone."

3. OSHA and ACGIH have established relatively high permissible exposure limits for acetone, based on avoidance of sensory irritation, of 50 ppm (8-hour TWA) and 1000 ppm (15-minute STEL).

4. Acetone has low toxicity to aquatic organisms and microorganisms and a low potential to affect adversely terrestrial plant germination and growth. Acetone is miscible with water and has a low octanol/water partition coefficient, and a low potential to bioaccumulate. These properties show the environmental hazards of acetone are negligible.

B. Acetone Does Not Deplete Ozone in the Stratosphere. Acetone contains no halogen and has no potential to catalytically destroy ozone. The US Environmental Protection Agency (EPA) approved acetone as a substitute for ozone depleting substances (ODS) for foam blowing under the Significant New Alternatives Policy (SNAP). [59 Fed. Reg. 13044 (Mar. 18, 1994)]

C: Acetone Does Not Contribute Significantly to the Formation of Ozone Smog. After careful consideration, the EPA determined that acetone has a negligible contribution to tropospheric ozone formation and is, therefore, not regulated as a VOC. [60 Fed. Reg. 31633 (June 16, 1995)]

Environmental Considerations for Acetone
- Not a catalytic depletor of ozone
- Not a source of acid rain
- Low toxicity to aquatic plants
- Little effect on plant germination and growth
- Low octanol/water partition
- Low bioaccumulation
- Slow atmospheric reactivity [30 day lifetime]

CONCLUSIONS

As determined by the Environmental Protection Agency, acetone is NOT a Volatile Organic Compound. Acetone does NOT contribute to smog formation or acid rain. It is NOT a carcinogen. To put things in perspective, acetone is naturally occurring in the atmosphere at a level of 0.5 ppb with the major source being propane and higher hydrocarbons. Were the entire US foam industry to convert to acetone as the only blowing agent, nation-wide emissions of acetone would increase by only 5%.

No other low boiling point solvent identified as an effective auxiliary blowing agent in flexible polyurethane foam offers the same combination of beneficial qualities as acetone - Low Photochemical Reactivity, No Depletion of the Ozone Layer and No Suspicion of Adverse Chronic Health Effects. Use of acetone reduces total foam plant emissions by almost 50%.