



Markets & Companies

Global paints and coatings: A highly fragmented sector

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THE NEWSPAPER
FOR THE CHEMICAL AND
LIFE SCIENCES MARKETS

Chemicals

European chemical industry maintains positive levels of 2006

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Newsflow

Merck KGaA has formed a multi-year strategic alliance between its Merck Serono division and Archemix of Cambridge, Massachusetts (U.S.), to discover, develop and commercialise first-in-class aptamer therapeutics with a primary focus on the treatment of cancer. Additional areas of the collaboration include autoimmune and inflammatory disorders. The collaboration gives Merck Serono the option to obtain product licenses to certain of Archemix's lead-stage aptamer programs and the right to select and develop aptamers against six targets in oncology and other indications. Archemix has the option to exercise a co-development and co-promote option on any of the products to be developed on a 50:50 cost and profit-sharing basis in the U.S. This is the second research agreement this year between the two companies. Additionally, Merck will make a US-\$29.8 million equity investment in Archemix. Merck also retains an option, under certain circumstances, to acquire additional Archemix common stock upon an initial public offering. Other financial terms were not disclosed.

► www.merck.de
► www.archemix.com

Sasol Limited business unit, Sasol Wax, said it will double production of waxes in South Africa. Sasol Wax is producer and marketer of synthetic and petroleum derived waxes, with production facilities in South Africa and Europe. The waxes, which are manufactured via the Fischer-Tropsch process, are used in a wide variety of specialised applications including hot-melt adhesives, polymers, inks and high performance bitumen modifiers.

The project will be implemented in phases in line with the projected growth in key markets. The first phase will come into operation in 2010, with the second phase expected to be completed in 2013. The project will cover the full range of products from medium melt candle waxes to ultra-hard waxes for speciality applications.

► www.sasol.com

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Backwards Integration

Sabic Europe to Become Industry Leader

Keeping costs to a minimum and full integration back into olefins are two key factors for success in the petrochemical industry, according to Boy Litjens. Litjens is CEO of Sabic Europe, a subsidiary of the Riyadh-based Saudi Basic Industries Corp. The company has the ambitious plan to become the "undisputed leader" in the European petrochemical industry. Brandi Schuster spoke with Litjens about trends on the petrochemicals market, SABIC Europe's plans for growth and the future of the industry. The interview was held before Sabic announced the acquisition of GE Plastics for US-\$11.6 billion.

CHEManager Europe: Mr. Litjens, you've said that Sabic Europe's success is independent of its "rich parents." The company has no feedstock advantage and buys at market price. How does Sabic



Boy Litjens
CEO of Sabic Europe

Europe benefit from the parent company?

B. Litjens: Sabic has a very strong reputation on the market as one of the most committed and powerful petrochemical players. Having the Sabic name – which we also use as our brand name – sends the right message to customers.

In principle, we are not going to produce in Europe what we can produce cheaply in the Middle East. Partly we import products; we predominately produce products in Europe which are not produced in the Middle East. That's a very strong asset. We also benefit from the development of new products.

You said that everybody is currently making money in this business. What sets Sabic Europe apart?

B. Litjens: In this business, there are a number of very

► Continues Page 4

The Chemical Industry in 2020

Macroeconomic Trends Affecting the Chemical Industry

In his book "World Out of Balance," author Paul A. Laudicina, chairman of the board of management consultants A.T. Kearney, describes the macroeconomic trends set to impact on the world economy in the coming decades. How the chemical industry will continue to show a healthy balance sheet in future in the face of these developments – and which types of company in particular – was the subject of a presentation by Thomas Rings, vice president of A.T. Kearney with responsibility for the process industries, at the 2007 Annual Handelsblatt Conference for the Chemical Industry in May. Dr. Andrea Gruss asked him about the success factors critical for the industry in future.

CHEManager: Mr. Rings, what are the macroeconomic trends that will likely shape the world economy by 2020?

"For the primary chemicals industry, proximity to raw materials is increasingly important."

T. Rings: The main trends can be divided into five different areas: demographic change;



Thomas Rings
Vice president of A.T. Kearney

sort of siege mentality. Certain countries and consumer groups would be less accessible and chemical markets along with them. In this case, a stronger local presence would be of crucial importance for chemical companies, because consumer behaviour in the individual, protected markets would develop differently.

In the second scenario "Open borders, lingering fears," we assume that globalisation marches on and borders open even wider. In contrast to the previous scenario, consumer behaviour would become more homogeneous. The truth probably lies somewhere between the two. This scenario we call "Patchwork World".

What will be the role of natural resources in these scenarios?

T. Rings: They are the core factor in all of them. Strong economic growth worldwide will lead to a run on energy reserves, which has indeed already begun. In the Castles and Moats scenario, natural resources and their availability would again mean increased importance for the chemical industry, because countries with their own resources supplies will be more restrictive with them and use them to develop strategically dominant positions. Venezuela and Russia, for example, are already utilising their natural resources for political purposes. The greater the political isolation of these regions, the more difficult

it will be for countries lacking sufficient resources of their own to gain access to oil and gas.

This won't be without consequences for the chemical industry...

T. Rings: Yes. For the primary chemical industry the proximity to raw materials and the new Asian markets will be even more

What other factors will affect the industry's performance in 2020?

T. Rings: With the shift in demand to Asia – especially China and India, where a great broad middle class of consumers will come into being – the demands of these consumers will also change. This is the third great macroeconomic

successful in these circumstances, the specialist chemicals businesses must not only grasp what is important for their direct customers, but develop a deep

"Specialist chemicals companies must develop a deep insight into the needs of the end customer."

insight into the needs of the end user. So a lasting competitive position will only be achieved by those companies that unite high innovative potential with excellent knowledge of the customer's added value chains or a unique technology position.

► www.atkearney.de



important. They cannot service these markets from their existing plants. Only the big players that are located near a major market and have world-scale plants with good access to raw materials will still be competitive in future. This trend is already evident in the numerous investments in chemical plants in the Middle and Near East and the strategic securing of global raw materials supplies, for example by Chinese petrochemical companies.

driver for the chemical industry I mentioned at the beginning. This driver is especially crucial for the specialist chemicals sector, because they won't be able to use their high-tech products from the West on a 1:1 basis for all the buyer segments in the new markets. They will have to offer products appropriately tailored to different buyer segments there. This means innovation in the specialist chemicals sector will become more important in future. To be suc-

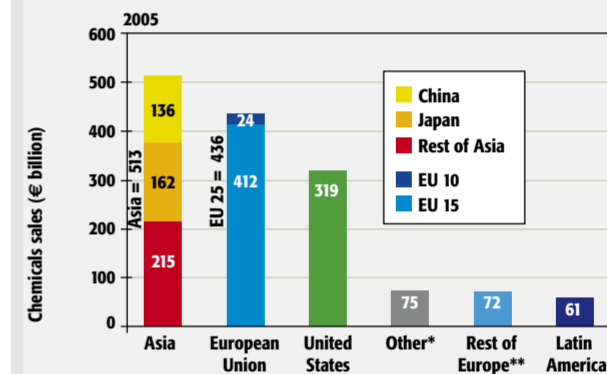
MARKET REPORT

A Sustainable European Chemical Industry

Europe has for decades been a leading platform for chemical production. The question is what needs to be done to ensure the right framework conditions prevail in Europe so that its chemical industry can remain prosperous in the future and can continue to deliver solutions to key sustainable development issues. New chemistry will provide answers to many of the key problems in the area of sustainable development, and it needs to be ensured that this happens in Europe.

Supplying virtually all sectors of the economy, the chemical industry is an essential engine for change and innovation. Time

Asia is first in world chemicals sales



World chemicals sales (excluding pharmaceuticals) in 2005 are estimated at €1476 billion. The EU accounts for 30% of the total.

* Including Canada, Mexico, Africa and Oceania

** Switzerland, Norway and other Central & Eastern Europe

Sources: Cefic, ACC, VC and Global Insight

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Saltigo: New Managing Director

As of 15 July, Wolfgang Schmitz will be the new managing director of Saltigo, a subsidiary of the Leverkusen,



Wolfgang Schmitz



Dr. Axel Westerhaus

Germany, chemical company Lanxess, replacing the current managing director Dr. Axel Westerhaus. According to the company, Westerhaus has left the position at his discretion to take on new responsibilities outside the corporation. To date, Schmitz has been head of the Lanxess' Inorganic Pigments business unit. He will continue in this position as acting managing director until a decision about his successor has been made.

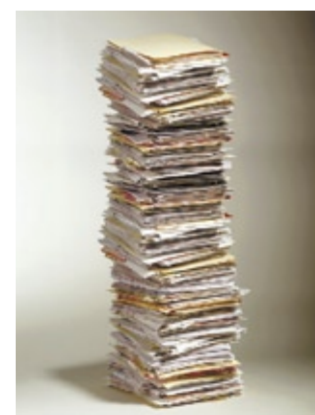
► www.saltigo.com
► www.lanxess.com

New European Chemicals Agency Opens

The new European chemicals legislation, Reach (Registration, Evaluation, Authorisation and restrictions of Chemicals) has entered into force, and with it the new European Chemicals Agency starts operations in Helsinki. The Agency, which is responsible for managing the implementation of the new requirements, will launch a website providing key information such as guidance documents, helpdesks and other tools relating to Reach. The Agency is to become fully operational on 1 June 2008, when companies will begin on-line submission of pre-registrations and registration dossiers. The Agency's Interim Executive Director is Geert Dancet, who has been seconded by the Commission to head the team which will get the Agency started.

Commission Vice President Günter Verheugen, responsible for enterprise and industry, said, "The Chemicals Agency will play a key role in

the effective implementation of Reach, helping to deliver improved health, and environmental conditions while at the same time maintaining competitiveness and encouraging innovation."



One of the Agency's first tasks is to make sufficient information available to companies - especially small- and medium-sized enterprises (SMEs) - on how to comply with the new requirements. For this purpose, the Agency is launching a multilingual

website. The website serves as a single access point for general information on chemicals, guidance documents and other tools on how to comply with the Reach legislation. From 1 June 2008 it will also provide an interface for on-line registration of substances.

Companies will also have access to a helpdesk through the site. The Agency helpdesk is connected to a network of national Reach helpdesks, many of which are already operational and actively disseminating information on the new Regulation through workshops, brochures and websites. For the first 18 months some 40 officials have been seconded from the European Commission to help with setting up the Agency. They will play a key role in training the new staff and building up the operational structure.

► echa.europa.eu

Krohne: Framework Contract with Uhde

Krohne Messtechnik said it has concluded a framework contract at this year's Hannover trade fair/Interkama with Uhde regarding the supply of

flowmeters. The agreement encompasses electro-magnetic, Coriolis and variable area flowmeters. In addition, Uhde can also obtain ultrasonic and

vortex flowmeters from Krohne with very favorable terms.

► www.uhde.biz
► www.krohne.de

April 2007: European Chlorine Production

European chlorine production in April reached 890,265 t, or 1.6% lower than the previous month (904,636 t). Production was nevertheless 1.7% up on daily basis (April 29,676 t/day vs. March 29,182 t/day). Compared with the same month last year (838,159 t), production rose 6.2%.

April exports of caustic soda were 47.7% up (46,619t) compared with the previous month (31,564t). In comparison with the same month last year (46,736t), April 2007 exports saw a 0.2% decrease with the January-April average for 2007 (38,840t) 6.4% below

the same period last year (41,495 t).

Stocks of caustic soda in April totalled 322,282t, or 19,784t higher than end March stocks (302,498 t).

► www.eurochlor.org

EU 25 + Norway/Switzerland Production & Capacity Utilisation

Month	Production (tonnes)			Capacity Utilisation (%)	
	2006	2007	% change	2006	2007 (estimate)
January	890,468	923,199	+3.7	85	86
February	811,314	845,506	+4.2	86	87
March	878,403	904,636	+3.0	84	84
April	838,159	890,265	+6.2	82	86

Ineos Group announced it has reached agreement to acquire the Borealis petrochemical business in Norway for €290 million, debt free. The deal includes 50% of the Noretyl ethylene cracker at Rafnes and associated downstream, integrated businesses at the nearby Bamble polyolefins site.

The acquisition of Borealis follows the recent announcement made by Ineos Capital,

to buy Norsk Hydro ASA's polymers business (Kerling) and completes the total purchase of the Noretyl cracker, a 50:50 joint venture between Norsk Hydro and Borealis. The opportunity to purchase both shareholding interests in the Noretyl cracker presents Ineos with unique benefits by bringing the businesses at Rafnes under a single ownership.

The acquisition is being made by Ineos Group Limited and is conditional on receipt of bank consent (with additional financing already committed) and approval from the EU competition authorities. The transaction is expected to close in the third quarter 2007.

► www.ineos.com

► www.borealisgroup.com

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MARKET REPORT

A Sustainable European Chemical Industry

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and again, the industry has proven its importance for the European economy and society. Synthetic dyes were central to the development of textiles during the Industrial Revolution, and led to the birth of the pharmaceuticals industry; petrochemicals initiated the post-war



René Van Sloten
Cefic

plastics and materials revolution; fine and specialty chemicals offered and indeed continue to offer a multitude of products, both for consumer items and industrial applications or processes, and active ingredients for crop protection as well as intermediates for pharmaceuticals completed this product portfolio.

The challenges for today's chemical businesses are enormous and include: extensive globalisation of all business dimensions, stronger shareholder value requirements,

Globalisation imposes challenges for the European chemical industry. Europe has for example lost its first place in the worldwide sales ranking to Asia, due to the fast growing emerging markets in India and China, while the growth potential in Europe is limited. Emerging markets attract the customers of the chemical industry, such as manufacturing and construction and, consequently also the production of the chemical industry itself. Asian companies are becoming fierce competitors for the European chemical industry – on the world markets but also in Europe itself. Additionally, production in the Middle East is growing thanks to cheap access to raw materials. On the other hand, European companies are benefiting from the strong growth in emerging countries by increased exports or by investing directly in these markets.

Of course, as an international industry, European chemical companies feel that competition is getting fiercer on the world market. It seems that the competitive advantage that the European chemical industry had in former times is shrinking, or even worse, disappearing. This does not, however, automatically imply that chemicals production in Europe is becoming less attractive. The strong growth elsewhere in the world makes the total cake bigger, so it is not a zero sum game.

This is supported by the statistics. In 2006, European chemical production increased by 2.1% and the extra-EU trade surplus increased to €40.5 billion, demonstrating that Europe is still in the game. And it is not only the external market that

ute to the economic growth and sustainable development of Europe.

The European chemical industry can rely on its capacities as a problem solver. Europe is looking for a sustainable growth path and chemical companies can contribute to that with their innovative products. Innovation in chemistry is spurring research and development in lots of promising fields such as highly efficient thermal insulation, efficient lighting, fuel cells, photovoltaic and bio-based products. Chemistry will be at the centre of the tremendous global change to be implemented in the next four to five decades in the world: the switch from a predominantly fossil carbon-based industry and economy to a global world depending significantly on renewable resources and alternative non fossil energies. The chemical industry will therefore have to switch a significant part of its feedstock to natural renewable raw materials, using new processes which also need to be safer, cleaner and cheaper. At the same time, it also has to provide new solutions to other industries ("economy of the hydrogen"...).

Much of the European chemical sector's R&D spending is dedicated to finding new solutions that directly or indirectly reduce energy use. As

the chemical industry is an energy intensive industry, chemical companies are also continuously making efforts to improve their own energy efficiency. Over the last 10 years, energy consumption per unit of chemical production has decreased by 25%. In this way, the EU chemical industry safeguards its competitiveness and – at the same time – makes a significant contribution to sustainability.

However, for a globally producing and competing industry such as chemicals, unilateral agreements on energy efficiency, renewable targets and emission reductions are an additional strain on competitiveness. But the European chemical industry is taking up the challenge, trying to further decrease energy consumption and at the same time supplying downstream users with innovative solution for energy saving products.

Nevertheless, competitiveness aspects should play a bigger role in such political decisions. The High Level Group on Chemicals, which will start in autumn, will provide critical analysis and actionable advice on areas vital for the European chemical industry's competitiveness. It will bring together senior representatives of the Commission, Mem-

ber State, industry and civil society, and has the capacity to create a common understanding about a sustainable chemical industry contributing to a sustainable Europe.

As a science-driven industry, chemical companies offer high value added employment for highly qualified people. But this also requires that there are an adequate number of science students and graduates to fulfil recruitment needs. At the same time Europe has to be an attractive workplace for scientists, offering appealing research conditions and cooperation between science and industry. Additionally, successful research and development and bringing innovative products to the market need adequate funding schemes through public and private sources and the right intellectual properties framework.

On the international scene, growing chemical markets and production elsewhere in the world not only imply increased competitiveness, but also growing opportunities to serve these markets with products made or developed in Europe. To seize these opportunities, chemical companies need a fair chance to enter these markets. Therefore a continued international market access strategy, via the Doha round or via

bilateral agreements is crucial. The removal of technical barriers to trade and convergence of chemical regulations should play an increasing role in the future.

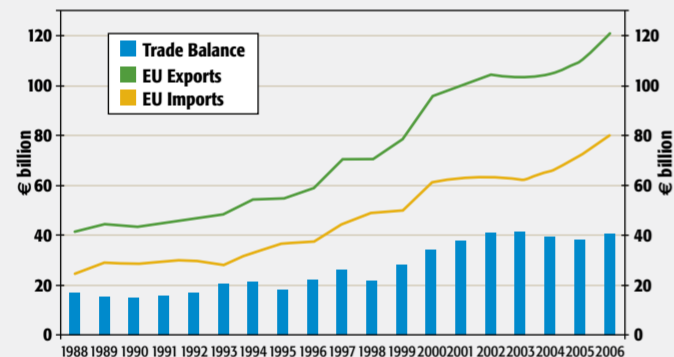
Benefits For All

The European chemical industry can successfully adapt to a changing global and European framework in order to remain an attractive chemical production platform. But there is some homework to do. The chemical industry has to respond to the needs of a sustainable European society and economy. This requires an innovation effort and engagement with society. At the same time, this transition can be supported or hindered by the political and regulatory framework in Europe. Ideally, all parties should work together to achieve a sustainable European chemical industry, because that could benefit everyone.

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European trade in chemicals with the rest of the world



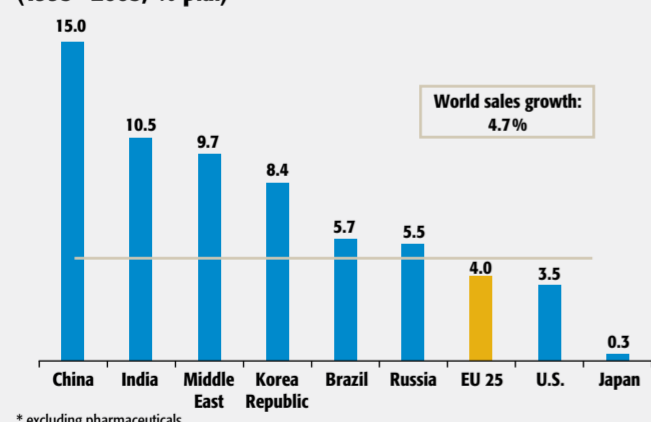
Source: Eurostat-Comext

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higher energy and feedstock costs, impacts from climate change and CO₂ discussion, safety concerns and risk aversion. At the same time, societal concerns are shifting to impact of climate change, ageing population, lack of clean water, food or security of energy supplies. That will be the

counts: 75% of the chemical industry's sales are going to the European home market with some 500 million consumers with strong growth potential in the new Member States. In 2005, almost half (13) of the 30 world chemicals majors had their headquarters in the EU – repre-

Average growth of chemicals* sales in selected countries (1995–2005, % p.a.)



* excluding pharmaceuticals

Source: Cefic, Global Insight and VCI

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world in which the chemical industry will need to operate. The challenges for industry and society offer however tremendous and unique business opportunities for the chemical industry. The chemical industry is uniquely placed to help develop the solutions to these problems.

The Situation Today

Europe has been a global leader in chemicals for decades, but this leading position of the industry cannot be taken for granted. Like other manufacturing industries, the chemical industry needs to adapt to a new global and European framework.

senting approximately 15% of world chemical sales.

The Way Forward

Competitiveness of industry starts at home. In order to provide society with innovative solutions and to benefit from market opportunities in third countries, industry needs to have good framework conditions on its home market. There has to be a general agreement within society that Europe wants to remain a key platform for industrial production. The chemical industry and other manufacturing sectors are important employment generators and contrib-

When productivity is clearly on the up
you have the formulae for success

Flexibility will ...

... grow |

totally integrated
automation



Choose the right vaccines to keep your business fit and healthy. Try productivity growth combined with validated solutions. Our comprehensive automation technology is engineered to fit your specific needs. We'll use open standards to integrate your processes right to the management level and do everything to ensure your competitive edge for the long term. Our secret development? It's called **Totally Integrated Automation**.

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3E Company Acquires HSE Systems 3E Company, provider of environmental health and safety (EH&S) compliance and information management services, has acquired HSE Systems, the developer of MSDgen, an enterprise solution for authoring and distributing material safety data sheets (MSDS) and labels. 3E Company will now feature HSE Systems' MSDgen authoring tool among its compliance solutions. Financial terms of the transaction were not disclosed. HSE Systems will continue to operate from its Massillon, Ohio (U.S.) site as part of 3E Company.

► www.3ecompany.com
 ► www.hsesystems.com

Hydro to Sell Polymers Business Norsk Hydro said it has entered into an agreement to sell its polymers activities to the UK-based chemicals company Ineos for approximately NOK5.5 billion (ca. €675 million) for net debt and equity as of 31 December 2006. The agreed payment is subject to closing adjustments including changes in equity until the closing of the transaction, which is expected in the third quarter 2007. Hydro expects a gain on the transaction of approximately NOK400 million after tax, based on International Financial Reporting Standards (IFRS).

The company said the deal with Ineos is in line with Hydro's strategy to focus on aluminium and power production and divest non-core assets. The company has considered divesting or listing its polymers unit, which was recently named Kerling. Following the agreement with Ineos, the application for listing on the Oslo Stock Exchange will be withdrawn.

The transaction is subject to clearance by EU competition authorities and other relevant anti-trust bodies. The sale of the 29.7% ownership interest in Qatar Vinyl Company (QVC) is subject to pre-emption rights.

► www.hydro.com
 ► www.ineos.com

Ineos Chlorvinyls Sells E-PVC Business Ineos Chlorvinyls said it will sell its Emulsion PVC (E-PVC) business to Vinnolit. The value of the deal is not disclosed. The sale consists of the commercial goodwill of the Ineos Chlorvinyls E-PVC business along with its E-PVC production facilities at Hillhouse (UK) and Schkopau (Germany). The deal will also include Vinnolit entering into an offtake agreement for the entire E-PVC output at Porto Torres (Italy). The E-PVC business has an annual turnover of approximately €150 million.

► www.ineoschlor.com
 ► www.vinnolit.com

Chemtura Announces Strategic Restructuring Chemtura said the company plans to restructure its global supply chain for standard antioxidants in order to position itself to be more competitive in the world plastics market and to more effectively serve its global customers. The restructuring supports Chemtura's overall objectives of reducing costs and optimizing its global manufacturing footprint, while maintaining the company's strong commitment to the antioxidants business. According to the company, this restructuring, which includes the closing and/or divesting of selective sites in Europe, as well as potential investments in other parts of the world to better meet customer needs, will result in pre-tax charges, principally severance costs, of about US-\$15-20 million and accelerated depreciation of about US-\$30-35 million in the second and third quarters of 2007.

Chemtura's manufacturing facilities at Pedrengo and Ravenna, Italy, and Catenoy, France will be affected by these changes. During the third quarter of 2007, the company intends to end standard antioxidant production and to close the antioxidant facilities at Pedrengo and Ravenna and also proposes to shut down two intermediate chemical products at Catenoy. The intermediates produced at Catenoy are used at the Pedrengo facility.

About 125 to 135 employees would be affected at Pedrengo, about 25 to 35 at Ravenna and around 35 at Catenoy.

► www.chemtura.com

Arkema Sells Business to Hexion Arkema said it has sold its Urea Formaldehyde Resins business to Hexion Specialty Chemicals. The sale of this activity, which reports annual sales close to €100 million, falls in line with Arkema's strategy for a selective management on its asset portfolio.

The deal, which should come into force in the third quarter of 2007, is subject to approval by antitrust authorities. The Urea Formaldehyde Resins business, solely based on the Leuna site, Germany, following the closure of the French production unit based at Villers-Saint-Paul (France), offered very little synergy with Arkema's other activities. Urea Formaldehyde Resins are used in particular as binders for particle board and chipboard, and in paper impregnation for the manufacture of laminated board.

► www.arkema.com
 ► www.hexion.com

Agilent Technologies Acquires Stratagene Agilent Technologies has completed the acquisition of Stratagene, a developer, manufacturer and marketer of specialised life science research and diagnostic products. Agilent expects this strategic acquisition to accelerate its growth in life sciences through a complementary product portfolio and strong market reach into academia and government. The company paid approximately US-\$250 million for Stratagene, or US-\$10.94 per share of common stock. Completion of this acquisition will have no impact on Agilent's earnings-per-share guidance. Agilent's revenue guidance for the third quarter is now US-\$1.38 billion to US-\$1.42 billion.

► www.agilent.com
 ► www.stratagene.com

Celanese Announces Revitalisation Plans Celanese has announced business revitalisation plans for its Emulsions & PVOH (polyvinyl alcohol) business, including global manufacturing restructuring and an R&D and technology realignment, which will better position the business for sustainable, profitable growth.

"Our goal is to create a stronger, more competitive position for our business. This plan will help us accelerate product innovation and global market penetration while reducing costs in the wake of product and market shifts," said Doug Madden, president, Celanese Acetate, Emulsions & PVOH. "We will continue to meet our customer requirements as we transition out of underutilized assets."

As part of the plan, Celanese announced capacity rationalisation across select European and North American sites and functions. Celanese expects that the restructuring will be completed in the next 18 months with uninterrupted service to customers.

► www.celanese.com

Backwards Integration

Sabic Europe Looking to Become Industry Leader

► Continued Page 1

simple rules. First of all, you need to simplify your system as much as possible and try to have a transparent, well-organised and well-controlled business process. Secondly, the whole business process must be low cost; not only the production assets but also the logistics, sales, overhead, etc. Total business costs should be in the first quartile. That implies if tough times are coming – and they will, even if we don't know exactly when – we still be healthy and profitable; the laggards with high costs in this business will suffer.

What does Sabic Europe do to keep costs at a minimum?

B. Litjens: We continuously invest in upgrading our facilities, which also includes scrapping down smaller and older units and replacing them with big new ones. For example, in Gelsenkirchen, Germany, we are currently constructing a new bi-model HDPE line, which is replacing a smaller unit. We are doing the same in the Netherlands. We continuously work towards improving efficiency per employee and coming up with unconventional and creative solutions which are of benefit for our customers, such as our e-business. It doesn't make sense to come up with a lot of expensive solutions, and if we don't have a win-win situation, then perhaps the customer is satisfied, but we are not. Or vice versa. These kinds of creative and unconventional solutions bring us to where we are today.

Emerging markets will need about 20 years to catch up to Western Europe's mature market. What kinds of opportunities are to be had during this time?

B. Litjens: Everybody's talking about India and China. And of course, if you want to take advantage of the growth,



there are big opportunities to be had there. However, we shouldn't underestimate that Europe and the U.S. are the biggest markets and will be for at least another 15 years. If you have a 2% increase in this market, you need to have a 40% increase in the other markets. That would imply that there are also opportunities for growth in Europe.

What role will Central and East Europe plan for Sabic Europe in the coming years?

B. Litjens: These emerging markets are very important for us. Since we have a philosophy that we want to grow faster than the market, Central and East Europe are opportunities where we are seriously looking for profitable growth.

One of Sabic's main goals is to achieve a turnover of US-\$60 bn by 2020. What role will Sabic Europe play in this?

B. Litjens: The Sabic 2020 plan is the corporate strategy. We haven't yet decided what the European share of that should be. We will go further, for sure, but the turnover level has not yet been defined.

What is Sabic Europe's goal for the next five years? The company's turnover has gone from €2 billion to €8 billion since 2002, a dramatic increase.

B. Litjens: Our five-year strategy for 2010 was to achieve a turnover of €8 billion, which we have already reached, three years ahead of schedule. We are currently developing our strategy for the coming years, and in the end, our goal is not an increase in turnover, but an increase in profit. We want to have profitable growth. We are not growing for the growth itself, rather to increase the profitability of the company.

The full reintegration of olefins is also a key to success. Is Sabic Europe looking to build or acquire new crackers?

B. Litjens: We considered the construction of a new cracker over a period of two years. We spent over €50 million in engineering to come to the conclusion last year that it was just too expensive. The market is overheated, so we decided to postpone the cracker construction. Immediately afterwards, we decided to acquire Huntsman, which has one of the biggest crackers in Europe.

Is it Sabic Europe's plan to acquire crackers rather than building them?

B. Litjens: As I said, we have a stretch up until 2010, so now we are consolidating that strategy. In any case, if you want to grow further in this business, you have to be backward integrated. Substantial growth is not financially feasible if it is not backed up with your own olefins.

Renewable resources are becoming more and more important, such as feedstocks from cellulose, corn and sugar. How will this affect the petrochemical industry?

B. Litjens: It's important that the petrochemical industry is conscious of its role and that we invest in and take initiatives in research in developing products that reduce CO₂ and energy consumption, particularly in

"We are not growing for the growth itself, rather to increase the profitability of the company."

light of the environmental challenges we have. On the other hand, we also see that we will get back the energy we have borrowed over the course of time.

These developments are very important, and it is important to be proactive in this respect; however, I don't think that these materials will replace petrochemicals in the next 10-20 years. Of course, in some applications, such materials really make sense. It's not a threat, but it's important not to become complacent. We also have to look into the opportunities it's going to offer us.

► www.sabic.com

Actions Speak Louder

'Global' Supply Chains Often aren't Global, Study Reveals

Nearly half (48%) of supply chain executives at multi-national companies in the chemical, consumer goods, industrial and retail sectors consider their supply chains to be global, yet operating decisions made on behalf of those supply chains would indicate otherwise. Indeed 60% of these executives said supply chain decisions in their companies are regional or local in scope, according to a recent study conducted by BDP International's Centrx consulting unit and St. Joseph's University in Philadelphia (U.S.). Just 35% of respondents reported their companies' supply chains are managed globally.

"These results suggest that some multinational companies operate a series of what might best be described as multi-domestic rather than global supply chains," said Centrx Managing Director Yone Dewberry. "The reasons for this vary, but the unrelenting pressure to achieve per-unit cost reductions, in tandem with the emergence of true global data visibility, must hasten supply chain integration to accommodate the exigencies of international trade."

The globalisation of trade has brought with it a dramatic increase in companies' sourcing and delivery points, which inevitably has resulted in longer lead times and a need to improve regulatory understanding. Cited by 64% of all respondents (87% European; 55% North American), on-time delivery is the single most pressing issue facing their supply chains.

However 43% of all respondents reported shorter lead times, reflecting investment by their companies in supply chain technology and management systems. These included

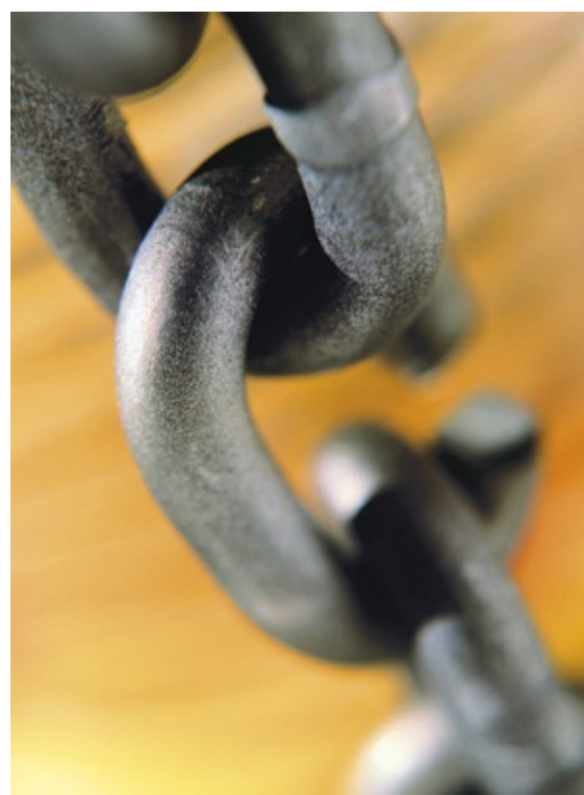
warehouse management, ERP and TMS systems. Most of the 32% of respondents whose companies had not made such investments reported longer lead times. More than a third (35%) of all respondents' companies

Among the strategies companies are pursuing to hedge against the vagaries of their far flung supply chains are increasing inventory levels, cited by 46% of study participants, and sourcing from multiple countries (43%). Also cited were increased outsourcing activity and investment in trade compliance and security. Significantly, over three-quarters of those surveyed reported increasing investment in compliance and security programs. Among respondents from consumer goods companies, 83% reported increased reliance on external compliance specialists, compared with 55% of the total survey population.

indicated they can measure on-time delivery to customers, and 69% can also measure on-time delivery from vendors. In addition, they collaborate on shipment visibility with carriers (82%), suppliers (42%) and customers (20%).

The study was conducted using an online survey distributed to 220 executives with global supply chain responsibilities. The 35% rate of response included respondents from a variety of industries, companies and regions. Approximately two-

"With the exception of respondents from the chemical and industrial sectors, most deemed landed costs an even greater challenge than on-time delivery."



had not implemented advanced technology in their supply chains.

The second most frequently cited supply chain issues were total landed costs and logistic costs, each noted by 39% of respondents. With the exception of respondents from the chemical and industrial sectors, most deemed landed costs an even greater challenge than on-time delivery. Interestingly, respondents from chemical companies who identified inventory management as their greatest challenge have seen their supply chain costs increase over the past two years.

trade has expanded remarkably in recent years," said Michael Ford, BDP's vice president of regulatory compliance and quality. "It also reflects the need for more and better information about international shipments in today's hyper-security-conscious environment." Most respondents said regulatory compliance is even more costly than supply chain visibility or RFID technology.

On-time delivery and supply chain visibility remain the most compelling supply chain issues, and respondents' companies are putting metrics in place to measure them. Most (80%)

thirds of the participants' companies are headquartered in North America, 20% in Europe, and 14% in Asia and the Middle East/Gulf Region. Nearly half of the companies represented have annual revenues in excess of US-\$10 billion, and another 20% have revenues of more than US-\$2.5 billion.

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Paints And Coatings

System Oriented Value Creation

In 2005, the global coatings market was worth about US-\$85 billion (26.5 billion liters). Between 2005 and 2010, the annual growth rate is forecast to be 5.4% per year. Growth is particularly driven by increasing demand in the developing markets of Asia (mainly China, Thailand, Indonesia, India and Taiwan) and Eastern Europe (especially Russia, Hungary and the Baltic States).

As many other sectors within the chemical industry, the paints and coatings segment is facing a variety of challenges, such as rising energy and raw material costs, the relocation of production and research facilities to Asia and maturing markets in the western industrialised nations. In order to stand up to global competition, it is particularly important to reposition into growth markets, focus on the customer and provide innovative service offerings.

Ongoing Consolidation

The global paints and coatings industry is a highly fragmented sector. Although the top ten producers represent about 50% of the market, thousands of producers make up the other half. Even though the number of mergers and acquisitions has

slightly decreased in 2006 when compared to preceding years, it is expected that the sector overall consolidate further. Large market players, in particular, will broaden their portfolio by acquiring small and medium size producers. Their intent is to enlarge their range of products, brand portfolios, technology

not simply be for the sake of growing volume or revenue. The focus must be growing customer accounts. It is crucial to build more client accounts and, via local presence or an adapted product or service portfolio, meet client needs in the best way possible. In fact, the most successful mergers

and coatings in the U.S. Particularly strong in the architectural paint category, Sherwin-Williams has shown constantly good growth rates of 5-6% per year. This is attributed to their marketing strategy. It is focused on the professional painter market through its core Sherwin-Williams brand which is sold exclusively through a company branded retail chain of more than 3,000 stores.

By this concept, Sherwin-Williams has established exceptional proximity to both private and professional end users, and controls a large part of the value chain. By this, they gain better insight into client needs and more pricing power than would be possible by selling their products via channels such as DIY-markets or wholesalers.

Customized Service Concept

The thorough knowledge of clients and markets is fundamental for the design and implementation of successful service concepts. Good examples can be found in the automotive industry. BASF Coatings has successfully implemented a service concept within the model of system partnerships. As a system supplier, the company designs, assembles and supplies complete systems or system components. Other than a module supplier, a system

supplier stands out by providing a high degree of design and development.

In that sense, BASF Coatings has successfully established and conducted system partnership with numerous automotive manufacturers and suppliers for years, e.g. Magna Steyr, DaimlerChrysler and Volkswagen. Since 2003, BASF Coatings has centrally provided surface coatings materials for Volkswagen in Mexico. At the same time, BASF is responsible for material management and stock logistics.

Innovation in Pricing and Processes

Pricing is an integral element of the system partnerships. BASF Coatings is paid on a "cost per unit" basis, rather than on the volume of paint consumed. The client pays by "properly painted" car body. This "cost per unit" billing has meanwhile been established at eight car manufacturers, among which are DaimlerChrysler and Volkswagen.

This value based pricing approach is even driving innovation: BASF Coatings has recently introduced a new coating technology. The aim of the new process is to integrate functions which are currently performed by the primer surfacer in automotive OEM paint systems into the basecoat. This

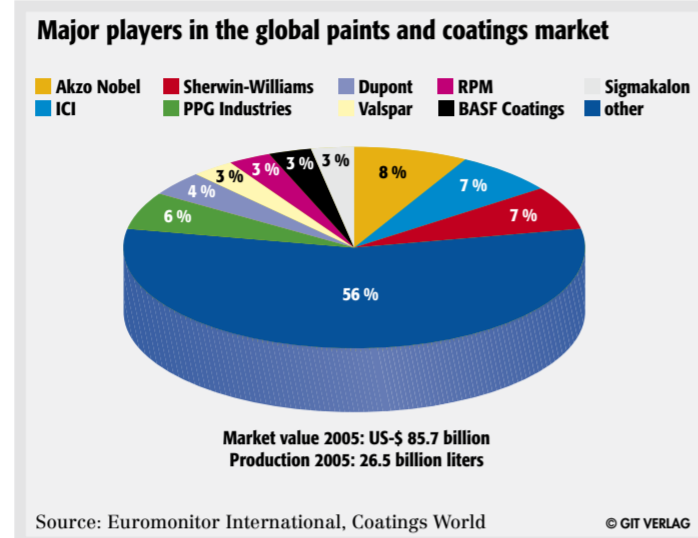
innovation can make the entire primer surfacer application section superfluous when coating automotive bodies, with a corresponding shortening of the coating line. The now superfluous basecoat coating lines can be used for capacity expansions.

Outlook

Consolidation of the highly fragmented paint and coatings

by the merger – not only the operational integration of the companies.

The paints and coatings sector shows itself surprisingly innovative. Future success factors, such as the precise knowledge of end markets, sophisticated service concepts and value based pricing have already been well-implemented by leading companies. They have moved towards the end customer within the value



base, as well as provide a service proposition. Another motivation is to extend the geographic presence, such as Valspar has done. By purchasing 80% of the shares of Chinese manufacturer Huarun Paints, Valspar (a U.S. major) has gained access to the distribution system for architectural paints in one of the most dynamic growth markets.

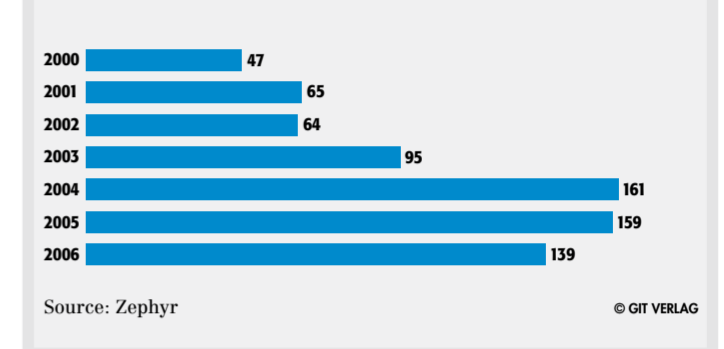
However, the objective of mergers and acquisitions must

are accomplished as a component of a broader strategy to surround the customer, that is, serve more customer needs.

End Market Proximity

In the U.S., Sherwin-Williams has already broadly realized what Valspar is still aiming at in China: With a market share of 30%, Sherwin-Williams is the leading manufacturer of paints

Completed mergers and acquisitions, worldwide



segment will proceed in the future. Fundamental within any acquisition due diligence is to thoroughly examine the innovation ability and product differentiation of the acquisition target. Deep knowledge of the customer base and customer needs is as critical. Within all phases of the M&A process, the focus needs to be on the value creation that can be realised

chain. They may be inspiration for other chemical industry sectors.

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Green And Growing

EU Eco-industries Now a 'Prominent Force'

According to Frost & Sullivan, the green energy sector is growing at breathtaking speed, which experts contribute to the challenges of climate change. Globally, it has already become a multi-billion dollar industry, with high growth potential which is attracting record investment. Over the last few years, eco-industries in the European Union have grown to such an extent that they have now become a prominent force across the entire European economy. Today, they represent about 2.1% of its gross domestic product (GDP) and account for 3.5 million jobs.

Frost & Sullivan Green Energy experts are analysing all the key segments of this market, both in Europe and globally. There is no doubt that this area is expanding at an extraordinary rate and – based on their research – Frost & Sullivan analysts forecast that revenues are set to double, triple or increase even more over the next few years.

- Biodiesel.** Biodiesel is surely one of the fastest-growing areas in the chemical industry and in the Green Energy sector. Last year in Europe we consumed 3.89 million t of biodiesel, generating revenues of €2.93 billion. By 2013, the total EU biodiesel market is forecast to be 9.75 mt in terms of unit shipments while revenues are forecast to be €7.46 billion, based on current biodiesel market prices. The average growth over the forecast period will be 14%.
- Renewable Energy.** New analysis from Frost & Sullivan European Renewable Energy Market – Investment Analysis and Growth Opportunities reveals that this market earned €8.89 billion in 2005 and estimates



this to reach €14.54 billion in 2010. Even in China, the government feels there is an urgent need to take action and is stepping up efforts to accelerate the development of clean energy. Frost & Sullivan research analysts reveal that the Chinese renewable energy markets earned revenues of \$6.9 billion in 2006, and that these are likely to reach \$17.9 billion by 2013.

Amongst the market segments, solar PV will be one of the fastest growing renewable energy sources in China until 2013, with its growth exceeding even that of wind power. The biomass power industry has great revenue potential, not only because of sufficient government funding but also due to the adequate availability of feedstock fuels.

- Green Buildings.** Buildings are responsible for 40% of Europe's total carbon-dioxide

emissions. Climate change is the EU's top priority according to the European Commission and Member States are committed to cutting down on CO₂ emissions to meet the Kyoto Protocol targets. Despite all their efforts, Member States keep on wasting a significant proportion of their energy due to inefficiency. Therefore, if the EU is to achieve its targets, reducing energy use in all buildings is essential. According to Frost & Sullivan, if more stringent standards are applied to new buildings and renovations, the EU will achieve a significant cut in greenhouse gas emissions. Unfortunately, any efforts will be in vain if they are not accompanied by a change in consumer behaviour.

- Hybrid vehicles.** Reducing emissions below 140 g/km of CO₂ will be possible mainly with the help of alternative

fuels and hybrids (micro, mild and full). While original equipment manufacturers (OEMs) are aware of this fact, further development or market acceptance of these alternative fuels and hybrids is restrained by the distribution network, availability and high implementation costs. According to Frost & Sulli-

van analysis of the Alternative Fuels and Hybrid Technologies, while advancements in engine technology have helped reduce emissions to an average of 160 g/km, hybrids, ethanol, biofuels, compressed natural gas (CNG), hydrogen and fuel cells are necessary to reduce them further. The main priority of OEMs today

is to reduce emissions, which will require the help of local governments and fuel suppliers to promote alternative fuels and hybrids in a cost-effective manner.

- Waste Management and Recycling.** An estimated 1.3 billion t of waste is generated annually in the EU and this still continues to rise. The

overall volume of waste is growing at rates proportional to the economic growth rate of the EU25. Amongst the various streams of waste generated, management of hazardous and municipal waste alone costs the EU an estimated €75 billion annually. This translates to the waste management and recycling industry earning huge revenues that are expected to increase enormously over the next few years. Frost & Sullivan finds that the European Waste Management and Recycling market earns total annual revenues of €100 billion.

"It is clear that this is a period of truly booming growth in the Green Energy sector and this is an issue that is here to stay," said John Raspin, Frost & Sullivan Energy & Environment Practice director. "We are seeing double-digit growth in many segments of the market and companies of all shapes and sizes are positioning themselves to exploit the growth opportunities."

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The chemical industry is one of the most regulated industries. The management of chemical safety, environmental regulations, export and import controls in global trade require chemical companies to comply with a huge set of regulations. The increasing number of regulations as well as the increasing complexity of every single rule make it more and more difficult and expensive to comply with all regulations.

The most recent example of this evolution is Reach. Replacing about 40 existing directives, the legislation requires companies producing or importing chemicals in quantities of more than one ton per year in Europe to report and document specific data about the handling of such substances. This can potentially result in dramatically increased operational costs to remain compliant. More than 6,000 chemical companies are now required to begin compliance with the new regulations covering more than 30,000 chemical substances, with additional impact to other industries such as pharmaceuticals, consumer goods, and oil and gas that make substantial use of chemicals in their manufacturing processes.

Many environmental regulations apply to substances and not to materials. This is a key issue – not only for Reach. Other examples are Toxic Substances Control Act (TSCA) and other national substance inventories, classification systems for hazardous substances and dangerous goods like GHS (Global Harmonized System for the classification of Dangerous Goods) and new legislations like RoHS (Restriction of Hazardous Substances), China RoHS and WEEE (Waste Electrical and Electrical Equipment). In addition to this governmental legislation, downstream industries like food and beverages or cosmetics have their own rules with regards to ingredients kept by their suppliers.

The Impact of Substances and Their Properties

Taking all this into consideration, there is a huge impact that substances have on logistics operations and product development. The most obvious impact is that companies need to know what is in their products. Answering this question is more difficult as it seems to be, because looking at recipes or bills of materials might not be clear enough. The reason is that not only pure substances (defined as chemical elements and

their compounds in the natural state or obtained by any manufacturing process) are used for manufacturing of a product but very often preparations (defined as mixtures or solutions of two or more substances). Therefore, breaking down from the product to the substances requires the resolution of preparations and their preparations and so on.

While most chemical manufacturers might be in good shape solving this product data management issue, problems occur when other industries need this information, too and do not have this infrastructure for substance data management in place. The exchange of this information along the supply chain and its usage in order to ensure legally compliant business operations are aspects that are not yet solved even in many chemical companies. All this will happen with the legal requirements mentioned above.

Up And Downstream Communication

In the past, managing dangerous goods, handling hazardous materials and ensuring product safety required the chemical industry to know which substances a product or good contains. From the properties of these substances, risks could be derived and safety measurements defined.

Even if in many companies this is still cumbersome and very often manually done, a lot of progress has been achieved in automatic generation of labels, safety data sheets or Tremcards. But today, the need for up and downstream communication about substances, their properties and the specification of products and preparations has increased beyond the submission of the documents mentioned before.

According to the Reach legislation, importers of preparations and in some cases even products need to know the specification of preparations and products. Otherwise they cannot determine the volumes of substances they import or check whether the supplier has an appropriate Reach registration. Articles can require a registration according to the legislation when they contain substances that will be disassociated during a product's lifetime.

Additionally, a buyer of chemical substances and preparations needs to check whether the supplier has registered it for the usage it is bought for. Therefore, in the near future, suppliers must share information like registration numbers and registered exposure scenarios with their customers in addition to the data they provide today. They also need to share the specifications of prepa-



rations and articles they supply. On the other side, they need to collect usages and related exposure scenarios from their customers resulting in communication up and downstream similar to what we know from RoHS. The EU's RoHS directive outlines that certain products being shipped into a EU country must not contain hazardous materials like lead, mercury, cadmium, chromium, polybrominated biphenyls or polybrominated diphenyl. Manufacturers need to certify that none of their products contains these materials. According to both legislations, it is now required to share information about products, ingredients or components, what they contain and what are they used for across the whole value chain. As an outcome of this, not only the chemical industry but all the downstream industries based on chemicals need to care now for substances and not for materials only.

Legal Checks on Substance Levels

Having exchanged the information up and downstream, the next challenge is to use this for compliance checks for:

- Creating purchase orders for monitoring imported substance volumes against Reach thresholds a company has registered for;
- Creating a process order for monitoring manufactured substance volumes against Reach thresholds a company has registered for;
- Monitoring product compliance of components, products or preparations against governmental or own directives with regards to ingredients while creating a purchase order;
- Monitoring product compliance of components, products or preparations against governmental or customer's directives like national substance inventories, creating a sales order, or delivering a product into other countries.

These kind of checks are usually not supported by IT solutions and require a lot of manual work. This is in differentiation to what we see with regards to labelling and safety data sheet creation. The described lack of legal support through IT solutions leads to high costs and legal uncertainty.

Integrating the World of Substances into the World of Business Operations

In order to overcome this problem, a deep integration of substance and specification data into Enterprise Resource Planning (ERP) systems is

needed. Reach, RoHS and other legislations require a check of substance related information against legal rules that is integrated into business transactions (such as creation of purchase or process orders, developing recipes, receiving sales orders or shipping goods). In the past, many companies maintained substance and specification data in systems beside their ERP and integrated them only for the printing of labels or generation of Tremcards and Safety Data Sheets. But the increased legal requirements now force the integration of the substance world into the ERP systems. Otherwise technical integration will become a nightmare or if manually done, legal checks will become very costly and will slow down the company's ability to respond timely to its customer's inquiries.

Many ERP systems do not know the distinction between materials and substances or specifications. According to leading analysts AMR, SAP is the only ERP provider with any substantial support for Environmental Health and Safety (EH&S) processes based on its EH&S module. For Reach and other regulations, SAP EH&S is enhanced by a capability called Substance Volume Tracking. This functionality is available now for SAP releases 4.6c and above. Substance Volume Tracking helps to keep a certain quantity of chemicals and other hazardous substances within the limits a company has registered for. It does this by recording the quantities of substances that need to be tracked while purchasing, importing, producing, selling products and materials. Comparing the recorded quantities with the limit values, the system can warn in good time before a limit value is exceeded. If a limit value is exceeded, the system can also block the respective business process. This means a company can ensure that it stays below the quantity limits. For those countries or business partners forbidding certain substances in general or for some usages, this limit can be set zero. This makes Substance Volume Tracking not only relevant for environmental or product compliance and therefore an important step for Reach compliance but also ensures compliance in foreign trade.

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Chemicals Trends Report

European Chemical Industry Maintains Positive Levels of 2006

In February 2007, chemical production (excluding pharmaceuticals) grew by 3.4% compared to February 2006 and remained on a high growth level. Chemical producer prices (excluding pharmaceuticals) remained unchanged for almost half a year. In September 2006 chemical producer prices reached their record level and have not changed significantly since that point in time. Comparing February 2007 to February 2006, chemical sales (excluding pharmaceuticals) grew by 6.5%, but looking at recent months, a stabilisation trend can be observed. The oil price continued to rise modestly in March 2007, to US-\$62 per Brent barrel. No major changes are expected in the short or medium term. Underlining the attractiveness of EU chemical products around the world, the external trade surplus of EU chemicals went up by 6% to €40.5 billion in 2006, from €38 billion in 2005. In April 2007 chemical business confidence stopped the downward trend and remained unchanged on a satisfactory level. Economic confidence of the industry in the Eurozone rose to its highest level ever in April

2007, showing that industry is reaping the benefits of the positive economic development in 2006.

In a year-on-year (yoy) comparison, consumer chemicals showed the highest growth with 6.5% in February 2007, followed by pharmaceuticals (4.7%), petrochemicals (4.2%) and basic inorganics (3.3%). All sectors showed a production increase compared to February 2006, although polymers grew by only 0.7% in a year-on-year comparison. Looking at recent months, most chemical sub-sectors were increasing production compared to January 2007, except for specialty chemicals and polymers.

Chemical Producer Prices Stop Upward Trend

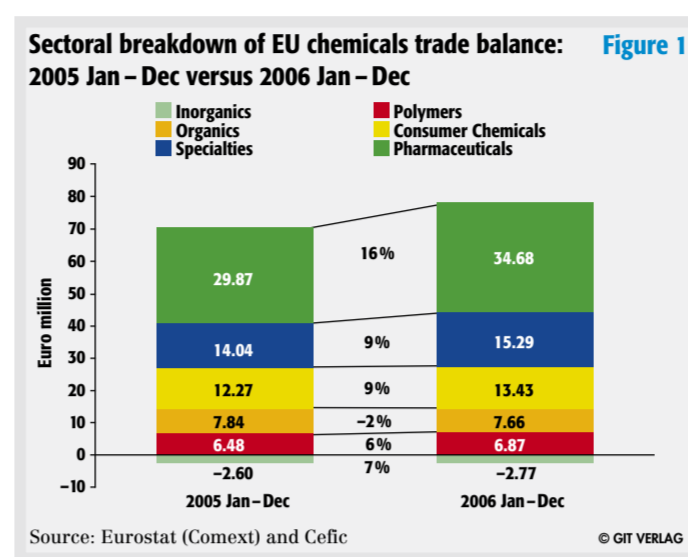
In February 2007, chemical producer prices (excluding pharmaceuticals) remained basically unchanged for almost half a year. Back in September 2006, chemicals producer prices reached their record level and have not changed significantly since that point in time. Compared to February 2006, chemicals producer prices (excluding pharmaceuticals) increased by 3.5% in February 2007. Petrochemicals showed the highest increase (5.2%) comparing February 2007 to February 2006. Polymer prices grew by 3.8%, basic inorganics

by 3.1% and specialty chemicals by 2.8%. Prices of consumer chemicals registered only a modest increase, 1.4% whereas pharmaceuticals remained the only sector with decreasing producer prices, -0.6%.

The oil price continued to rise modestly in March 2007, to US-\$62 per Brent barrel. According to Consensus Forecast May 2007, the oil price is supposed to remain at the current level in the short and medium term. Energy prices are increasing slightly over the level of the last five months, but have yet to reach their record level of August 2006 again.

Positive Year-On-Year Sales Growth

Comparing February 2007 to February 2006, chemical sales (excluding pharmaceuticals) grew by 6.5%. For petrochemicals, year-on-year growth amounted to 9.6% in February 2007, followed by consumer chemicals with an increase in sales of 8.0% and basic inorganics with 6.4%. Polymers sales grew by 4.8% against February 2006 and specialty chemicals by 4.7%. With 4%, pharmaceuticals showed the lowest sales growth, which still implies a positive development. It should however be taken into account that in recent months, since December 2006, sales are unchanged or even falling. But as the year 2006 was a growth



year, the year-on year comparison is still positive.

Extra EU Trade Surplus up by 6%

Year end figures for 2006 indicate that the external trade surplus of EU chemicals went up to €40.5 billion, from €38 billion in 2005. That underlines the attractiveness of European chemical products around the world. Mainly pharmaceuticals, specialty chemicals and consumer chemicals contributed to the rise in the trade surplus, the first increasing by 16% and the latter two by 9%. The trade surplus of polymers increased 6%. The worst performance came from the base chemical sub sectors: the external trade surplus of inorganics

decreased slightly by 2%, whereas organics even increased their trade deficit by 7%.

Despite the good external performance in 2006, managers in the chemical industry are uncertain about the competitiveness of the European chemical industry. The competitiveness indicator for the first quarter of 2007 is decreasing sharply, especially regarding the competitive position of the European chemical industry in the external market, but also to a lesser extent on the internal market (fig. 1).

Chemical Business Confidence High

After some ups and downs in previous months, chemical con-

fidence remained unchanged on a rather high level in April 2007, but below manufacturing confidence. The positive message is though that the downward trend of March 2007 in chemical business confidence has been stopped. Looking at manufacturing sub sectors in April 2007, the picture looks quite positive for most of the sectors; only "Office Machinery and Computers" have observed a negative production trend in recent months. All other sub sectors are confident about the last few months. "Electrical Machinery" shows the best recent performance.

Looking into the near future, production expectations are especially encouraging for "Office Machinery and Computers", "Machinery & Equipment", "Food and Beverage", "Electrical Machinery" and "Basic Metals". "Printing and Publishing" has the worst perspective for its production in the near future, but its situation cannot yet be described as on a downswing. "Textiles" and "Clothing" remain on a slightly positive trend with an improving production in recent months and somewhat positive outlook ahead.

Global Perception of EU Economy Remains Stable

In April 2007, the Economic Sentiment Indicator (ESI), reflecting the global perception

of the economic situation in the EU, remained broadly stable at a high level. With regard to the five main economic sectors (industry, consumers, services, retail sales and construction), the economic perception of the European industry remained stable in the EU25, but rose in the Eurozone to reach its highest ever level. Retail confidence in the EU reached its highest level for almost two decades in April 2007. Business confidence was unchanged in the service sector and construction, and consumer confidence remained constant as well.

The general stabilisation shows that the European economy is reaping the benefits of its positive economic development of 2006. In fact, GDP in the EU grew by 3% in 2006. For 2007 and 2008, the European Commission is forecasting a marginal deceleration to 2.9% and 2.7% GDP growth respectively.

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C'est La Vie

Applying Reach Legislation in France

With talks between the EU Commission's Reach working party and the industry on the contents and objectives of Reach still under way, UIC Picardie (French Organisation of Chemical Industry) anticipated the new regulation and initiated a project to support companies in chemicals management and implementation. TÜV Rheinland BioTech was instructed to provide support for around 30 companies during the second phase of the project, Reach implementation.



Along with engineering, the chemical, rubber and plastics industries play a leading role in Picardie, accounting for 17% and 16% respectively of the region's industrial workforce. With 17,200 employees and 150 companies, Picardie is the sixth-largest French region in terms of chemical industry employees. They work mainly in paint and dyestuff, detergent and cosmetics manufacture.

Why launch a project? Given the complexity of the EU regulation and the costs associated with implementing Reach, companies are uneasy and fearful of capitulating to the challenge or, if it were no longer possible to manufacture important products, of having to withdraw them from the market once and for all. That can have serious repercussions for downstream users. To keep negative consequences of Reach to a minimum and prepare for the regulation as well as possible, interested companies, especially small and

medium-sized chemical enterprises, are to receive support from UIC Picardie and the Aisne and Oise region of the French employers' federation MEDEF.

At the end of 2006 UIC Picardie, MEDEF Aisne and MEDEF Oise launched a collective project (Sustainable Management of Chemicals). It enables SMEs to optimise chemicals management and Reach fulfillment and to do so within an optimal time frame and at a modest outlay thanks to regional financial support from the Regional Directorate of Industry, Research and Environment (DRIRE) and Picardie's Regional Council.

To be optimally prepared for Reach implementation, the UIC has decided to prepare companies in a first phase (Lot 1) by setting up and optimising chemicals management. A keynote of this phase is taking stock of the substances handled as an interface to the Reach project (Lot 2) as described.

The aim of the project is to implement Reach practically and pragmatically. Companies involved in the project are to be enabled by optimising their own processes, learning the Reach contents and improving their data position to overcome any difficulties in implementation and by fulfilling the regulation's requirements at an early date to gain or extend a competitive edge. The entire project is scheduled to run for a period of two years, with individual projects planned to take about 30 days each.

Project Content

As a part of Lot 2, TÜV Rheinland BioTech was instructed to draw up a method and implement it in both collective and individual processes. The main project steps are:

- To sensitise the different Reach players
- To train a responsible Reach person for each participating company

- To implement Reach
- To provide GHS (Globally Harmonised System) training
- To implement the GHS

The aim of the first phase is to enable the participants to implement the legislation in their companies, to determine their position in the supply chain and to identify their resulting obligations under Reach. It is especially important for participants to understand the repercussions both for their companies and for companies that are upstream and downstream of them in the supply chain.

In a second step the procedure that Reach involves is explained. Detailed training in pre-registration, registration and approvals processes will enable companies to name and train their respective Reach experts.

While these activities are undertaken collectively, determining each company's Reach situation is an individual matter. Collaboration between a company's Reach expert and the TÜV Rheinland BioTech project staff will lead to practical and successful implementation of the new regulations. The aim of the project's second phase is to implement the GHS at the same time on the basis of the EU's REACH regulation.

Project Objective

The main objective of the project is to provide small and medium enterprises with the basics that they need to be able in future to carry out a full Reach registration themselves, to identify the repercussions and risks that companies face and to fulfil their GHS obligations.

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Dealing With Complex Registrations

Discerning Your Position Prior to Pre-Registration

With Reach coming into force in June, there is little time to develop strategies for registration of key chemicals as phase-in substances prior to the pre-registration deadline of 1 December 2008. This paper outlines the specific registration challenges facing more complex chemicals and highlights the fact that before you can pre-register, you have to know what it is that you want to register. The value of early consortium formation in addressing these issues is explained.

The pre-registration time-line for phase-in substances under Reach is particularly tight and some of the more common advice being offered by commentators is to pre-register "everything" and then sort out the real registration requirements in the period that follows. While this may be reasonable advice for simpler mono-constituent substances, such as monomers and other basic raw materials, it is less easy to translate into action for more complex chemistries such as multi-constituent substances and reaction products of unknown, variable or complex composition (UVCs). Even the naming of these types of substance can be problematic (fig.1).



Fig. 1: The Jungle of Terms

The European Chemical Agency that will be formed to handle all of these pre-registrations will not be operational until June 2008, and there will be little opportunity to obtain direct guidance from the Agency prior to the pre-registration window. Accordingly, companies looking to pre-register more complex chemistries must rely on other sources to ensure that they adopt the right approach. The Reach Implementation Plans (RIPs) provide an important set of guidance. However, there are two potential problems here. Firstly, most of the three series RIPs providing industry guidance are still in their final stages of development and cannot be fully relied upon as yet. Secondly, RIPs have no formal legal status and where the guidance ultimately proves to be in conflict with the 850 pages of Reach text, the latter will prevail.

The question therefore arises as to how a large number of disparate companies will come up with exactly the same descriptions of otherwise similar products. If they fail to do so, it is unlikely that the Agency will have the time or expertise to re-group pre-registrations as part of their function of establishing the Substance Information Exchange Fora (SIEFs). The consequence could therefore be that there are far more substances identified during the pre-registration phase than is appropriate, bearing in mind the chemistries covered.

The Naming and Grouping of Substances

The July 2006 draft of RIP 3.10 provides important guidance on the naming of substances of well-defined composition and substances of "poorly defined or variable composition." This treatment provides a valuable framework for developing appropriate nomenclature. However, the degree to which "additional identifiers" are used will influence the breadth of compositions covered by a single substance registration and related submissions. The use of CAS numbers as identifiers is notoriously unreliable in these areas of complex

composition and other approaches need to be taken (fig. 2).

In areas where complex chemistry is the norm (e.g. in the resins sector), it seems inevitable that the only real means of developing appropriate nomenclature and groupings of UVC will be through early co-ordination via trade associations or other engaged third parties. The Reach text itself provides no hard and fast rules for such nomenclature and its resulting groupings, so it may therefore be necessary to consult with the European Commission or other pre-Agency authorities to ascertain whether individual approaches are deemed as appropriate. Again, this will need to happen prior to the pre-registration window.

Handling of Exemptions

A further complication emerges when substances which might otherwise be registered are found to qualify for an exemption. The most obvious class of substances exempted from registration are polymers - Title I, Article 2 Clause 7 of the Reach text provides a full list. However, the text needs to be read carefully, since exemption from registration does not always lead to exemption from authorisation.

One of the particular complications for manufacturers of complex substances which may be close to the

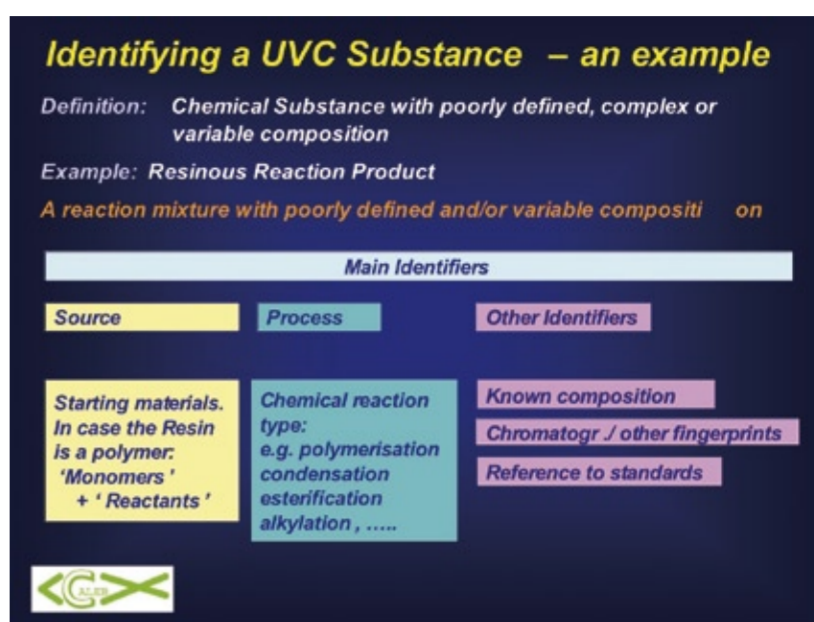


Fig. 2: Identifying a UVC Substance - an example

polymer/non-polymer divide, is that an evaluation needs to take place in each case to determine status. Once again, this analysis needs to occur prior to the decision to pre-register, since, if a substance is exempt from registration (i.e. a polymer) it does not require pre-registration. Even before this, there needs to be agreement on the means by which the 3+1 criteria are evaluated under the polymer definition. The common interpretation of GPC chromatograms could be particularly important (Fig. 3).

Even if your product does meet the criteria for polymer exemption, the burden of registration may not necessarily be over. An additional component of the legislation requires all manufacturers to register the monomers from which their polymers were derived if the monomer units so-produced represent > 2% of the total. There is, of course, no need to register your monomers, if your suppliers up the supply-chain have already done so. However, the basic problem with this provision is two-fold:

In most cases it will not be clear whether the monomer has been registered by your supplier until well after the pre-registration period is over. For most importers of polymers, their monomer suppliers may have no reason to register under Reach. Accordingly, their registration burden

deadline is only two years beyond the pre-registration deadline (i.e. 1 December 2010).

As the Reach text has developed, there has been particular confusion surrounding the use of the word 'consortium' and many have assumed that it has been replaced by the SIEF. However, Caleb is clear that an important distinction remains.

Consortia are fundamentally industry-initiated voluntary organisations that are established to actively review existing datasets and to develop strategies for filling gaps. SIEFs, on the other hand, are Agency-initiated bodies which are established solely to ensure that all pre-registrants are connected and that there is a formal mechanism for data exchange. Accordingly, a SIEF, by itself, is unlikely to lead to the level of cooperation required to ensure joint-submission, even though there are financial incentives in the form of reduced registration fees for those who submit jointly.

One of the key values in early consortium formation is that levels of knowledge, cooperation and trust are established at an early stage. With so little time available for registration, it is critical in practice to develop these understandings as soon as possible. SIEFs arrive far too late in the process to be of value in relationship-building

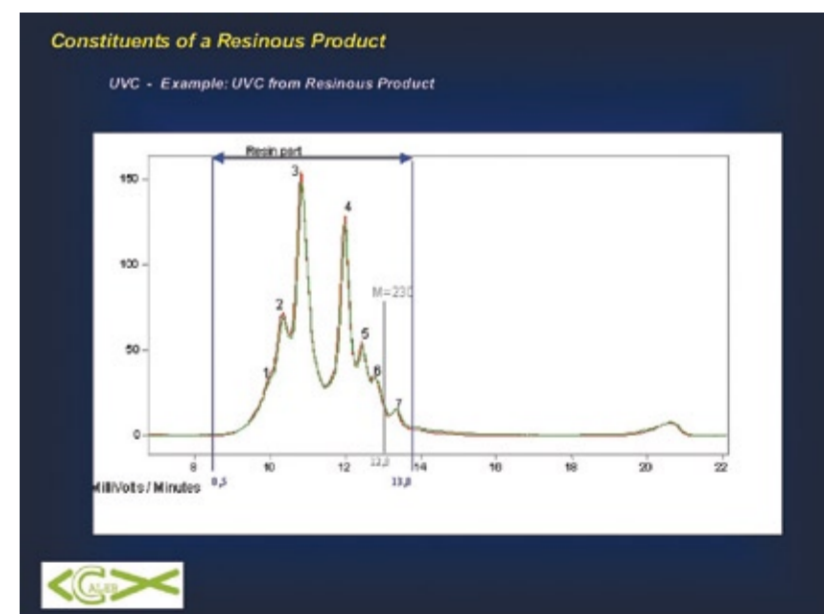


Fig. 3: A typical GPC Chromatogram

is likely to be larger than their EU-based competitors. The only defence against these scenarios is to pre-register all monomers used to ensure that inclusion is guaranteed as a phase-in substance.

The Need for Early Cooperation - The Role of Consortia

All of the above examples highlight the need for early cooperation within common-interest groups. The formation of the SIEFs after the closure of the pre-registration period will be too late to reach agreement on matters such as nomenclature, substance groupings and exemption determinations, particularly in areas where complex chemistries are involved.

Moreover, this is not to imply that early cooperation is a disadvantage for more simple substances. For large numbers of existing substances, the current toxicological database is far from complete. However, since each manufacturer/supplier is only likely to have one piece of the jigsaw, it will be important to compare notes early in the proceedings. This is particularly the case for those placing on the market over 1,000 t/y of that substance, since the registration

and co-operative planning for joint submission. Yet many companies have expressed concern over participating in such consortia for fear of falling foul of EC Competition Law.

To address this concern, the current draft of RIP 3.4 provides important guidance on the relationship between Reach and EC Competition Law and explains how such potential risks can be overcome. One of the major routes foreseen to compliance with both sets of legislation is the engagement of an appropriate third 'independent' person or trustee. This concept of consortium management is one that has already been tried and tested in similar global initiatives such as the U.S. Environmental Protection Agency High Production Volume (HPV) Challenge Program and the OECD SIDS Program and is now set to be a key determinant in the success of Reach.

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UNDER CONSTRUCTION

Basell: Spherizone Plant Expansion

Basell said it plans to implement a new debottlenecking and revamping project for its Spherizone process plant in Brindisi, Italy. As a result of the investment, the capacity of the unit will be increased by 50 kt, bringing the total to 235 kt/y. The revamped unit is expected to start up in the first quarter of 2009. This expansion follows a first debottlenecking project which was completed earlier this year.

www.basell.com

Borouge Signs Contracts for Expansion Project

Borouge formally signed contracts valued at approximately US-\$3.1 billion for Borouge 2, the major expansion project at the company's production facilities in Ruwais, Abu Dhabi in the United Arab Emirates. The contract with Tecnimont worth approximately US-\$1.855 billion, is for the construction of three new Borstar technology polyolefins units and associated material handling facilities, laboratory facilities and marine works. This is the largest supplier contract Borouge has signed since its inception as a company in 1998 and is awarded on a lump sum turnkey basis.

The contract with Tecnicas Reunidas, worth an estimated value of US-\$1.234 billion, is for the construction of the offsite and utility facilities for the expanded plant, and is awarded on a convertible lump sum turnkey basis. Preliminary work will begin immediately and both contracts are scheduled to be completed in 2010.

www.borouge.com

Uhde: Biggest Contract in Company History

Egyptian Agrium Nitrogen Products (EAgrium) has commissioned Uhde to build a turnkey fertiliser complex in Damietta, some 160 km north-east of Cairo. EAgrium is investing some US-\$1.2 billion in the new fertiliser complex, which will comprise two 1,200 t/d ammonia plants and two urea plants with respective production capacities of 1,925 t/d. The plant complex will also include various offsite and related utility systems, product handling and storage facilities. Completion is scheduled for 2010.

www.uhde.biz

Degussa Expands Rigid Foam Production

Degussa is planning to build a production plant for the rigid polymethacrylimide foam at its largest U.S. site in Mobile, Alabama. The new plant comprises an investment volume of about US-\$10 million and is scheduled to commence operation in mid-2008. Inspec Foams, a wholly owned subsidiary of Degussa, will manufacture Rohacell in Mobile to the same high standard of quality as in Degussa's first and, until now, only plant in Darmstadt, Germany.

www.degussa.com

Akzo Nobel Investing €50 Million in Brazil

Akzo Nobel's pulp and paper chemicals business, Eka Chemicals, has signed an agreement to supply, store and handle all chemicals for a greenfield pulp mill being built in Três Lagoas, Brazil. The new mill – known as the Horizonte Project – will have an annual production capacity of 1,250,000 t of pulp, and was recently transferred to Votorantim Celulose e Papel (VCP) as part of an asset exchange.

Under the terms of the agreement, Eka Chemicals will establish a chemical island at the new site, mainly for the production of chlorine dioxide. In addition, Akzo Nobel's pulp and paper chemicals business will also expand its existing site at Jundiá (São Paulo) where a new production line will produce 30,000 tons of sodium chlorate a year, most of which will be destined for the same Três Lagoas mill. The total investment for Akzo Nobel amounts to around €50 million.

Start up of the new mill – which will use wood exclusively from high yield eucalyptus plantations – is expected in 2009, with work on the company's new facility due to start immediately.

www.eka.com

Honeywell: Automation and Control Design Contract

Honeywell has been awarded an automation and control design contract for the Nuon Magnum plant, a 1,200 megawatt coal/biomass and natural gas power station planned in Eemshaven, the Netherlands. The project will begin with a study phase, followed by an Engineering Procurement and Construction (EPC) phase. For the EPC phase, Honeywell has proposed implementing Experion PKS together with its Safety Manager system and an operator training simulator, as well as providing related engineering services.

www.honeywell.com

Implementing Single-use Technologies

Strategies for Optimising Today's Increasingly Disposable Processing Environments, Part 2

Biopharmaceutical companies are no longer asking why they should adopt disposable processing methods, but rather what new processes can be made disposable. Disposable technologies are not only available for an increasing range of applications, but they are also expanding from stand-alone devices to multi-component systems. With this growing trend comes a greater number of benefits and implementation considerations. In Part 1 the main topics were efficient facility design, measuring cost savings and new innovations in disposable processing.

For all their advantages, single-use technologies do pose some challenges in the area of biocompatibility. While disposable products are constructed of biologically inert materials with low extractables, even trace amounts may need to be addressed in specific cases. Likewise, drug makers run the risk of losing product to the surface of the device through non-specific adsorption. Because extractables and adsorption tests must be performed for each product and application, they can be very time and labour-intensive. If there is a last minute change in raw materials, repeating such tests could cause serious program delays.

Drug manufacturers should look for USP Class VI tested disposable products with low extractables ideally, but be familiar with the lower classifications as well. Materials such as polyethersulfone (PES), polyvinylidene fluoride (PVDF), nylon and stabilized polypropylene are ideally suited for disposable applications because they exhibit low extractables and can be pre-sterilized by gamma irradiation. An example of a disposable filter capsule that demonstrates low extractables is the Pall Kleenpak Nova capsule. Extractables were measured for the empty 20 inch filter capsule and were found to be less than 1 mg in water and less than 15 mg in a 96% Ethanol solution.

Capacity Limitations... Size Doesn't Always Matter

Bag strength is a limitation across all disposable applications that require fluid to be collected into a non-rigid plastic medium. Process bags are reported to be limited to 2,000-liter volumes and 5,000-liters for storage vessels. There is also a certain discomfort level with disposable bags as processes are scaled up to larger volumes, because there is a greater risk that the material will fail due to physical limitations.

However, what disposable technologies lack in size, they make up for in volumetric throughput and productivity. Many disposable technologies have been shown to outperform their stainless steel coun-



terparts, enabling manufacturers to use smaller batches to achieve the same quantity/time ratio. Patient-specific therapies, either cellular or protein-based, gene and viral therapy, and radio-immunotherapy, can all be prepared in small batches ideally processed with single-use technologies. The success of these therapies will be an important factor in driving wider scale adoption of disposables.

Disposal of Disposables vs. Solvent Waste

Although it is commonly perceived that disposable products have a negative environmental impact, the solvents used to clean stainless equipment can have their issues as well. The need to reduce solvent waste is therefore another factor driving disposables usage, especially as processes are scaled up. In a study comparing a disposables model to a fixed vessel model of the same utility system size, approximately 100 disposable plastic bags plus associated tubing per batch resulted in approximately 200 kg of plastic waste. The waste can either be incinerated or go into a landfill.

In the case of a fixed vessel model, 141 tons of Water for Injection is generated for the CIP process from 204 tons of purified water. In addition to that cost, about 4.2 tons of dilute CIP chemicals are needed (equivalent to about 100l of 40 percent caustic and 5l of 80 percent phosphoric acid). These additional materials will require treatment before discharge.

While this study is by no means comprehensive, it does show that waste management is a non-trivial exercise when considering either scenario. Also, while cleaning chemicals such as acids and bases are not necessarily difficult to dispose of or hazardous, other chemicals may require special handling and cleaning chemical residues may even be damaging to equipment.

One of the difficulties in trying to assess the cost of waste removal for disposables vs. cleaning chemicals is that it is largely dependant on how the waste is treated. In general, solvent waste is more costly to dispose of than solid waste. With solid waste, costs can vary based on whether it is incinerated or sent to a landfill. The municipality and regional regulations by which the waste must be handled will largely determine cost, but this still



Single-use Kleenpak Nova capsules are available in a range of sizes and configurations.

offers an economy over liquid waste disposal.

Reliance On Suppliers

Reliance on suppliers must factor into the equation when considering whether to adopt or expand disposable operations. This becomes even more of an issue as operations grow increasingly disposable. The biggest concerns in this area are managing inventories and deliveries. Will quality be consistent in terms of sterility and performance, and will both the product and supplier be around in the years to come? Given the amount of time dedicated to process development, changing product suppliers at any point late in the program could be prohibitive. For this reason it is critical that biopharmaceutical manufacturers carefully audit and select an established, reputable supplier that is known for consistent high quality and performance.

Managing Supply and Recurring Costs

Managing the supply of disposable products may pose a storage dilemma for smaller companies, and even some larger ones depending on warehouse capacity. To address this issue, suppliers are moving towards "just in time delivery" at the

vessel systems, which include cleaning and cleaning validation, sterilization, equipment engineering and installation, utility usage, time and labor to service, and larger space requirements. By contrast, the cost of disposables continues to drop as technologies advance and the installed base of users grows.

Answering a Universe of Application Needs

Disposable products have been proven to speed and simplify complicated biopharmaceutical production processes, such as those used to manufacture conjugate vaccines. Advanced disposable technologies have been demonstrated to significantly enhance the performance of large molecule applications. As with their use in early development and small batch applications, single-use technologies offer perhaps the most practical solution for low-cost drug manufacturing operations. Similarly, demand for low-cost vaccines, including those used for biodefense, can be cost-effectively met through the use of disposable processing methods.

In the same way that many developing countries bypassed fiber optic network installations in favor of wireless technologies, many pharmaceutical

Table 1: At-A-Glance Comparison of Disposable vs. Fixed Vessel Systems

Considerations	Single-use	Stainless Steel
Capital Costs	Minimal	Significant
Cleaning	No	Yes
Cleaning and steaming Validation	No	Yes
Labor	Minimal	Significant
Volume Limitation	Yes <10,000 liters	No
Process/Technology Transfer	Simple	Complex
Utility Usage	Reduced	High
Extractables/Adsorption	To be determined	The bulk of the extractables comes from the high area of the filter membrane – so extractables/adsorption is essentially the same for stainless steel and disposables.
Time to Ramp Up Manufacturing	Fast	Slow
Carry-over residue from cleaning	No	Yes
Risk of Operator Error	Reduced	Higher
Risk of Cross-contamination	Very low	Higher
Footprint	Small	Large
Recurring Costs	Materials, reduced utilities, labor and time	Cleaning chemicals, utilities, labor, time
Waste	Yes, but less than solvent waste	High solvent waste from cleaning chemicals and WFI
Pre-sterilization	Yes	No
Translucency of components	Yes	No
Need for cleanrooms	Reduced	High

same time that manufacturers are striving to optimize their own supply chain operations. The size and experience of the supplier also comes into play where customer service and delivery are concerned. Learning about a larger supplier's track record on service and delivery will be easier than gauging that of a smaller supplier's.

Although disposables have a perceived higher cost of materials per batch, they do not even come close to the greater expenses associated with fixed

companies are turning to the cost-effective plastic factory and disposable systems suppliers to avoid building expensive hard-piped plants to serve markets in developing countries.

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An Ancient Material in a New Light

A Closer Look at Vitreous Enamel and Glass Lined Equipment

Enamelling has a very long history. Since the discovery of enamel about 3,500 years ago, people have been looking for the best coating material, with the aim of providing good aesthetics, artistic decoration and the best possible protection of substrates through coating. The development of enamel in art over many years has to a large extent been expanded into industrial applications in the past 250 years. Today, you can still find numerous enamelled objects in good condition which have withstood long-term use and atmospheric conditions over many years.

Chemists, physicists and materials engineers were quick to discover the advantages of enamel coating and understood how to exploit the unique properties of enamel in the way they had with glass. The size of technical glass products (e.g. vessels, pipes) and the working pressure that could be used was limited and, with the development of industrial chemistry in the mid 19th century, the first enamelled vessels were constructed. At that time, vessels were made of cast iron and the enamel was dusted on when the iron was red-hot.

Perhaps due to its ancient history, enamelling is seen as an old material or an outdated technology. However, this opinion is totally incorrect, because enamelled vessels and reactor's accessories still have advantages that cannot be obtained elsewhere. A differentiation should perhaps be made within the overarching term of "enamel" and a separation should be made between artistic objects and high-quality technical enamels. That's why it's preferable to name the enamel used for anticorrosion on vessels glass-lined technical equipment or glass-lining.

In the 1950s, the chemical and pharmaceutical industry needed ever larger vessels or reactors for the expansion of production capacity. The limits of vessel size when using cast iron was a capacity of 6 m³. In order to be able to construct larger vessels, there was a changeover from cast iron to welded-steel construction. At the same time, the properties of enamel were also significantly improved and thus the service life of the vessels was significantly increased. This era can be considered as the infancy of glass-lined technical equipment for use in demanding process in the chemical and pharmaceutical industries. The manufacturers of glass-lined vessels then invested heavily in the research and development of new application technologies using glass-lined steel products. The result of these efforts are today's high-quality glass-lined technical equipment.

In order to demonstrate the advance that was made in the 50s, two examples will be used (see also table 1):

The rate of corrosion (weight losses) of cast enamel with 20% hydrochloric acid in weight at a temperature of 108°C was improved from 3.1 g/m²/24h in 1950 to 1.1 g/m²/24h with glass-lined steel in 1957. Today's glass-lined steel (2005) has a corrosion rate of 0.14 g/m²/24h, i.e. the chemical resistance of glass-lined technical equipment has been increased by a factor of 8 during this 50 years.

For caustic soda, i.e. an aqueous, strongly alkaline solution of sodium hydroxide (NaOH), the advances are



even more apparent. At a pH value of 14 and a temperature of 80°C, enamel resistance has been improved by a factor of 13. Table 1 provides a summary of some of the properties of technical enamel.

consists of corrosion starting in ion exchange between the alkali metal ions of the enamel (Li+, Na+, K+) and the H+ protons (or H₃O+ hydronium ions) of the acids. In the following, there is surface decomposition of the

phosphoric acid the speed of corrosion increases with the acid concentration: 10% w H₃PO₄ at 163°C leads to enamel corrosion of 0.1 mm/a; with 70% H₃PO₄, this value is obtained at 112°C.

Organic monocarboxylic acids attack enamel only slightly. With 20% acetic acid, the corrosion rate of 0.1 mm/a is only reached at a temperature of 180°C. As the glass-lining on steel is generally about 1 mm thick, glass-lined vessels have a very long service life.

In alkalis, the vitreous network of the enamel is continually destroyed as a result of decomposition of the siloxane bonds (Si-O-Si bonds) by OH ions. This means that the permitted corrosion temperature in alkalis is lower than for acids, and the temperature of the reaction media in the reactors has to be well controlled, as an increase in temperature of 10 K results in a doubling of the corrosion speed of the enamel.

The use of additives to the reacting substance can inhibit the corrosion of enamel permitting the use of glass-lined equipment in more severe conditions. In the case of an acidic medium, some 10 to several 100 ppm of silicon dioxide can effectively protect the enamel, because the additive substantially reduces the corrosion in the liquid. In the case of alkaline reaction media, some 100 ppm of calcium, aluminium or zinc compounds can work as effective additives.

The alkali resistance of glass-lined technical equipment can also be significantly increased on the part of the enamel through certain enamel components (ZrO₂), as the layers of reaction product formed through the corrosion medium inhibit further corrosion of the enamel surface.

What must be stressed in particular is the high corrosion resistance of glass-lined technical equipment against organic, neutral media (e.g. solvents), which is often seen as a decisive advantage for technical enamel in comparison to organic plastics as possible alternative materials to enamel.

Mechanical Resistance

As enamel is a material similar to glass, in addition to its outstanding properties it also has corresponding features, namely brittleness (low impact resistance) and low tensile strength. The latter features are often - unjustifiably - overstressed by potential users who do not know enamel well, i.e. a poor impression is given.

During cooling down after the firing process for glass-lining, the enamel layer is placed under com-

pression through the steel substrate, which is important for the overall properties of the composite material, because in enamel, as in glass, the compressive strength far exceeds the tensile strength. Under mechanical loads (deformation, impact), these compressive strains must first be balanced by relevant extension effects before the enamel is placed under - unfavourable - tensile stress.

Modern glass-lined technical equipment has very good resistance to impact and wear as well as a good resistance to thermal shocks.

New Developments in Glass-lined Equipment for Chemical Processes

Glass-lined equipment is used in many ways in the chemical, fine chemical and pharmaceutical industries. However, the classic (old) type of reactors are not always suitable for the wide range of processes, the specific problems those provide, and the objectives of increased productivity and improved quality. However, relevant advances have been made by the manufacturers of glass-lined equipments, and today parts can be enamelled that would not even have been considered 15 years ago.

Now a complete range of agitated reactors are offered, classified according to users needs and their processes. From small 6 litre laboratory vessels up to 110m³ reactors the chemical industries will find a selection of equipment for different pressure and temperature ranges, as well as many constructional variants at their disposal. 60m³ plug free reactors for pressure of 30 bar with a weight of 75 tonnes and with 60 mm steel thickness can be provided today.

Stainless steel reactors can also be glass lined. These reactors are used for low temperature processes or in the pharmaceutical industry, where they are installed in clean rooms. Glass-lined stainless steel vessels are available in all surface finishes.

The risk of destroying the enamel through electrostatic charge and discharge can be avoided through the use of electrically conductive enamel, where creepage current increases rapidly even at low voltage and thus prevents an increase in voltage, which can often be the cause of enamel destruction.

Special developments in vessel parts (e.g. block-flanges) or accessories such as special valves, manhole cover with fused glass, glass-lined heat exchangers or dimple plates for heating and cooling, have significant advantages compared to old designs.

Glass-lined Technical Equipment and Other Materials

Glass-lined steel has proven itself to be an outstanding material that can be used under a wide variety of operating and load conditions. In particular, vitreous enamel is a modern material with a variety of uses in the chemical and pharmaceutical industries.

Examples of the universal usability of enamel can be seen from a comparison with other materials in table 2.

The only metal material comparable to glass-lined technical equipment with reference to the area of application and from a corrosion point of view is tantalum, the use of which is associated with significant disadvantages. In particular, these are the material costs of the tantalum raw material and the costs of the welding procedure, which always has to be carried out in a controlled atmosphere. In addition, tantalum is made brittle by hydrogen, i.e. the wide range of hydrogenation and dehydrogenation reactions can only be carried out to a limited extent using tantalum plated reactors.

Other metal materials can only be used in very restricted areas of application, for example stainless steels and alloys, which are currently experiencing very steep price increases of +80% between August 2004 and August 2006) and their components (primarily Ni, Cr and Mo) which catalyse unwanted secondary reactions. Even the expensive metals like titanium or zirconium are only alternative materials for enamel in limited areas of application.

The smooth surface which is an important property of enamel (fire gloss, fire polish) can only be achieved with a great deal of effort using alternative metal materials. The associated benefit of glass-lined steel comes into its own particularly in the pharmaceutical industry, where an ability to thoroughly clean reactors and their accessories is demanded, or in the chemical industry in polymerisation processes in which vessel surfaces have to possess non-stick properties (as protection against baking on).

Organic plastics as an alternative to enamel only have a very limited application relevance in the construction of chemical or pharmaceutical apparatus, primarily through their low temperature resistance. Only PTFE has a relatively high thermal resistance in addition to good chemical resistance. In general, organic plastics are susceptible to diffusion and are only minimally gas tight. Steel substrates coated with plastics have the disadvantage that films made from organic material are not vacuum safe (separation from substrate).

Vessels and equipment parts made from glass can be an alternative to the composite of glass-lined steel with regard to chemical and thermal resistance, but here too parameter properties that are decisive in the process are often not met (heating and cooling conditions, limited tensile strength and elasticity), so glass equipments can only be introduced for small dimensions.

		1955	1957	1964	1972	2005	Factor
		Iron	Steel	Steel	Steel	Steel	
HCl 20%	ΔG	3,1	1,1	0,7	0,3	0,14	7,8
108°C							
NaOH	ΔG	5,5	9,5	2,6	0,9	0,7	13,6
1N 80°C							
Thermal shocks (a)	ΔT	85°C	130°C	170°C	190°C	220°C	1,7

ΔG = Weight losses in g/m²/24 h

(a) Thermal shocks temperature on glass-lined plates according to DIN ISO 13807

Table 1: Development of properties in glass-lined technical equipment (the thermal shock values refer to flat samples in accordance with EN 13807).

Chemical Resistance

In general, glass-lined technical equipment have good resistance to acids, indeed at any acid concentration up to comparatively high temperatures. The minimum resistance values of enamels lie in the acid concentration range of 20–30%w for most mineral acids. The mechanism of enamel corrosion by acids

silicate bonds of the enamel with the formation of a corrosion-impeding layer of silica gel. For mineral acids (inorganic acids), corrosion rates are 0.1 mm/a at temperatures of 120–140°C at the most unfavourable acid concentration. Hydrofluoric acids, however, attack standard technical enamel at any temperature. The concentration should not exceed 20 ppm. Exceptionally, with

	OXIDIZING	REDUCING
WITH CHLORIDE IONS	TECHNICAL VITREOUS ENAMEL	
	TANTALUM	
	PTFE - FLUOROCARBONS	
		ZIRCONIUM
		HASTELLOY B
		TITANIUM - PALLADIUM
		TITANIUM
		HASTELLOY C
		MONEL
		HASTELLOY F
NO CHLORIDE IONS	ZIRCONIUM	HASTELLOY C
		MONEL
		INCONEL
		18/8 Cr-Ni STEEL

Table 2: Chemical resistance of glass-lined technical equipment and alternative materials under different conditions.

BASF Forms Exclusive Partnership with Agion

Agion Technologies has formed a multi-year, exclusive partnership with BASF to develop and commercialise styrene copolymers, including BASF's Luran S product line, that will feature Agion's naturally-safe, antimicrobial technology. BASF's copolymers are used in a variety of markets such as household appliances, automotive, cosmetic packaging, building and construction, and consumer electronics. The partnership is initially focusing on the European market, but a global rollout is envisioned in the near future.

The incorporation of Agion antimicrobial technology into plastics inhibits microbial growth on the surface of products. The technology provides continuous protection from microbes by releasing silver ions to the surface of the product at a slow and steady rate. This allows for the long-lasting protection of the product against the damaging effects of microbial growth. BASF's Luran S is an all-purpose plastic that offers UV stability, good chemical resistance, stability and thermal

shock resistance. Luran S is used in a variety of applications and can be found in many different final products including sanitary equipment, building & construction, appliances, computer/communication equipment, cosmetic packaging and recreational equipment.

www.basf.com
www.agion-tech.com

Borealis: €113 Million Net Profit

Borealis has announced a net profit of €113 million for the first quarter of 2007, a 13% increase over the previous quarter. Net interest-bearing debt was reduced by €61 million during the quarter, and the gearing ratio decreased from 34% in the fourth quarter of 2006 to 30%. The company credited the performance to strong market conditions, especially in the infrastructure sector, as well as by key market sales growth and operational excellence.

During the quarter, Borealis announced that it will invest

€370 million in its Stenungsund, Sweden, operation to supply the growing wire and cable market, and confirmed that it is also on track to complete the 330,000 t/y expansion of its polypropylene facilities in Germany based on Borstar technology by the end of this year.

In April, Borouge, the company's joint venture with the Abu Dhabi National Oil Company, awarded a further US-\$3 billion in contracts for Borouge 2, the major expansion project in Ruwais, Abu Dhabi, in the

United Arab Emirates, that will triple annual production capacity to two million tonnes of polyolefins.

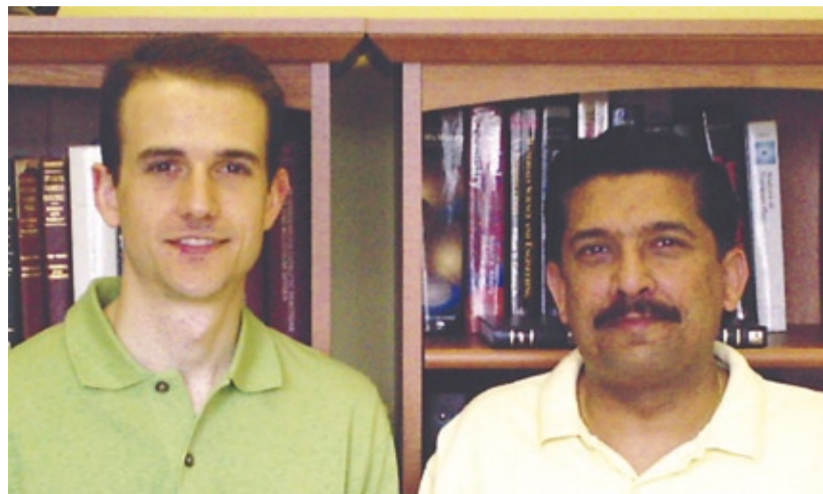
Looking ahead, Borealis Chief Executive John Taylor said, "We will continue to strengthen our European asset base by driving cost competitiveness throughout the value chain. In addition, the expansion of Borouge will substantially develop our position in the high growth markets of the Middle East and Asia Pacific."

www.borealisgroup.com

Cutting Styrene Monomer Production Costs

A New Way of Formulation

Exelus, a U.S.-based developer and licensor of chemical process technologies has recently achieved breakthroughs in a new chemical route to styrene monomer that will cut feedstock costs by 30% compared to the conventional EB-based process.



James Nehlsen on left, Mitrajit Mukherjee on right. Mr. Mukherjee is also the president and founder of Exelus.

Styrene monomer (SM) is a large volume commodity chemical used in the production of plastics and synthetic rubber for numerous applications. Current global styrene demand is about 25 million metric tons per year. Styrene production is currently based primarily on two technologies, the ethylbenzene (EB) dehydrogenation route and the PO-SM process. In the more common EB-based route, benzene and ethylene are combined to make ethylbenzene, which is dehydrogenated to styrene. The PO-SM route produces styrene as a co-product with propylene oxide. Recently, the high cost of petrochemical feedstocks, including benzene, have led to the cancellation of several planned styrene expansions as the economics of the EB route have become less favourable, although the high price of propylene oxide is currently supporting the PO-SM technology.

The EB-based styrene technology is over 70 years old and has not changed

significantly for over 30 years. In addition to the problems caused by high feedstock cost, styrene production consumes tremendous amounts of energy – about ten times the average of similar chemicals. The large energy usage is a direct result of the fundamental process chemistry and is becoming a liability as energy costs

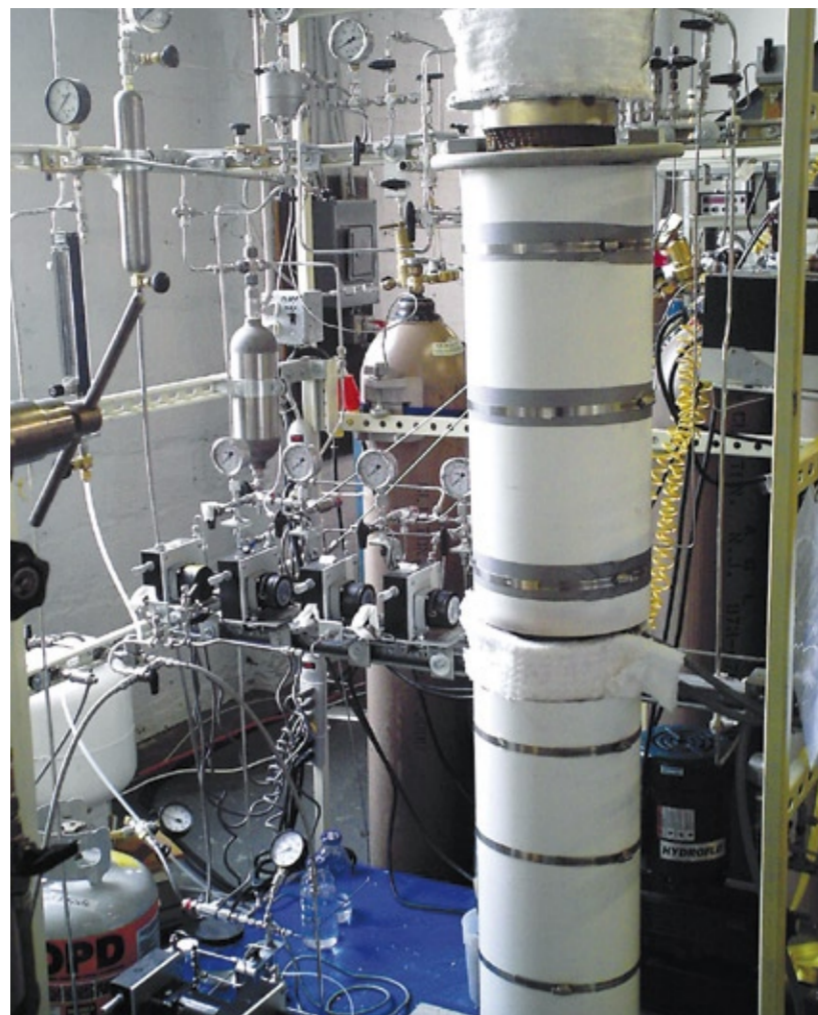
continue to rise. Styrene production is also a major contributor to methane emissions, a potent greenhouse gas. As a mature technology, no significant improvements are likely.

For a new technology to offer a step change in performance and economic benefit, it must move away from the conventional chemistry. To this end, Exelus, (Livingston, New Jersey, USA) is developing ExSyM (Exelus Styrene Monomer Technology), a completely new SM technology based on unique chemistry that offers the potential for dramatic cost savings.

The ExSyM technology potentially offers considerable benefits over conventional SM technologies including:

- Lower temperature operation
- Lower capital cost
- Significantly lower feedstock cost
- Low utility consumption

The ExSyM process is based on a different chemical route to styrene that avoids the need for difficult and expensive dehydrogenation. This



alternate route uses the side-chain alkylation of toluene with methanol (figure 1). Styrene is formed directly in this reaction, so no dehydrogenation is required. The energy that must be supplied to the reaction is reduced by half over that for the conventional route.

Changing the feedstocks from benzene and ethylene to toluene and methanol reduces feedstock costs by about 30% and greatly reduces the energy requirements of the process. These savings can reduce production costs by 25–35% over the conventional technology, leading to shut-down economics.

For this reason, this route to styrene has been studied by industrial and academic investigators for over 30 years. The rapid decomposition of

methanol has been the primary cause of low styrene yield obtained in all previous studies. Also, the formation of EB rather than styrene has been a significant hurdle. Reaction yields have been typically limited to less than 10% to styrene making the process uneconomical.

Researchers at Exelus have discovered techniques to greatly improve the yields to styrene and have successfully demonstrated styrene yields as high as 60% and overall yields of 80% in bench-scale studies. These high yields are sufficient to produce considerable savings for producers. Exelus is currently applying these techniques to the development of a commercial process.

One of the key ingredients in achieving high yields is a break-

through catalyst designed to produce high SM yields. "Producing styrene rather than EB is vital to the economics of this process," says Dr. James Nehlsen, one of the researchers developing the ExSyM process. "If the catalyst makes too much EB, then a dehydrogenation plant is still required and the process is no longer competitive with the conventional technology. We have designed catalysts that produce up to a 10:1 ratio of styrene to EB."

The unique solid catalyst is safe, non-corrosive, and chemically sta-

Table 1: Expected Process Parameters

Feedstock Consumption	
Toluene	0.89 kg/kg SM
Methanol	0.39 kg/kg SM
Process Conditions	
Space Velocity	5 hr ⁻¹
Temperature	400–425 °C
Pressure	1 atm

ble. The ExSyM catalyst permits the development of a simple, fixed-bed process for styrene production. A key goal in the development of the ExSyM process is to ensure that the process can be retrofitted into existing EB/SM plants with minimal modification. Some of the characteristics of this process are:

Lower Temperature Operation – The reaction occurs around 400 °C, compared to >600 °C required for conventional SM technologies. This means that the heat of reaction is added at a lower, and therefore more efficient, temperature.

Lower Capital Cost – the milder reaction conditions reduce the capital cost requirements significantly. The conventional SM process requires large amounts of steam generated at near 900 °C to provide the heat of reaction. Eliminating this requirement reduces metallurgy costs. Also eliminated is the entire EB synthesis plant.

Reduced Feedstock Cost – the economics of styrene production are completely altered using this new synthesis route. Benzene (\$940/mt) and ethylene (\$1100/mt) are replaced by toluene (\$650/mt) and methanol (\$350/mt). This change results in a feedstock savings of \$340/mt of styrene produced assuming 85% selectivity.

Low Utility Consumption – The hydrogen co-product is easily recovered and burned to provide most of the energy required to run the process, greatly reducing carbon emissions.

A preliminary process flow diagram for the conceptual process is shown in Figure 2. A fired heater,

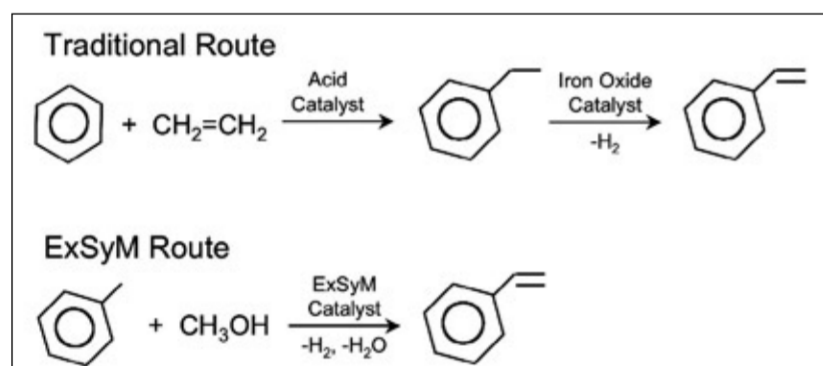


Fig. 1: New route to Styrene Monomer

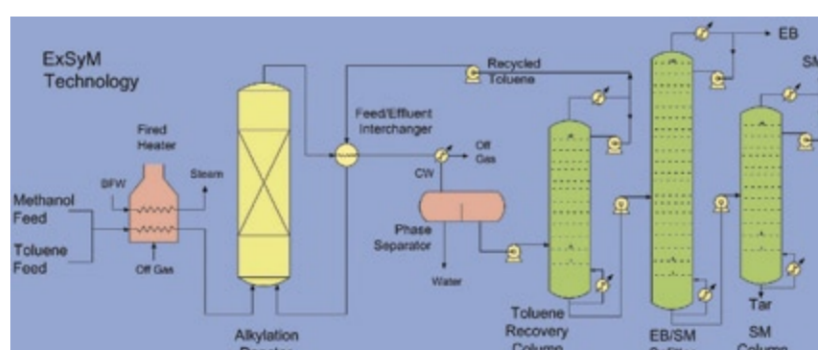


Fig. 2: Conceptual process flow diagram for the ExSyM process

Characteristics Of Chinese GMP

Comparison of Chinese GMP and ICH Q7

In recent years, the pharmaceutical manufacturers in China have been legally obligated to implement GMP (good manufacturing practice) in order to assure the quality of pharmaceutical products. For the foreign pharmaceutical companies entering the Chinese market, it is important to be aware of the characteristics of Chinese GMP and the differences between Chinese GMP and the international GMP – ICH Q7 – when materials sourcing.

The current Chinese GMP was amended and issued as regulation by the State Foods and Drug Administration (SFDA) of China in 1998. It includes 14 chapters and 88 articles, covering organization and personnel; building and facilities; equipment; materials; hygiene and sanitation; validation; documentation; production management; quality management; production distribution and recall; complaints and adverse reactions report; and self-inspections. In addition, it encompasses six appendices, which are supplementary provisions for the aseptic drugs, non-aseptic drugs,

APIs, biological product, radioactive products as well as Chinese medicine.

Based on Chinese GMP, criteria for GMP Certification and Inspection were issued in draft form by SFDA in 2006. There are 268 inspection items in the criteria in total, including 115 critical items and 153 non-critical items. The SFDA requires all pharmaceutical companies to gain GMP certification for the production of pharmaceuticals (e.g., APIs, finished products). GMP certification is based on assessment of on-site inspection results (table 1) and is valid for five years. After the validity period has transpired, a full inspection will be conducted by SFDA to check whether the drugs manufacture still meets the GMP requirements.

In order to guide the Chinese pharmaceutical companies to carry out validation activities, the "Guide for the Validation of Drug Production" was published by SFDA in 2003 in Chinese, which was written by experts from various major Chinese pharmaceutical companies. It focuses mainly on theories, methods, and procedures as well as examples of validation, including validation of analytical methods, cleaning valida-

Tab. 1: Criteria for the GMP Certification and Inspection*

Deficiencies found during inspection		Results
Number of critical items	Percentage of non-critical items	
0	≤ 20%	Qualified for the GMP certification
0	21–40%	Corrective actions should be taken within 6 months and inspection will be done again
≤ 3	≤ 20%	
0	> 40%	
≤ 3	> 20%	Not qualified for the GMP certification
> 3		

* Source: SFDA – Criteria for the GMP Certification and Inspection

tion as well as validation of computerized systems. However, it should be stressed that this book is only a technical reference book for the validation of drugs production and is not legally required by SFDA.

Scope and GMP Starting Point

The ICH Q7 applies only to the manufacture of APIs for use in human drug products. In comparison, Chinese GMP is applicable to the manufacture of both finished products and active pharmaceutical ingredients. An API starting material is defined and GMP starting point is specified in the ICH Q7 guideline. In Chinese GMP, explicit definitions with regard to starting material and GMP starting point are not given. The only requirement is

that the batch production records of APIs should be started at the latest from the refinement of crude product, which could be similar to the GMP starting point.

According to the ICH Q7, less stringent in-process controls may be appropriate in early processing steps, whereas tighter controls may be appropriate for later processing steps (e.g., isolation and purification steps). In comparison, Chinese GMP focuses mainly on the last production process steps from the crystallization, which are required to be executed in clean rooms.

Personnel

The ICH Q7 requires that there should be an adequate number of personnel

qualified by appropriate education, training and/or experience to perform and supervise the production of intermediates and APIs. In Chinese GMP, there are more detailed requirements on the education of the responsible persons of company management, production management, and quality management. Those persons should have at a minimum a college degree of medicine, pharmaceuticals or related sciences. Training for personnel engaged in production and quality control of drugs is needed according to Chinese GMP, but there is no requirement on the periodical assessment of the effectiveness of training, although training examination is required.

Concerning the personnel hygiene, Chinese GMP requires additionally that health files of drug production personnel be established. For production personnel with direct contact with drugs, a physical examination should be at least annually conducted. In general, Chinese GMP focuses

on the process off-gas, heats the feed to the reactor. A feed-effluent exchanger cools the effluent, which is condensed and settled to remove the water product. The organic phase is then sent to the distillation train to produce purified SM and recover the excess toluene.

The distillation train is the same as for a conventional SM plant, where the toluene recovery column can be borrowed from the EB plant. Since the reaction conditions are milder than those in a conventional process, the styrene reactors and fired heater can likely be reused as well.

The expected process parameters, based on bench-scale testing, are given in table 1.

The ExSyM process has been tested in bench-scale reactors. Catalyst stability has been proven for 50 hours of continuous operation. Process development is continuing. Small-scale piloting, including a 1000-hour process performance test, is expected to begin in Summer 2007.

"We have received considerable interest from industry-leading companies regarding the ExSyM process," says Mitrajit Mukherjee, the president of Exelus. The financial difficulties facing the styrene industry as a whole are making many producers consider alternative approaches. The potential savings from this new process are simply too large to ignore."

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Characteristics of Chinese GMP

Comparison of Chinese GMP and ICH Q7

Continued Page 11

more on personnel hygiene in clean rooms.

Quality Management

According to ICH Q7, there should be an effective system for managing quality that encompasses the organisational structure, procedures, processes and resources and necessary activities to ensure that products will meet the intended specifications for quality and purity. For this purpose, the responsibilities of the quality unit and responsibility for production activities are specified, and internal audits and product quality reviews are required. Moreover, in this quality management system, the quality unit (QU) must be independent from the production unit, fulfilling both quality assurance (QA) and quality control (QC) responsibilities.

In Chinese GMP, there is a quality management department responsible for quality control and testing of drugs. The quality management department should be led directly by the responsible management of the company. The responsible persons of the quality management department and the production management department should be independent of each other. Generally, the quality management department of Chinese GMP has limited responsibilities in comparison with the ICH Q7, focusing mainly on the activities related to product quality testing / analysis.

ICH Q7 requires that a product quality review to verify the consistency of process should be annually conducted and adequate corrective actions should be taken (see 2.50). In comparison, a similar requirement such as product quality review cannot be found in Chinese GMP.

Buildings And Facilities

According to Chinese GMP, pharmaceutical companies should be located in a clean environment, e.g., the location/site with less industrial pollution. The general layout of the production, administration, living, and ancillary areas should be appropriately arranged. Whether buildings are appropriately located in accordance with the production process flow and the required air cleanliness classes, is considered to be one of the critical items during the SFDA's on-site inspection for GMP certification. In comparison, similar requirements are not described in the ICH Q7.

In Chinese GMP, it is not explicitly described that defined areas or other control systems for some activities (e.g., sampling, quarantine, laboratory operations, etc.) are to be considered during the design and construction of buildings and facilities.

There are adequate requirements for clean rooms in Chinese GMP. However, for the classification of air cleanliness grade, there are differences between Chinese GMP and international GMP. For example, the air cleanliness class of 300,000 in Chinese GMP is an unknown class for foreign countries (table 2).

According to Chinese GMP, the last production steps of APIs (e.g., refinements, drying, packaging) should be conducted in clean rooms of not lower than class 300,000. For APIs with legal microbiological control requirements, they should be processed in clean rooms of class 10,000 (even in class 100 if necessary). In contrast, such kinds of requirement are not described in the ICH Q7.

Material Management

According to Chinese GMP, the management systems for purchase, storage, dispatching, and use of materials used for production should be established. However, there is no explicit requirement on:

- Changing the source of supply of critical raw materials should be treated according to change control;
- Materials stored in fibre drums, bags, or boxes should be stored off the floor and suitably spaced to permit cleaning and inspection;
- Sampling should be conducted at defined locations;
- Materials should be re-evaluated to determine their suitability for use;
- Full analysis should be conducted on at least three batches before reducing in-house testing.

Production Management

In ICH Q7, there are very detailed requirements on production and in-process controls. In Chinese GMP, there are mainly four kinds of production management documents, e.g., master formula, job position instruction, standard operating procedure (SOP), and batch production records. However, the operational requirements for process and in-process control are only mentioned in the master formula and batch production records without detailed contents.



Tab. 2: The classification of clean rooms – Chinese GMP*

Grade of air cleanliness	Maximal permitted number of particles/m ³		Maximal permitted number of microorganisms	
	≥ 0.5 μm	≥ 5 μm	Air sample (cfu/m ³)	Settle plates (cfu/plate)
100	3,500	0	5	1
10,000	350,000	2,000	100	3
100,000	3,500,000	20,000	500	10
300,000	10,500,000	60,000	–	15

* Source: The Annex of the Chinese GMP – General Principle

In ICH Q7, there are clear definitions and requirements to guide rejection, reprocessing, reworking and recovery during the drugs production. In comparison, requirements on such activities are not prescribed in Chinese GMP. Moreover, operational procedures for deviation, change control and out-of-specification (OOS) are also absent in Chinese GMP.

Validation

Risk analysis is nowadays highly recommended during the validation of

drug production even if not directly outlined within the international GMP. Before starting validation, a comprehensive risk analysis is conducted to define the APIs in terms of critical product attributes, to identify process parameters that could affect the critical quality attributes of the APIs, and to determine the range for each critical process parameter expected to be used during routine manufacturing and process control. However, there is no such recommendation on risk analysis or equivalent measures for validation in Chinese GMP.

In Chinese GMP, the requirements on validation are very briefly described. Design qualification (DQ), cleaning validation, validation of analytical methods, and validation of computerised systems are not officially required, although those validation activities are described in the SFDA's technical book, "Guide for the Validation of Drug Production."

The Chinese GMP stipulates that re-validation should be conducted at defined intervals or after any significant changes that may affect the product quality, e.g., changes of production process, quality control method, critical raw material and excipient, and critical equipment. But detailed requirements on change control procedures cannot be found in Chinese GMP. It should be mentioned that a full re-validation is also required by Chinese GMP when the GMP-certificate validity period expires. In contrast, according to the ICH Q7, whether to execute re-validation should depend on the results of the periodic reviews of validated systems and the product quality reviews.

Documentation

According to ICH Q7, validation documents, e.g., all specifications, master production instructions, all procedures impacting products quality, validation protocols and validation reports should be approved by the Quality Unit (QU). In Chinese GMP, there are requirements on the drafting, revising, reviewing, approving, withdrawing, distributing and retaining of validation documents, but it is not mentioned that important validation documents should be independently approved by quality management department. According to the SFDA's book, validation documents should be jointly approved by the manager of quality management department and the responsible vice-manager of company. For process validation, any critical changes to validation protocols should be jointly approved by the manager of quality management department and the manager of production management department.

In Chinese GMP, the requirements on the contents of documentation are not explicitly described, e.g., product quality control documents, master production instruction and batch production records. Furthermore, there is no detailed requirement on e.g., records of raw materials, inter-

mediates, API labelling and packaging materials, laboratory control records, and batch production record review.

Summary

In general, Chinese GMP covers most of the important aspects of pharmaceuticals production, with even some of the provisions being comparable to international GMP. Nevertheless, the most obvious differences between Chinese GMP and ICH Q7 can be summarised as follows:

- The responsibilities of the quality management department are limited and not comparable to the responsibilities of the quality unit described in ICH Q7;
- Validation documents are not independently approved by the responsible persons of the quality management department;
- The definition of the GMP starting point is not required by Chinese GMP;
- There is no recommendation on risk analysis or equivalent procedures to identify the critical parameters/attributes;
- Chinese GMP focuses mainly on the last production steps of APIs (e.g., crystallization, drying, blending, packaging), which are required to be performed in clean rooms of the class 300,000 or even better;
- Re-validation does not depend on the results of periodic reviews of validated systems and product quality reviews;
- There is no requirement on the periodic assessment of the effectiveness of training;
- Design qualification, cleaning validation, validation of analytical methods, and validation of computerized system are not legally required by Chinese GMP, although they are described in the SFDA's technical book;
- Some particular procedures are absent or not described in detail, e.g., deviations, change control, out-of-specification (OOS), reprocessing, reworking, recovery, etc.

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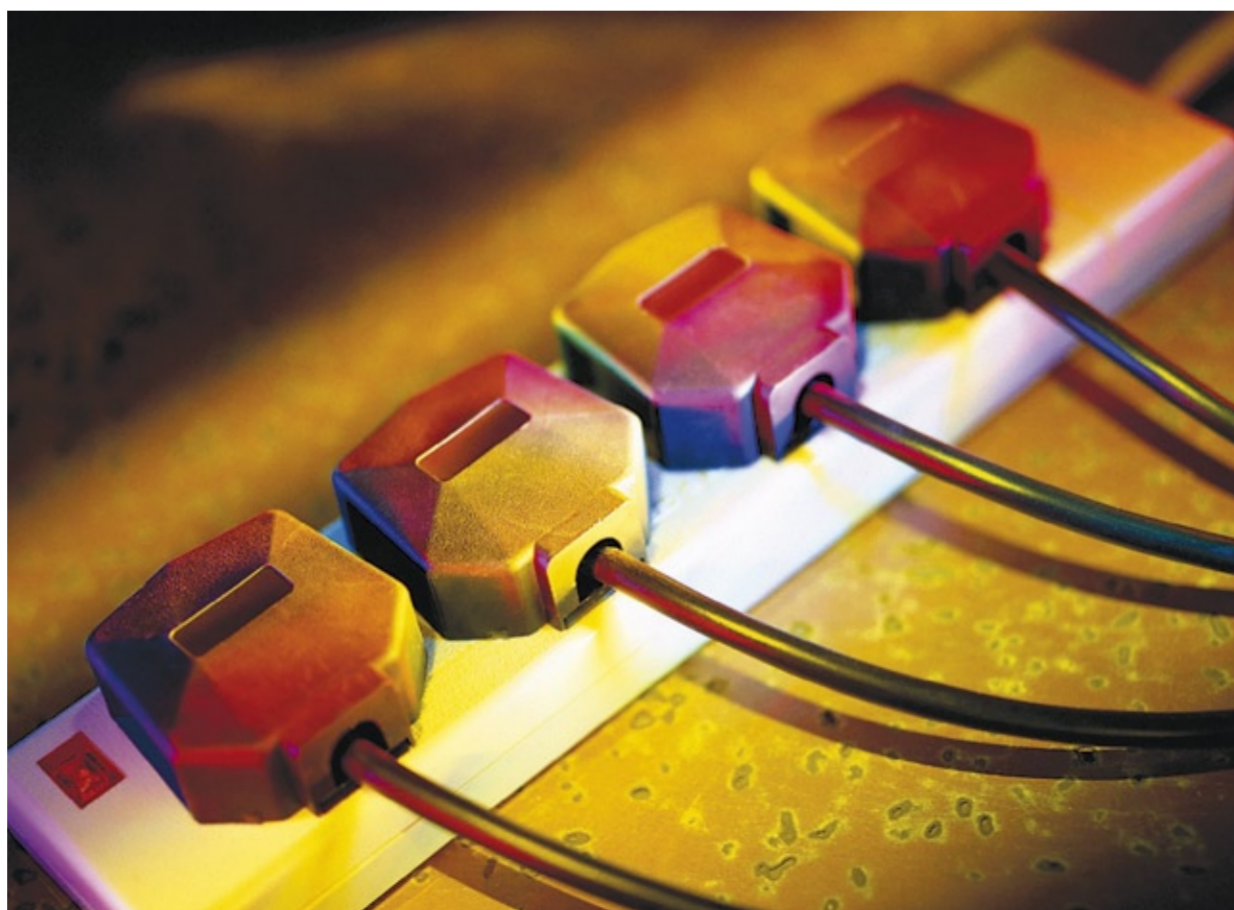
Slow But Steady Growth

MEMS-based Sensors and Actuators Find Opportunities in Industrial Automation

The reliability, scalability, sensitivity, and cost-effective solutions offered by micro-electro-mechanical systems (MEMS) technology has provided viable sensor solutions for industrial automation. The trend toward MEMS-enabled miniaturisation and micromechanics bolsters the development of components, devices, systems and subsystems for industrial applications.

New analysis from Frost & Sullivan, Impact Analysis of MEMS Based Sensors and Actuators on Industrial Automation, finds that MEMS-based sensors and actuators have experienced a slow yet steady growth in the industrial automation sector. As the industrial arena moves toward intelligent, distributed as well as wireless monitoring and control, MEMS technology will likely play an increasingly vital role in this sector.

The small size and simple structure of MEMS devices make them easily adaptable in places not suitable to heavily structured devices. Moreover, the low energy consumption and high precision of these devices are vital to wireless monitoring and multi-sensor networking in industrial automation applications.



Wireless sensing enables sensors to measure a parameter despite harsh circumstances and therefore it represents a substantial benefit

to industrial automation. Additionally, wireless sensors allow for more efficient configuration or re-configuration of large-scale sensor

networks to establish comprehensive monitoring of key parameters with respect to vital plant processes or machinery.

"Actuators such as radio frequency MEMS for wireless sensing applications are making inroads, but still are in a relatively embryonic stage as the investment required is high and the revenues are less in this sector," said Frost & Sullivan Industry Analyst Avinash Bhaskar.

"On the other hand, pressure sensors fabricated using MEMS technology represents one of the largest applications in industrial automation," added Research Analyst Menaka S.

Industrial applications such as process control, automotive testing, hydraulic, and pneumatic monitoring/control, utilize silicon micromachined pressure sensors. Compact silicon micromachined gauges and sensors with integrated electronics also assist with pressure (vacuum) measurements in semiconductor tools/equipment such as loadlock transducers.

With regard to costs, industrial automation is less price-sensitive than higher-volume markets for more commodity-type sensors.

"Since MEMS device fabrication requires a large initial investment, efforts are focused on application segments where there is large volume demand," Bhaskar said. "As a result, consumer electronics, medical, and automotive segments are currently driving the MEMS industry."

However, the industrial automation market can offer MEMS developers and providers opportunities to provide higher value MEMS-based sensors and actuating devices that could command a higher price compared to MEMS devices used in more price-sensitive, higher-volume applications.

"MEMS developers and providers can focus on collaborating with users in the industrial arena to provide them with a high-value solution for key industrial applications such as intelligent networked health monitoring of machines, which involves monitoring multiple sensed parameters or distributed process control," Menaka said. "MEMS sensors for parameters such as pressure, flow, acceleration/vibration/tilt and angular velocity, have started playing a vital role in the industrial automation technology arena."

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Transparency in the Middle Ranks

The Site Scorecard – Site Portfolio Management for Chemical Companies

Large European chemical companies have between 50 and 300 production sites worldwide – a number that is all the more important when you consider that managing existing sites and occasionally establishing new ones is simply not enough any more. Globalisation and restructuring of the chemical industry call for permanent site portfolio management in all its dimensions – expansion, downsizing, exit, ongoing risk management, rating of new sites added after acquisitions, etc. Developed by Stratley, the site scorecard is an action-oriented analysis tool for rating existing sites and selecting new ones.

Today, decisions about sites are made against a global backdrop. New facilities can be built just as easily in Europe as they can in Asia or the Persian Gulf. At the same time, the downsizing and closure of sites in the “old” industrialised countries are no longer taboo. Obviously, any decision about sites will initially be based on the logic of the business concerned. It determines, for example, in which region of the world production should ideally take place. Only then do specific site factors come into play, such as available land, infrastructure, cost levels – notably for site services – qualification of employees, site risks such as natural disasters, etc. These factors are generally grouped into lists of criteria, on the basis of which a shortlist is drawn up. The final decision is then reached by means of a profitability analysis.

Such a case-by-case approach no longer meets the requirements of large chemical companies. Case-by-case decisions frequently give insufficient consideration to the financial impact of choosing (or retaining) a poor site.



Safety, security and environmental risks or capital tied up unnecessarily can have serious long-term effects. What is needed is transparent and systematic identification and evaluation of specific site factors. The biggest challenge for a structured and standardised approach is the sheer number of sites in question, spread over very different areas of the world.

Rating Strategy: Quality vs. Risk

The Stratley site scorecard has proven itself in several projects, both in rating existing sites and selecting new ones. The scorecard constitutes an indexed rating method based on an extensive database with 15 aggregated criteria and includes the dimensions “site quality” and “site risks.” Each criterion is broken down into a

large number of individual values. For example, the criterion “space” embraces both expansion possibilities at the site as well as distance to residential buildings. The “employees” criterion includes qualifications, labour costs and safety awareness. Among the risks, both external risks such as political uncertainty or natural disasters play a role, as do internal risks such as past pollution and

residual costs. All these factors are quantified, weighted and integrated in the overall index which can be presented – at the highest level of aggregation – as a matrix of site quality and risk. The weighting of the criteria also differs according to region. For example, unused land in Europe is often a sign of overcapacity and shrinkage with the corresponding idle costs, whereas in Asia it offers valuable expansion opportunities. The rapid growth of cities in the Third World has to be taken into account, as do the high rates of wage increases in the emerging countries. In these cases, the site scorecard anticipates future developments using complex algorithms in order to prevent long-term errors in judgement.

Action Recommendations for Middle-ranking Sites

The site scorecard is more than an analysis tool – it is action-oriented. Using it, concrete recommendations can be developed for improving site quality and reducing risks. The indexed rating is augmented by structured interviews with individual site experts. In this way, individual inaccurate ratings can be corrected.

Using this approach in practice has not only produced recommendations as to which sites are particularly suitable for new investment or expansion and which should preferably be closed. It has also resulted in millions of euros worth of cash effects, e.g. through the sale of assets which are no longer needed. Crucial here was that, for the first time, the broad mass of middle-ranking sites was rated transparently, whereas the best and worst sites were generally long known.

The entire site portfolio of a company can be mapped clearly in the rating matrix. Projects carried out so far – approximately 100 sites have been included to date – permit a number of interesting

conclusions to be drawn. For example, some of the best sites are in the emerging countries of Asia, but the sites with the highest risks are also located in the Third World. Most Western European chemical sites are to be found among the middle-ranking locations but there are significant differences between them. Their strengths include high environmental and safety standards and professional logistics, though cost awareness and service cost levels are typical weaknesses.

This rating system does not make concrete decision-making redundant. Instead, it creates a basis for well-founded decisions which take into account long-term opportunities and risks and are therefore sustainable. Such a method is also essential to allow a major company's site portfolio management unit to operate professionally at acceptable resource cost. For example, managing an acquisition in which hundreds of newly added sites have to be compared with existing ones in the shortest possible time in order to achieve synergy effects is only possible in this way.

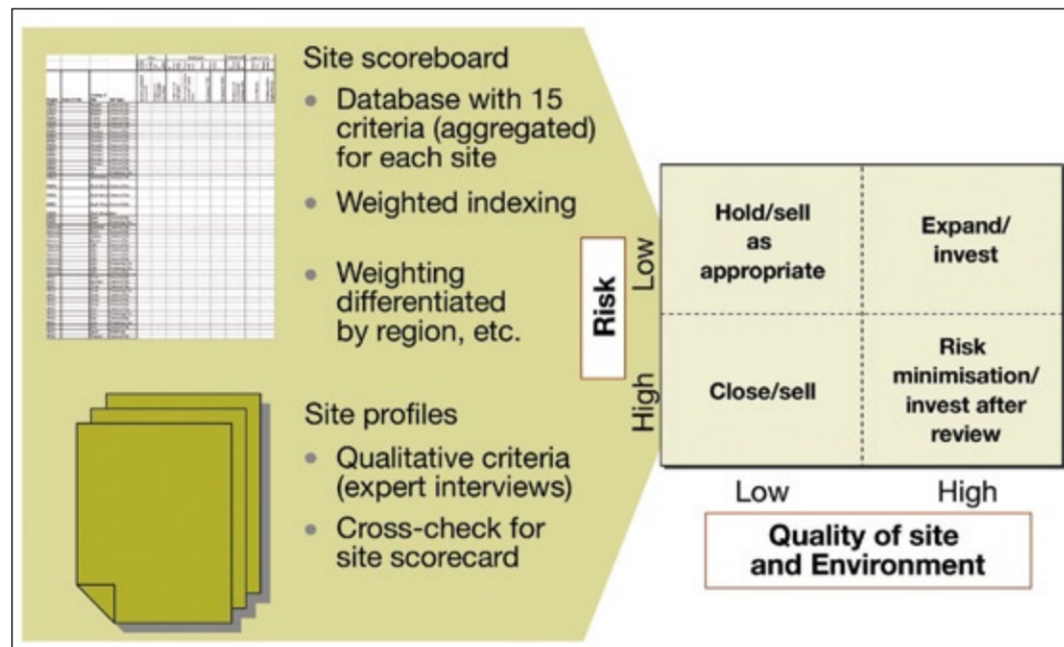
Conclusion

Experience so far suggests that IT-based methods such as the site scorecard will be indispensable in the future. Compared with case-by-case analysis, they are not only more systematic but also more efficient in view of the large number of sites and the frequency of rating. The site scorecard is not about playing

with numbers, it is a powerful tool which requires extensive background knowledge both in using it and in analysing the results. The knowledge of site experts is by no means made redundant; using this method, that knowledge can create more value more quickly than ever before.

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The Stratley site scorecard is a site rating tool based on a large database with 15 aggregated criteria and includes the dimensions “site quality” and “site risks.” It permits comparisons and ratings based on well-founded research.

Akzo Nobel Opens Fifth Chinese Plant

Akzo Nobel Powder Coatings has officially opened its fifth manufacturing plant in mainland China – the first to be located in the west of the country. The company said it is already the biggest powder supplier in China and it expects the new facility – situated in Chengdu, Sichuan province – will further improve service to the strong architectural, general trade coater and functional markets.

“China’s powder coatings market is the world’s largest and continues to enjoy double digit growth,” said Powder Coatings General Manager Rob



Molenaar. “Akzo Nobel has already stated its aim of growing the company’s total sales in China to US-\$1 billion by 2010 and this new investment is an integral part of that strategy.”

The company already operates Chinese powder sites in Bao An (in the south), Ningbo

and Suzhou (central China) and Langfang (in the north). The new Chengdu plant is located in a part of the country where markets have grown strongly in recent years, reflecting the Chinese central government’s policy of encouraging investment in less developed areas, away from the prosperous eastern and southern coastal provinces. Over 30 people will initially work at the site, bringing the company’s total number of powder coatings employees in China past the 1,000 mark.

► www.akzonobel.com

SGS Minerals Services Opens New Indian Lab

SGS Minerals Services announced the opening of a new facility in Chennai, India to serve the growing needs of the mineral exploration industry. The Chennai geochemical laboratory is equipped with ICP-MS, ICP-OES and AAS for the analysis of major, minor and trace elements and a multi-pour fire

assay facility for precious metal determinations. The laboratory is supported by a high volume sample preparation facility. This location will also function as a gateway to other SGS services and expertise.

According to the company, the Chennai laboratory complements SGS Minerals Services’

8 existing facilities in India and further expands the network of 40 commercial geochemical labs around the world. Specific tests are registered to the ISO/IEC 17025 standard.

► www.sgs.com

Tikkurila Establishes Company in China

Kemira Coatings (Tikkurila), the company responsible for Kemira’s paints and coatings business, said it will be establishing a sales company in China. At the same time, Tikkurila is to acquire the sales company Ceiec-Feelings operating in China from its owners CEIEC,

Ceiec-OTC and a number of private investors. Ceiec-Feelings’ business operations and the staff of 50 persons will be transferred to the new company. The parties have agreed on not disclosing any financial details. The acquisition aims at consolidating a basis for a pow-

erful development of Kemira’s market position in the rapidly growing decorative paints market in China.

► www.tikkurila.com

BASF: New Engineering Plastics Plant in Shanghai

BASF has opened a new engineering plastics compounding plant at its Pudong site in Shanghai, China. The new facility came on stream in March and is a world-scale plant with an annual capacity of 45,000 mt. According to the company, it is one of the most modern compounding plants in the world today, with the highest environmental standards and the most efficient production capabilities available.

“We have ambitious targets in Asia Pacific: by 2010, we aim to achieve 20% of our group



Dr. Martin Bruder Müller speaking at the opening ceremony in Pudong.

sales and earnings in the chemicals businesses in Asia Pacific; 70% of those sales are to come from local production,” said Dr. Martin Bruder Müller, member of the Board of Executive Directors of BASF Aktienge-

sellschaft, responsible for Asia. “This new plant will make a powerful contribution to these targets.”

Alongside this new plant in Shanghai, BASF has similar compounding facilities in Malaysia and Korea, which are part of BASF’s global network of engineering plastics and compounding plants. This network covers other countries in Europe, North and Central America. With the new plant, BASF’s total compounding capacity in Asia exceeds 100,000 mt.

► www.basf.com

Sika: New Production Facility in Turkey

Sika has opened its new production plant in Turkey. The 19,000 m² facility, located in a modern industrial park in Tuzla on the Asian side of Istanbul, employs

some 40 people in manufacturing admixtures, mortars, coatings as well as resins for flooring. Its modern equipment not only makes the new plant a

state of the art facility but also contributes to a substantial increase in Turkish production capacities.

► www.sika.com

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Century Of Innovation

Chemical Park Knapsack Turns 100

Aged companies are often seen as having grown old. They should be young and dynamic, only looking forward and not back. Given the background, history appears to be nothing but a burden. However, when taking a look at the most important German stock index, the DAX, one sees a very different picture. The 30 DAX-companies are on average 114 years old. Seventeen of them are older than 100 and only six are younger than 50. Their common denominator is that they are modern, successful and globally active. Consequently, age is not a burden; it's a sign of success – and this is also the case in the Chemical Park Knapsack in the ChemCologne, Germany, region.

A hundred years ago, the first chemical production plant in Knapsack began producing calcium cyanamide as a basis for artificial agricultural fertilizers. It was the first of its kind in the world, paving the way for numerous other production products. In 1914 the works had 400 employees and by 1919 there were 1,700. By 1920, the Hoechst AG had obtained the majority of the "AG für Stickstoffdünger – corporation for nitrogen fertilizer" in Knapsack and secured, via ammonia production, a raw materials basis for the production of nitric acid. The production of carbides was however even more important for Knapsack as it was the basis of Hoechst's indispensable acetylene chemical production. In 1925 Knapsack also became a part of I.G. Farben, the then merger result of Bayer, BASF and Hoechst, emerging into world's largest chemical company.



Site Knapsack overview in June 2007, on the right the new power plant of Statkraft, in front the plant of Sotec and InfraServ Knapsack under construction.

The number of employees rose to over 2,200 by the beginning of World War II. In an air raid in October 1944, 80% of the works were destroyed. The end of the war, occupation and the dissolution of I.G. Farben and its disastrous involvements with the Nazi regime led to a few years' delay in rebuilding. It wasn't until 1950 that all of the pre-war products could be produced once again in Knapsack. The construction of the first phosphorus

furnace in 1951 marked the site's preliminary peak. In the 1970s, an all time high regarding the number of employees, namely a workforce of 5,000, was reached. However, this number could not be maintained due to the changing structures in the world economy as well as the end of the Hoechst AG in the 1990s. Today, about 2,500 people are employed in the globally operating Chemical Park Knapsack, about 100 of them as trainees.

The production of basic phosphorus in Knapsack was discontinued in 1992. A few special phosphorus products however have been further developed, primarily by the newcomer companies that succeeded the Hoechst AG, such as Clariant and Thermphos. The chlorine network production and the central role of the PVC producers Vinnolit are what distinguish the site in particular. Another key factor for the site today is the production of crop protection

products (Bayer CropScience), synthetics (Basell) and superconductors (Nexans). Since the establishment of the Chemical Park Knapsack in 1998, about one billion Euros have been invested in the park and in the neighbouring RWE site Goldenberg for modernising and building new plants. The largest single investments made were the restructuring of the chlorine chemical industry (€120 million), the construction of the paper mill Myllykoski (€250 million) and two new power stations.

One of the most important factors for the site in Knapsack has always been the close proximity of well-

the site. The investment volume here is €105 million.

The centennial for the chemical industry in Knapsack: the companies will duly celebrate this once in a lifetime occasion for an industrial site. A chronicle is being written that will summarise the moving history of the chemical site Knapsack. Various regional sports events have been scheduled in conjunction with the centennial as well as competitions for local schools. The climax of the centennial celebrations will take place after the summer holidays on the weekend of the 24–25 August. On Friday evening there will be a gala

For further information about the history of the site, please click on the link "historie" at www.chemiepark-knapsack.de. For further information about current projects and developments, visit www.infraserv-knapsack.de.

priced energy resources. As long as the chemical industry has been present in Knapsack cooperation between the energy and the chemical industry has also endured. Even as early as 1929, the then corporation for nitrogen fertilizer and RWE signed an exceptional agreement for electricity. This contract was extended several times over the following decades and this accomplishment prevails even today.

Knapsack's importance as one of the leading energy locations in Germany can be seen clearly in the construction of the currently largest gas and steam power station in Germany. The Norwegian power company Statkraft is investing €400 million in the construction of its first gas and steam plant in continental Europe. Start up is scheduled for the end of this year. The construction of the largest power station for alternative combustible fuels in Germany, by E.on-subsiary Sotec and the Chemical Park Knapsack operator InfraServ, strengthens the energy structure of

at the Feierabendhaus Knapsack and on the following day a celebration for employees and members of the community in front of the main administration building.

The Chemical Park Knapsack is celebrating another jubilee as well. The Feierabendhaus Knapsack turns 50 this year. The landmark construction was built in 1957 and designed by Cologne architect Karl Hell. Since then this architecturally extraordinary building, which has also been graded as a listed building, is considered to be one of the most wonderful event venues not just because of its excellent acoustics but also because of the rather unusual design.

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Walk Down to Electric Avenue

e-QSS Can Improve Facility Management Service Quality

The users' demands on real estate of all kinds are growing. A professional Facility Management (FM) is intended to assure services just as required and at the very best price. A very important prerequisite to achieve this goal is quality assurance agreed upon by contract in order to create transparency of performance for both sides. And the very best solution for quality assurance is an electronic method for that it brings immediate results and thus the chance of immediate improvement.

tenders for such services like cleaning, catering, maintenance of gardens or technical installations or laundry. The workshop was the starting signal for a scrutiny of performance quality and budget in the cleaning service. Based on an exact analysis of the ac-

spots, avoids down times, prevents unexpected repairs and reduces in the long run the maintenance costs.

Whether heating system or air conditioning, closed circuit-TV, fire prevention or security technology: Technical installations must work

mistakes and provides an electronic list of faults within minutes – something that is quite helpful for the personnel.

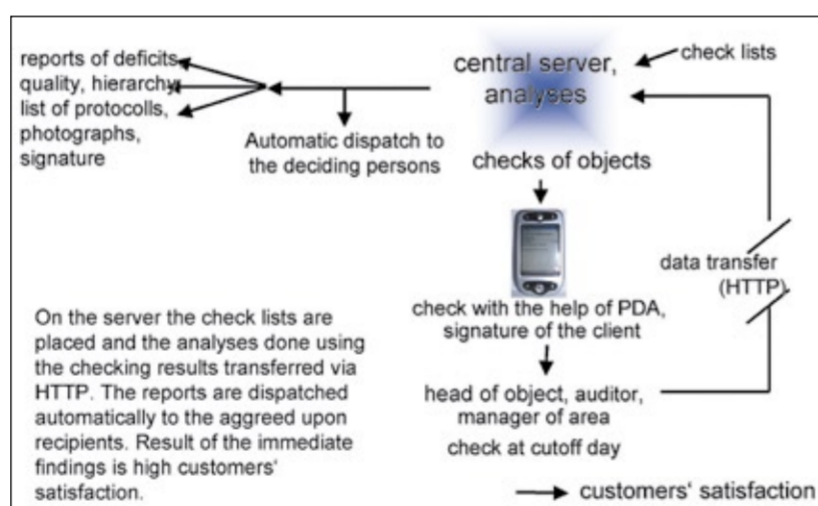
Such software on duty brings a continuous documentation of the actual situation of technical installations and possible problems of the maintenance level and its development: How much repairing work has got to be done and is necessary over certain periods of time? In case of technical problems, the service can react within short time.

Such a wording includes a risk because the service provider will in any case try to fulfill the duty with the least possible effort.

The following phrase requires of cause much more preparations, but it is much more unambiguous: "Machine-clearing of the main streets and gradient routes (clearing class I) must be started immediately when these roads begin to get icy. Immediately afterwards the materials must

assurance, for the client as much as for the service provider. The latter wins certainty for the case of complaints and gets enabled to introduce and realise a continuous improvement process in his own company and to establish further training for his staff in a very calculated way.

Of special advantage is, by the way, a software tool that can be engaged, just like e-QSS, for different services inasmuch as it oper-



The development of service performance should be and can be watched in detail when quality assurance works with an electronic tool. The illustration shows an extract of a monthly report.

tual situation, tenders were invited, including the requirement of quality assurance for the service provider.

This procedure has assured a long-term high level of cleaning up to today in the Industriepark Wolfgang. For quality assurance, e-QSS is on duty, a specialised software tool for services. The call for tenders is repeated periodically in order to align the performance level and the price with the present-day market conditions.

Why Quality Assurance?

The cleaning service is only a small part of the duties the Industriepark Wolfgang operates within the scope of FM. While the quality of cleaning is co-deciding about the clients' satisfaction, the best possible maintenance of technical facilities for example is an important factor for economic efficiency, too, because orderly, periodical servicing, together with the timely diagnose of weak

perfectly without their maintenance causing overly high costs. First and foremost, all laws and other regulations must be met with absolute reliability. The maintenance of technical installations must guarantee for conceptions of maintenance, emergency, etc. that make the company safe in case of liability and audits.

That is generally the concern of companies looking for a modern electronic method of quality assurance: gaining the best possible service quality, including legal certainty, at the best possible market price, as prerequisite for FM, that satisfies all the clients' demands at economical costs. And that is a goal reachable with the help of e-QSS.

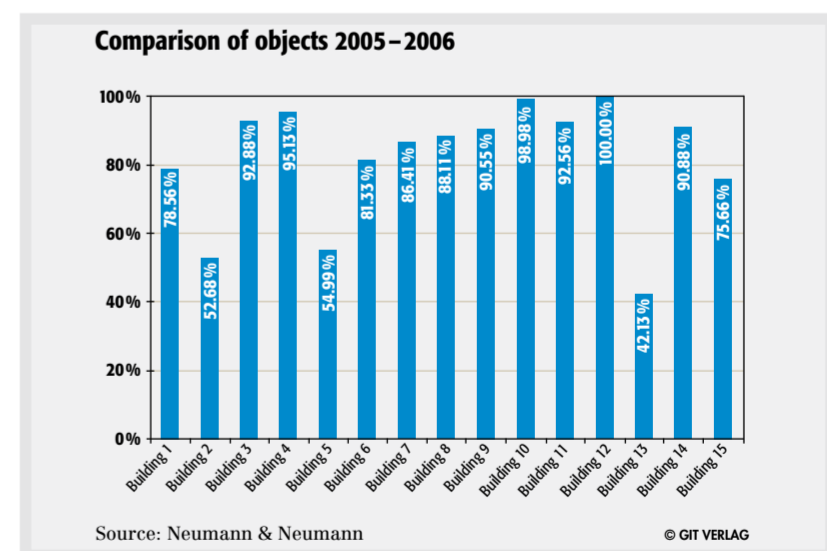
That software tool works on the detailed list of the agreed upon works. That list gets installed on a mobile device and is used as electronic check list for regular controls on the spot done by the service provider or by the client. This procedure assures an efficient maintenance, avoids careless

The Prerequisites Of Success

The cornerstones for the procurement alternately the production of the best possible infrastructural FM services are analysis of the present-day situation, data acquisition, detailed drawing up of demand, included exact professional definition of the required quality and, in addition, of the methods/tools that are thought to be used in order to guarantee the agreed upon quality level, and a first approximate estimate of costs serving as standard of comparison for the evaluation of different offers and for an accurate wording of the contract.

Last but not least, quality assurance must be agreed upon by contract in order to create performance transparency for both sides. The very best solution for that is as we have mentioned an electronic method for that it brings immediate results and combined with that the chance of immediate improvement measures.

For an example, let's have a look at the winter service. That seasonal area of responsibility calls for much apparatus and equipment binding a lot of capital. To procure the necessary service at a good price but at the same time sufficient to make the company safe in case of liability, you cannot be satisfied with a very common description of required service as follows: "In the winter, streets... within the area of contract are to be cleared from snow and strewed with blunting or thawing materials."



be strewed as defined in the supplement."

Summary

Effective quality assurance is possible if the client has his requirements very well defined; and if the checking rounds on the spot yield immediate results. The latter is an absolute must that paper lists are not able to provide! The only realistic way to reach this goal is an appropriate software tool. The electronic approach enables, in addition, to prolong the analyses without much work, to document and demonstrate the service provider's performance with the help of regular reports.

That means that complete performance transparency is an important result of the electronic quality

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Oswald Neumann

In the Industriepark Wolfgang for high-tech companies in the Rhein-Main-Area, seven of Degussa's business units are settled with production, research and development. The Industriepark Wolfgang, a 100% subsidiary of Degussa, runs all services necessary for the best possible operation of such a high tech industrial estate and for the integrated support of the residing companies.

Quality assurance has been an important matter above all since 2001. Back then, a workshop on building cleaning pointed the way. It was held by Neumann & Neumann, a consulting firm specialised in the organisation of infrastructural services and in inviting



PEOPLE



Dr. John LaMattina

Staff Changes at Pfizer Pfizer said that the President of Pfizer Global Research and Development, Dr. John LaMattina will retire from Pfizer after 30 years with the company by the end of this year. The company will begin a search both inside and outside the company for his successor, and Dr. LaMattina has agreed to remain during this period to ensure a smooth transition. Pfizer also announced that, after a distinguished career in which he made important contributions, Chief Financial Officer Alan Levin has resigned to pursue career opportunities outside Pfizer.

► www.pfizer.com



Dr. Werner Breuers

Lanxess: New Management Board Member Dr. Werner Breuers will take up his duties as a member of the Lanxess management board. At its meeting on 8 May, the supervisory board of Lanxess agreed to management board member Dr. Ulrich Koemm's request that he leave the company prematurely. Dr. Koemm will cease to be a member of the management board at the end of May.

► www.lanxess.com

New Member of Degussa Management Board The supervisory board of Degussa has named Patrik Wohlhauser, currently head of the Exclusive Synthesis & Catalysts Business Unit, as a further executive director of Degussa. His new responsibilities will include, among others, the new international sales function of RAG's subsidiary Degussa. Wohlhauser will also be the management board member responsible for the Consumer Solutions reporting segment and for the region Western and Eastern Europe.

► www.degussa.com

Chemtura Announces Executive Appointments Chemtura Corporation announced several executive appointments aimed at strengthening business and functional alignment in its new organisation. Eric Wisniewski has been appointed vice president of Strategy and New Business Development (S&NBD), assuming these duties, including merger and acquisition responsibility, from Greg McDaniel, who will be devoting his full efforts as group president of Crop Protection. Stephen Forsyth, executive vice president and chief financial officer, has been nominated to become treasurer of the corporation, pending a vote of the Board of Directors. Assistant Treasurer Carol Anderson will assume Wisniewski's responsibilities in treasury, risk and insurance, credit and collections, and cash applications. Douglas Debrecht has joined the company as vice president and chief information officer.

► www.chemtura.com

Atrium Innovations Nominates President, CEO Pierre Fitzgibbon has been nominated as Atrium Innovations' president and CEO. He assumes his duties as of July. Fitzgibbon held positions in the areas of corporate strategy, financing as well as in mergers and acquisitions. He was senior vice-president, finance, technology and corporate affairs of the National Bank of Canada, after being responsible for advisory services and corporate financing at National Bank Financial in Quebec, as vice chairman.

► www.atrium-bio.com

Celanese: Changes to Board of Directors Celanese Corporation announced that Farah M. Walters has been elected to the Celanese board of directors. Walters is currently president and chief executive officer of QualHealth, a company specialising in the design of health care delivery systems to improve quality and cost-effectiveness. Walters also serves on the board of directors and is lead director for PolyOne Corporation, a specialty chemical company. She chairs the company's governance and compensation committees and serves on the financial policy committee.

► www.celanese.com



Stephen S. Reinemund

Steven S. Reinemund Elected to ExxonMobil Board Exxon Mobil Corporation has elected Steven S. Reinemund to its board of directors. Reinemund is the retired chairman and chief executive officer of PepsiCo. With Reinemund's election, the ExxonMobil board stands at 12 directors, 10 of whom are non-employee directors.

Reinemund held a number of key leadership positions during his tenure at PepsiCo. He was the executive chairman of PepsiCo from October 2006 until 1 May, 2007. He served as chairman and chief executive officer from May 2001 until his retirement in October 2006. He was elected a director of PepsiCo in 1996 and served as president and chief operating officer from September 1999 until May 2001.

► www.exxon.com

New Thermo Fisher Scientific Chair Thermo Fisher Scientific announced that Jim Manzi, a member of the company's board of directors, has been named non-executive chairman of the board. Manzi assumes the role previously held by Paul M. Meister, who retired as chairman in April. Manzi previously served as the company's chairman from December 2003 through 9 November 2006, the closing date of the merger of Thermo Electron and Fisher Scientific, which created Thermo Fisher Scientific. He is currently chairman of Stonegate Capital, through which he manages his personal investments in technology start-up ventures in the U.S. and abroad.

► www.thermo.com



Anders Götzsche

New Executive Vice President, CFO at H. Lundbeck Anders Götzsche has been appointed new executive vice president and CFO of H. Lundbeck. He comes from a position as CFO and member of the group executive management of Det Berlingske Officin. Götzsche will take up the position no later than 1 September and will also become a member of the executive management. Since 2005, Götzsche has been responsible for finance at Det Berlingske Officin.

► www.lundbeck.com



Dr. Friedrich Wirsing

New Supervisory Board Member at BASF Dr. Friedrich Wirsing was appointed to BASF's supervisory board effective in May. Wirsing, who was elected as a substitute member of the supervisory board by employees, succeeded supervisory board member Dr. Karlheinz Messmer, who retired from BASF and the supervisory board at the end of April.

► www.basf.com

InformexEurope to Present Networking Forums

InformexEurope has announced a series of networking forums designed to help the fine and specialty chemical industries implement new strategies that can lead to enhanced research and manufacturing efficiencies. Presented by organic chemi-

cal consultants at Scientific Update, the forums offer team leaders, process R&D chemists and engineers, as well as commercial and business managers an opportunity to review examples of programs that can help chemical manufacturers bet-

ter utilise today's technologies. These and other networking forums scheduled to take place at InformexEurope, 16-17 April 2008 in Cologne, Germany, are conceived as a gathering place for like-minded individuals who want to work together

in support of world-class technology solutions, in support of a stronger, more competitive European chemical industry.

► www.informexeurope.com
► www.scientificupdate.co.uk

Chemtura Names VP, Global High Performance Industries

Chemtura has appointed Dr. Janet Chetland VP, Global High Performance Industries. She reports directly to Polymer Additives Group President Anne

Noonan. Chetland is responsible for global strategy, implementation and financial results for the high performance businesses. She will lead both commercial

and technological programs and will set business policies. The Global High Performance Industries business has three units: Industrial and Petroleum

Industries, Fine Chemicals and Polymers, and Catalysts and Inhibitors.

► www.chemtura.com

Syngenta: CEO Succession Plan

Syngenta announced that Michael Pragnell will retire from Syngenta at the end of 2007, when he also intends to

step down from the board. Mike Mack, currently chief operating officer Syngenta Seeds, is to be appointed chief executive

officer with effect from 1 January. Mack joined Syngenta in 2002 as head of crop protection NAFTA. He was appointed to

the executive committee in his current role in January 2005.

► www.syngenta.com

Rohm and Haas VP Wins Award

Philip G. Lewis, MD, Rohm and Haas vice president; director, Environmental Health, Safety and Sustainable Development was honoured by The Ameri-

can Chemistry Council (ACC) with a Distinguished Leadership Award. This award recognises executives and others in ACC member companies who

have provided outstanding leadership for the association. Dr. Lewis received the award at the association's annual meeting The Greenbrier in White

Sulphur Springs, West Virginia (U.S.).

► www.rohmhaas.com
► www.americanchemistry.com

Univar Wins 'Chemical Distribution Company of the Year'

Univar has received the "Chemical Distribution Company of the Year 2007" award from the Institute of Transport Management (ITM) in the UK. The award recognised the compa-

ny's dedication to customer service combined with a strong focused approach to long-term growth. Univar received the award for achieving success with a strong community and

customer-based approach. "By forging alliances and developing more cooperative client relationships to further improve distribution channels, the company is a role model for the rest

of the industry," the Awards Committee said in their recommendation.

► www.univar.com
► www.itmworld.com

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Please answer all sections by filling in the boxes

1. What is your company's primary business? (fill in one only)

- Chemicals and Petrochemicals
 Life Sciences (Pharma, Biotech, Agro)
 Plant Construction/Engineering
 Plastics
 Consulting
 Food & Beverage
 Site Management
 Other (please specify)

2. What is your job function (fill in one only)

- Managing Director/CEO/President
 Head of Plant Operations
 Sales & Marketing Manager
 IT-Manager
 Logistics Manager
 Commercial Director
 Engineering Manager
 Head of Production
 R&D Manager
 Purchasing Manager
 Head of QC
 Other (please specify)

3. How many people are employed in your facility?

- Fewer than 20
 101-500
 1,001-5,000
 20-100
 501-1,000
 5,000+

4. Do you recommend, specify or authorise the purchase of services, equipment and supplies?

- Yes
 No

5. Do you plan to purchase or invest in any of the following in the future? (fill in all that apply)

- Raw Materials
 Engineering Services
 Logistics
 Packaging
 Other (please specify)
 Processing/Manufacturing Equipment
 New Foreign Production Sites
 IT Services/Equipment
 Process Automation and Control

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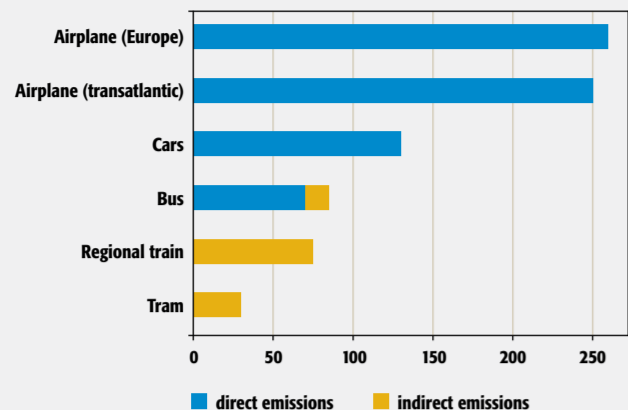
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Traffic: The Climate Killer

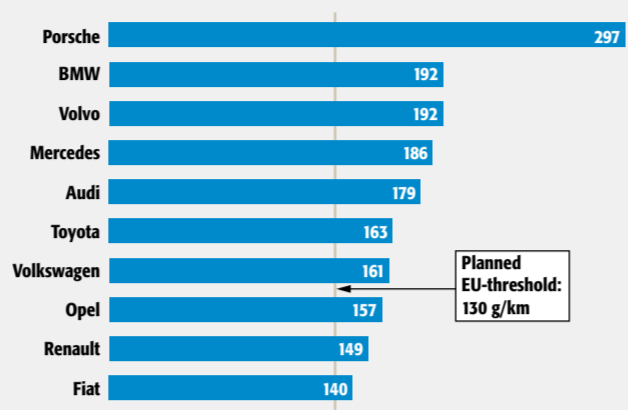
Who are the biggest contaminators? In grams per passenger and kilometre



Source: Frankfurter Allgemeine Sonntagszeitung

In cities across the globe, emissions from a billion vehicles on the road add up to a planet-wide problem. U.S. emissions have increased to 7 billion t of CO₂ in 2004, 16% higher than emissions in the late 90s. The UK has done better reducing their emissions to about 0.6 billiont, 14% below 1990 levels.

CO₂ exhaust from popular cars average in grams per kilometre (g/km)



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According to The Guardian, while cars account for a tenth of greenhouse gas emissions around the world, American cars are responsible for 20% of U.S. energy-related emissions. General Motors, the biggest U.S. car manufacturer, is responsible for nearly a third of those emissions, more than the biggest U.S. power company, American Electric Power.



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- A unique product network with link-ups to all important utilities and product pipelines
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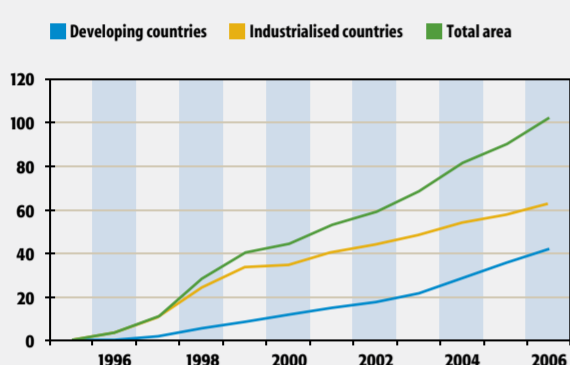
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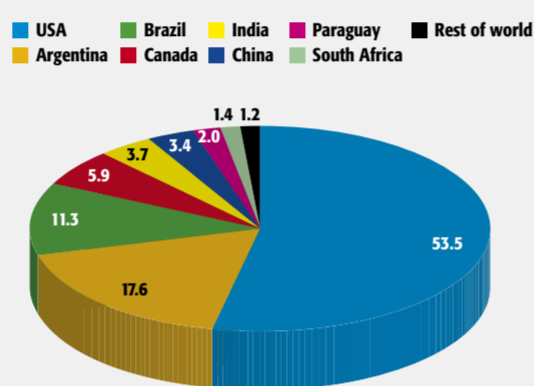
Worldwide cultivable land for genetically modified plants in millions of hectares



Source: VCI

In Asia, the U.S. and Latin America, the benefits of green genetic engineering are clearly being put to use: In 2006, 102 million hectares of land is being farmed with genetically modified plants, which is a 12% increase from 2005. At the same time, the number of farmers using transgenic plants increased from 8.5 million to

Usage of genetically improved plants 2006 in % of the worldwide cultivable land for genetically modified plants

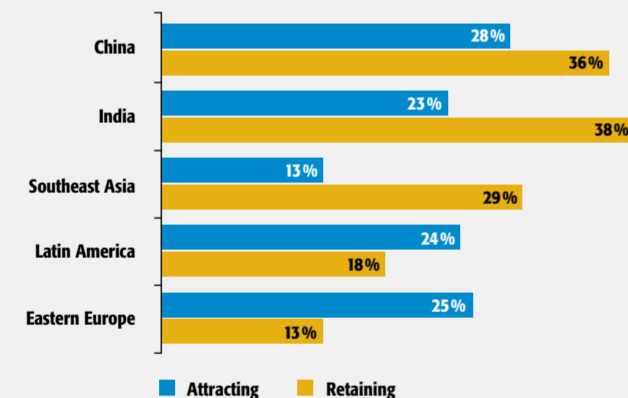


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10.3 million. More than 90% of those farmers are in developing countries. Green genetic engineering is expected to increase by 2015 to more than 20 million farmer and 200 million hectares in 40 countries. Currently, 99% of the area used comes from eight of the 22 listed countries, with half being farmed in the U.S.

Innovation In Emerging Markets

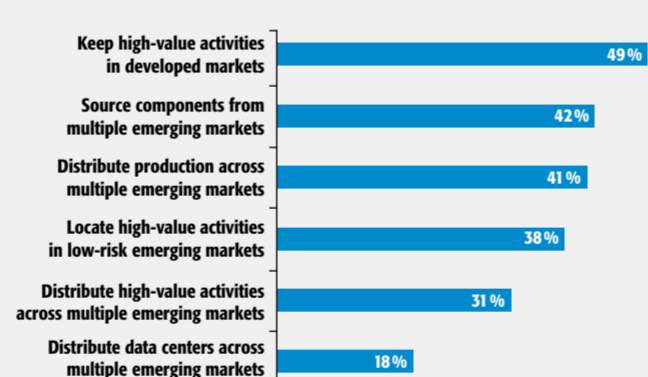
Attracting and retaining qualified workers in emerging markets percent using strategy



Source: Deloitte's Global Manufacturing Group

While emerging markets are brimming with opportunities, they are also fraught with risk. These risks include weak intellectual property protections, uncertain political environments, corruption and complex legal and regulatory regimes. Success in emerging markets requires an effective approach to managing these threats, including employing a variety of risk

Risk management strategies for emerging markets percent using strategy



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management strategies. Global companies in these markets must operate effectively in different cultures and languages, guard against increased threats to their intellectual property, be prepared to respond to potential political or economic instability, and comply with myriad local laws, regulations, and tax regimes.

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