

ADHESIVES Raw Materials **FACTS**

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SUPPLY-CHAIN RELIABILITY IS THE ISSUE

Ensuring the ongoing supply of raw materials has now eclipsed escalating prices as the major issue facing the adhesives industry. Past issues of National Adhesives' *Raw Materials Facts* highlighted the fragility of the raw materials supply chain. Hampered by low levels of reinvestment, negligible capacity expansion and booming demand, all it takes is one unexpected incident in a plant somewhere in the world to severely cripple the already precarious supply chain.

This year sales allocations and declarations of force majeure became business as usual in our industry — they used to be the exception. The recent devastation of Hurricanes Katrina and Rita exacerbated an already difficult supply situation. How difficult? Below we provide an overview of global supply and demand issues in adhesives raw materials and, on page 2, look at the potential impact on our major product streams.

Raw Materials

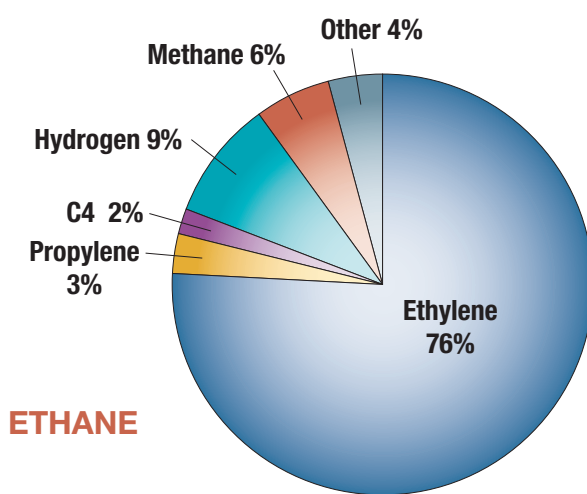
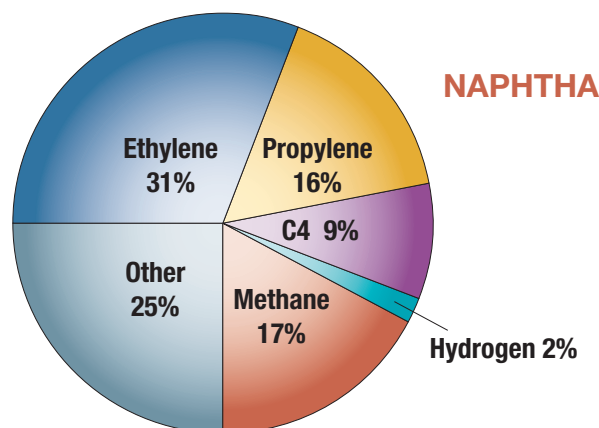
Crude oil and natural gas are the starting points in the production of most of the raw materials used in adhesives. Energy prices have skyrocketed over the past year, and experts question the ability of oil producers to continue to supply the increasing demand coming from a growing and developing world. Escalating energy prices had already created a challenging supply situation for our industry in 2005...and then the hurricanes hit.

The U.S. hurricane season, from August to October, traditionally shuts down oil production platforms in the Gulf of Mexico and refineries along the Gulf Coast both in anticipation of storms and as a result of damage caused by storms. This leads to tightened supply and inflated prices. When a strong storm season is followed by predictions of a cold winter in the Northeastern U.S., heating oil prices rise, and there is no relief to pressures on the supply chain.

This year the double whammy of high energy prices and additional shocks to the nation's petroleum supply chain due to the hurricane season has set up an unprecedented raw materials environment of very tight supply and record high prices.

Two important sources of raw materials are crude oil and natural gas, which are cracked to form ethylene and propylene, two of the primary adhesive precursor chemicals. Supply of these two chemicals affects the availability of the downstream raw materials used in making adhesives.

Feedstocks Make a Difference



The percentage of products produced by ethylene crackers change with choice of feedstock. The shift from heavy (naphtha) to lighter (ethane) feedstocks in new cracker construction will lead to a reduction in propylene produced, and could lead to future shortages.

Ethylene

Katrina took 10% of U.S. ethylene production capacity off-line. Industry experts don't expect a return to "normal" capacities until the end of the year. Chemical Market Associates, Inc. (CMAI) projects a 1.9% growth in U.S. ethylene demand in 2006 vs. 2005, while capacity is only expected to expand by 0.3%.

Banc of America Securities expects global ethylene supply to remain constrained through 2008. Meanwhile, SRI Consulting projects 4 to 5% per year growth in world ethylene demand from 2005 to 2009, slowing to 3 to 4% from 2009 to 2014. This will require the construction of 3 or 4 world-class ethylene crackers per year to maintain supply.

The number of cracker projects currently slated for construction is not enough to meet the projected demand growth.

Propylene

Approximately 5% of U.S. refinery grade propylene capacity shut down as a result of Katrina and is expected to remain offline for one to six months. In addition, a string of planned maintenance shut-downs in the coming months will contribute to a tight propylene supply market through early 2006.

SRI Consulting predicts 5 to 6% growth in global propylene demand over the next 5 years. However, this demand exceeds announced cracker expansions. Global supply will remain tight, and many experts question where new sources of propylene will be found.

Over 60% of global propylene is produced by ethylene crackers. The problem is that producers are taking advantage of cheaper sources of natural gas in the Middle East and shifting the construction of new ethylene crackers offshore. However, new projects are slated for ethane-based steam crackers, which produce significantly less propylene than traditional naphtha crackers (see graph). Meanwhile, propylene demand is outstripping ethylene demand and setting the stage for serious propylene supply shortages in the future.

Outlook

The underlying issue remains the same across the entire supply chain: too much demand and not enough supply. While new plants are scheduled to come on stream in the short term, experts predict that they will only maintain the status quo. They will do little to significantly alleviate long-term supply shortages. Amid this environment of growing demand, stretched plant operating rates and precarious supply-demand balances, small incidents have significant impact, and it doesn't take much for suppliers to become short of product.

In such a fragile supply chain, it's no surprise that events like Katrina and Rita, which shut down over twenty petrochemical plants, can have a major effect. All of a sudden, price becomes secondary to the issue of securing supply. National Adhesives is taking all necessary measures — often at considerable additional expense — to ensure supply of material to its customers. ■

HURRICANES: MAKING A BAD SITUATION WORSE

For the adhesives industry — and the nation — the arrivals of Hurricanes Katrina and Rita were just more bad news heaped on top of an already difficult situation. Prior to the onset of hurricane season, we experienced a late-August run-up in oil and natural gas prices, and in ethylene, propylene and the other key raw materials that impact the adhesives supply chain.

The run-up came on top of a year of unprecedented energy prices — industry pundits claimed prices couldn't go any higher, but they did. Repeatedly. Raw materials prices continued to climb as well, but the downstream impacts of the year's skyrocketing energy prices have yet to be fully felt in the prices being paid for raw materials. And the adhesives industry probably won't feel their full impact for several more months.

With this scenario already in place, the devastation caused by Katrina and Rita is the last thing that anyone needed.

What Drives Prices So High?

As storms grow in the Atlantic and head for the U.S. coast, petroleum companies take precautions to protect their facilities by shutting down production platforms and refineries in the storm's path. This restriction on supply leads to temporary spikes in the price of oil and natural gas.

Leading up to Katrina, oil prices jumped to a record \$70.85/barrel. These price movements before a storm typically have little to do with underlying economics.

Prices that increase afterwards are a result of supply-demand imbalances. Four weeks after Katrina, 56% of U.S. oil production and 35% of natural gas production remained shut down according to the U.S. Department of the Interior. Rita, while not as powerful as Katrina, actually had greater impact on key raw materials, as many more petrochemical plants were in its path and had to be shut down.

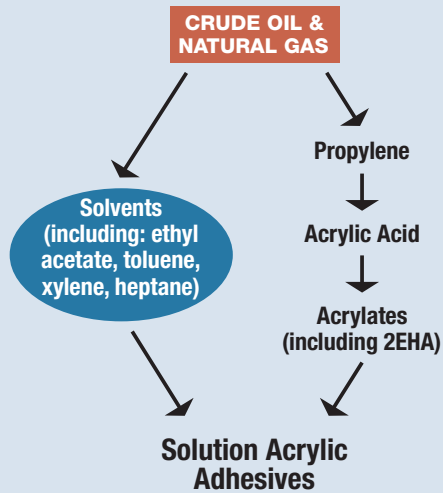
In a sense, it's simple economics. Shutting down a percentage of the country's production shifts the balance of supply and demand: demand remains stable, supply decreases and prices rise. When human nature is added to the equation, panic buying and stockpiling inflate demand, further stretching the imbalance and driving prices even higher.

The same scenario plays out when feedstock capacity goes down. The U.S. Gulf Coast — the region hardest hit by hurricanes — is the heart of the U.S. chemical industry. Key raw materials — ethylene, propylene, benzene — are already in high demand. When capacity goes offline, ripples are felt throughout the global supply chain — and prices start to climb. ■

IMPACT: SOLUTION ACRYLIC ADHESIVES

Supply constrictions in key raw materials continue to affect all solution acrylic adhesives:

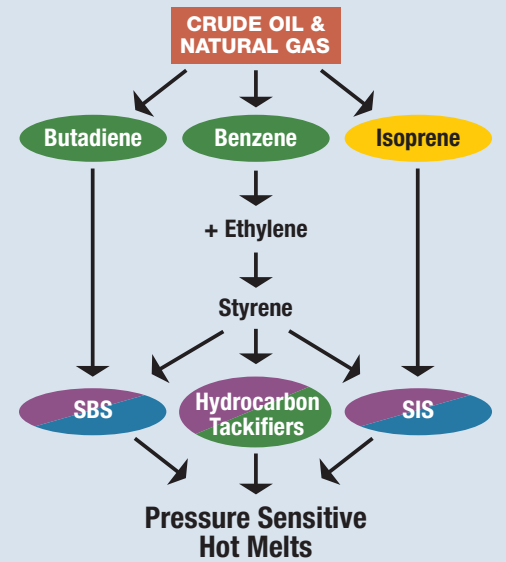
- Most specialty solvents used in solution acrylic formulations are on sales control.
- Supplies of acrylic acid and acrylates remain very tight.
- Several new acrylate plants are coming onstream; however, experts agree they will only satisfy projected increases in acrylate demand and will do nothing to alleviate the existing tightness in the market.
- Prices of 2EHA have tripled in the last two years. While demand for 2EHA has stabilized recently, only a limited number of global producers make the specialty chemical. Even a minor acceleration in demand will lead to more shortages. A new acrylic acid plant is now operating in China. However, it does not produce 2EHA and represents only a very small addition to global capacity.
- With high gasoline prices, there's more economic incentive for producers to leave propylene in the gas stream as an octane builder, further adding to the tightness of raw materials.



IMPACT: PRESSURE SENSITIVE HOT MELTS

Ongoing raw materials shortages continue to affect all hot melt adhesives:

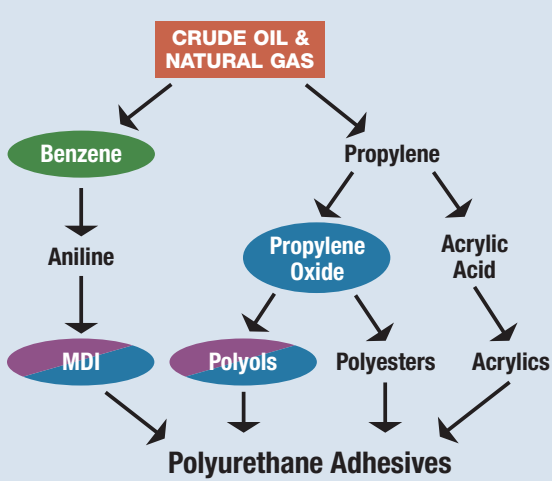
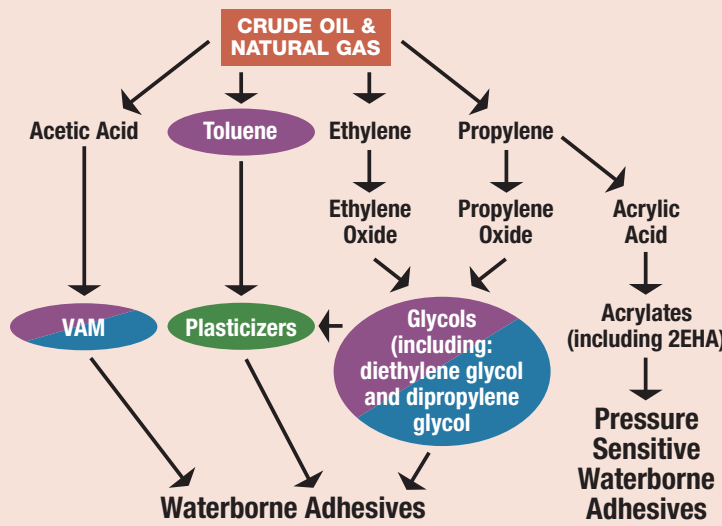
- Butadiene supplies are tight, and SBS is under sales control from at least one major supplier.
- Benzene is tight along with the global styrene market. Global styrene demand is expected to grow at 4% per year, according to CMAI, and operating rates will remain above 90% through 2007.
- The continued shortage of isoprene, due in part to high demand from competing industries, is contributing to supply problems for styrene block copolymers — especially SIS, which has been on allocation for over a year and is expected to remain in short supply into 2006. All major suppliers of SIS have some form of sales control in place.
- Tackifiers have been tight for over a year due to high demand, limited supply and several production problems. No new capacity is expected until 2007.



IMPACT: WATERBORNE ADHESIVES

Ongoing raw materials shortages continue to affect waterborne adhesives:

- Toluene, the precursor to plasticizers used in National's formulations, is on force majeure, which is resulting in tight supplies of plasticizers.
- Supplies of VAM are tight with supply allocations in effect.
- Prices of 2EHA have tripled in the last two years. While demand for 2EHA has stabilized recently, only a limited number of global producers make the specialty chemical; even a minor acceleration in demand will lead to more shortages.
- With high gasoline prices, there's more economic incentive for producers to leave propylene and toluene in the gas stream as octane builders, increasing the tightness of adhesives raw materials produced from them, like plasticizers and dipropylene glycol.



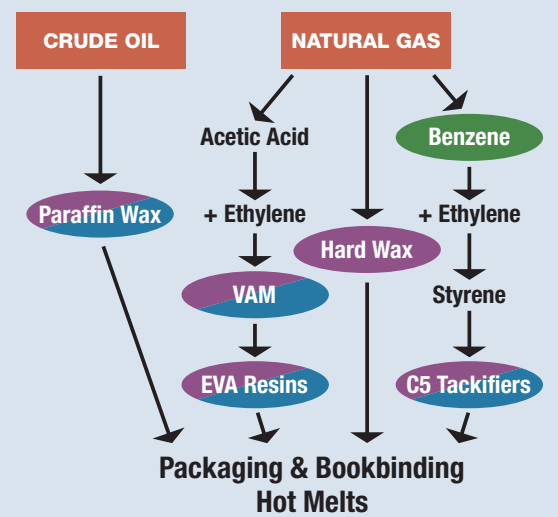
IMPACT: POLYURETHANE ADHESIVES

- Adhesives represent only a small portion (5%) of the polyurethane market. As a result, adhesives compete with many larger industries, such as producers of polyurethane foam, insulation and assorted other products, for a limited supply of raw materials.
- More than any other adhesive formulation, polyurethanes are closely tied to natural gas. It is the main feedstock from which all polyurethane raw materials are derived. When natural gas supply is tight and prices skyrocket, there's a significant impact on polyurethanes. This year, volatility in critical precursor chemicals — benzene, propylene oxide and aniline — has led to tight supply and high prices in urethanes.
- Several producers of propylene oxide have declared force majeure. Polyols supply will remain tight.
- MDI has been under extremely tight supply for the last 18 months and remains our biggest concern. There are only three global producers of MDI, and they are not keeping up with demand. A new plant under construction in China will add new capacity to the market when it comes on-stream in Q3 2006. However, this is the only new capacity being planned for the next 18 months, and MDI supplies are expected to remain tight until then.

IMPACT: PACKAGING & BOOKBINDING HOT MELTS

Ongoing raw materials shortages continue to affect all hot melt adhesives:

- Wax supply continues to be very tight. Fischer-Tropsch Sasol Wax is off force majeure but 25% sales allocation remains. Paraffin wax production in the U.S. continues to decrease, and Chinese wax supply is becoming less available.
- Supplies of VAM are tight and are contributing to downstream sales control for EVA resins, while demand on ethylene derivatives remains strong.
- Tackifiers have been tight for over a year due to high demand, limited supply and several production problems. No new capacity is expected until 2007.
- The immediate precursor to tackifiers is an octane booster, so as gasoline prices remain high, producers will choose to leave it in the gas stream, further adding to the tightness of raw materials supplies.



Legend for All Graphics

- = Sales Control
- = Force Majeure
- = Tight Supply
- = Shortage

SUPPLY UPDATE: NATIONAL ADHESIVES MEETING DEMAND

Amid the dramatic year-long climb in energy prices, the hurricanes, the declarations of force majeure and the many instances of raw materials sales allocations, National Adhesives has continued to steadfastly supply its customers with the adhesives needed to keep their businesses running smoothly.

National works closely with both customers and suppliers to develop accurate forecasts of raw materials needs. We continue to monitor our supply chain — not just our

suppliers but their suppliers, as well. At the moment, we are confident we can cover all expected demand. However, in this climate, all it takes is one unexpected incident — a fire, explosion, flood or any other disruption — at any major raw materials supplier in the world to upset the most carefully calculated projections.

National is committed to keeping our current customers supplied. Procurement continues to leverage its global supply contacts

to secure quality raw materials. However, maintaining supply in this market requires significant additional expenditure to move supplies around the globe to supplement shortfalls in the U.S.

Adhesives market dynamics are shifting. Shopping for the best price is no longer the priority, as securing supply is critical to maintaining operations. National continues to do everything it can to ensure the uninterrupted supply of adhesives to our customers. ■