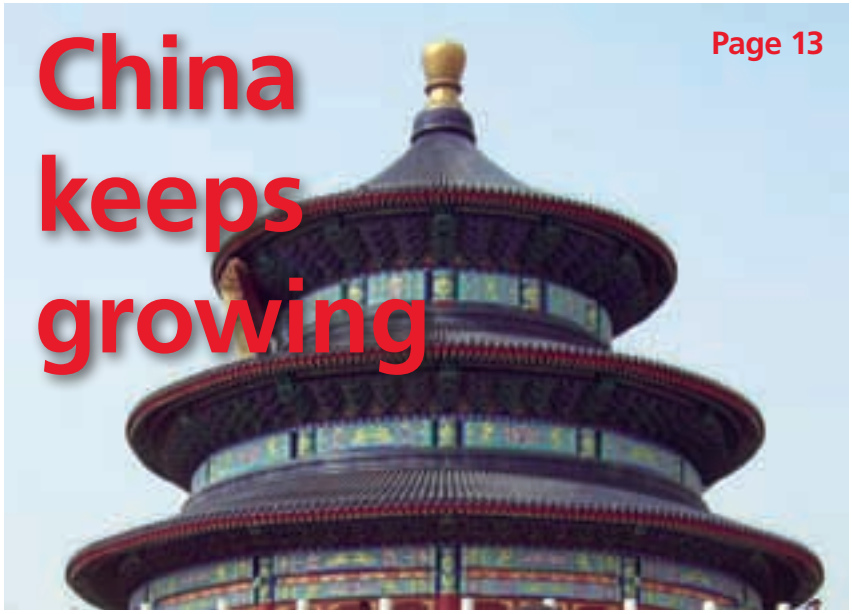
informally speaking

THE FORMALDEHYDE NEWSLETTER FROM FORMOX

spring/summer 2010



China keeps growing

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Great Bali conference

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In this special 15th anniversary issue...

Cautious optimism

The hoped-for recovery from the recession seems to be making its entry and optimism is budding – even blooming in some quarters – even if there is still considerable reason to be cautious.

One of the reasons to be cautious for us in the formaldehyde-related industry is the continued threats of restrictions on formaldehyde in the future. Although these threats are not directly related to the recession, their impact – should they be fully implemented – would have profound effects on the economy as well…. We urge our readers to support the efforts of FormaCare and FCI (see the FormaCare update in this issue).

Now for that cautious optimism. We had a great turnout for Formaldehyde Asia 2010, a good sign that formaldehyde producers are looking forward. There was an increased interest how to maximize output from plants (optimism), while at the same time many were still eager to squeeze every last drop of efficiency out of their plant operation (caution). You'll find an extensive report from Bali, plus some insights into how a plant audit can help you keep your operations optimal.

Then there's China, our second feature story. The recession has had an impact (caution), and although growth has been slightly off, it is still at a pace-setting level in global terms, and is rebounding (optimism). With the high growth rate and expectation that China eventually will overtake the US as the world's largest economy, China needs special focus and in this issue you'll find Stan's reports on three Formox customers in China.

Looking globally, you might say that our catalyst sales are a kind of "fingers on the pulse" of the economy. That pulse has been noticeably slower for a while. But now the beat is increasing, and we see clear signs that many of you are revving up again; so there's reason for cautious optimism!

You'll find a lot to read about in this special 15th anniversary issue of ***informally speaking***. I hope you enjoy it!

Marie Grönborg
General Manager
Formox AB

BALI high (lights)

Despite the lingering effects of the global economic crisis, Formaldehyde Asia 2010 was very well attended. Nearly 70 participants from 17 countries gathered in the lush, steamy tropical setting of Bali to learn about the latest market and technology developments, as well as each other's problems and solutions – and in general having a good time finding out how to run formaldehyde plants more profitably. Here's a brief summary of the highlights of the information-packed event.

Editor's note: Unfortunately not everyone made it out to the stairs for the first (larger) group shot, so I took a second one later, but some who made the first missed the second. What to do? Use both!

DAY 1

Formox update

Formox General Manager **Marie Grönborg** got things started with a review of what's new at Formox and in the Perstorp Group since the last Formaldehyde Asia in Bangkok in 2007. "Formox has become a separate legal entity – Formox AB – with a larger organization," says Marie, "which enhances our advantage of being able to develop the catalyst and the process in parallel – and to help formaldehyde producers improve and become successful."

But Marie also pointed out that no matter how well Formox sets its own agenda – no one is immune to what happens in the world around us. "I think you'll all agree that even if we have experienced changes before, the last 1½ years have been more turbulent than any other period during the last 15-20 years. That's why we feel we must focus on providing performance – not just commodities."

Marie noted that the financial crisis hasn't escaped anyone – and the formaldehyde-related industry was hit just as hard as everyone else. "What has made a difference in the downturn is how you have handled it – knowing how to operate your plants in a cost-efficient way at reduced capacity. Formox has clear recommendations for how to operate at reduced rates most economically."

Addressing the health and safety issues facing all formaldehyde producers today, Marie emphasized that HCHO is a cheap and efficient building block without the undesired properties of replacement chemicals. Moreover, HCHO has some very desirable "green" effects, in that it is used to make insulation and reduce weight in motor vehicles. But Marie also urged producers to utilize resources more efficiently and prevent emissions – an area where Formox provides the best available technology.

FormaCare update

The next speaker was **Lars-Erik Johansson**, Chairman of FormaCare, who gave a status report on key issues and activities (see also page 8). FormaCare represents the interests of formaldehyde producers and formaldehyde-related industries, particularly in Europe, but also elsewhere in the world.

The biggest issue all HCHO pro-

ducers are currently facing – and the most burning issue for companies outside Europe and North America – is the recent decision by IARC (International Agency for Research on Cancer) to declare that there is "sufficient evidence" of a causal association between formaldehyde and leukemia.

"IARC's finding is based on a study they found in China – a study we already know to be of highly questionable scientific value," says Lars-Erik. "Unfortunately, even though this is the case, it creates significant problems for all of us. First there is the danger of unfounded worries among downstream users, customers, employees, and the general public. This could spill over to unwarranted regulations and limit values. So FormaCare is working to immediately evaluate IARC's conclusions and address uncertainties.

"The downside is that no matter what evidence we come up with, IARC's decisions cannot be changed, only challenged. The upside is that IARC's decisions are not binding, only recommendations, so we will hopefully be able to influence legislators and other decision-makers with scientific fact. This makes it extremely important for us to have a good track record in research!"

FormaCare's multi-level approach is to apply scientific research to invalidate the conclusions of IARC, to approach authorities at EU and national levels and commence active science-based dialogue, to maintain FormaCare's position as credible and responsible partner, and to underline formaldehyde's unique benefits and applications qualities.

Methanol market update

The market for everybody's favorite raw material was the topic of the presentation by Ms **Heng Lee Shir** from the Singapore office of DeWitt & Co.

"Global methanol prices have seen almost unprecedented price variations over the past few years, and with four new mega-plants (total capacity 4 million MTPA) coming on stream during the first half of this year, combined with demand growth in China, many wonder what will happen this year," she says. "Will the market be able to absorb this additional capacity? Much will depend on how much China will continue to import and also how much methanol it will produce."

Heng Lee Shir pointed out that in recent years, China has been one of the key drivers of pricing in Asia, while also influencing prices elsewhere. "The phenomenal quantities China has imported are on a scale no one has ever seen before!"

But Chinese imports of MeOH have also been fluctuating – falling steadily since 2002, then picking up again in 2008 and more significantly during 2009, partly due to a drop in local production as prices fell below US$ 200/MT late last year, and partly due to the growth in Chinese demand.

"Much of this demand growth was driven by growth in the use of methanol in gasoline blending as well as for DME," notes Heng Lee Shir. "Based on Chinese government statistics, Chinese demand was 16.6 million MT in 2009. This represents a year-on-year growth rate of 37%. And even a very conservative estimate for 2010 demand growth, 17%, could potentially see demand grow to 19.4 million MT for 2010. So even with additional new capacity coming on stream in China, it looks quite possible that net imports could continue to increase in 2010."

Of the four new plants going on stream, two are in Asia (Oman and Brunei) and could mean as much as 1.25 million MT of additional methanol. The other two (in Venezuela and Egypt) are expected to give about 1 million MT of new production.

"Based on the simple projection we've made for China, this additional supply could be easily absorbed by China if demand growth is 37% this year, and the market could still be short. Or conversely, we could see some oversupply if Chinese demand growth is on the low end, at 17%," concludes Heng Lee Shir. "If demand growth is somewhere in between, we could also have a balanced supply demand situation. Which way it will go? Still anybody's guess…!"

HCHO market update

After a much-needed break for refreshments, our illustrious Scotsman, **Bob Crichton**, delivered the final update presentation, on the formaldehyde market and how it has been affected by the recession. "This time around, the recession was not only global but steeper. So what hope is there for new plant capacity over the next few years? Will the formaldehyde market ever recover?" asks Bob rhetorically. His answer: "Yes, growth will eventually resume – the only issues are by how much, where and when?

"Given the extraordinary sums of money governments have spent to stimulate the economy and prop up the financial system, perhaps we should not be surprised. And as we are in uncharted waters, it is not easy to predict what might happen next, but full recovery will probably not come before 2011."

Bob foresees growth in annual formaldehyde consumption from 34 million MTPA (37% basis) at the last peak (2007) to around 50 (±5) million by 2020 (±1 year) – an increase of some 16 million MTPA. "By the end of 2009, installed capacity had reached 54 million MTPA; this compares with 40 million MTPA reported in Bangkok [2007] and 32.5 million MTPA at the Singapore conference [2004] – an apparent average annual growth of 11%. "By far the highest growth was in China," says Bob. "The Middle East and Russia also experienced above average rates – albeit from a smaller base."

Bob notes that Asia is now the largest consumer of formaldehyde, with 42%, of which more than half is in China, a figure he predicts will climb to 50% by 2020. "It is not always clear where formaldehyde consumption will arise; for example, it depends on whether regional demand is met by imported panels or those manufactured locally. Whatever, the panel market is by no means saturated."

This not only applies to panels, but also to chemicals, where major HCHO producers are setting up large-scale plants. "As a consequence, 38% of the new chemical demand is projected to arise in China," says Bob.

"Globally, by 2020, formaldehyde's chemical derivatives will have the potential to consume close to 25 million MT, an increase of 8 million MTPA compared with today. Actual consumption will be somewhat less – in the range 22-24 million MTPA, but this is still an increase of 6 million MT over the 2007 peak."

What about threats to the industry? "Formaldehyde's continued dominance in the panel market will depend on meeting tighter emission standards, but this will most likely be achieved," claims Bob. "Threats from isocyanate binders never materialized, and there are simply not enough animal- and vegetable-protein-based resins to go around."

Bob also sees a clear trend towards bigger HCHO plants. "There will be further consolidation of the industry and hence an increase in the average plant size. Until 1990, 50,000 MTPA was the world average. It's now 80,000 MTPA – and increasing."

Admitting the uncertainties in his predictions, Bob refers to the words of the renowned economist John Maynard Keynes: "I would rather be approximately right than completely wrong!"

Be flexible!

Moving on to topics about optimizing operation, Formox's **Ronnie Ljungbäck** gave some pointers on how to be more flexible, e.g. running economically even when less than full capacity is required.

"Our work with the CAP concept has shown that this type of loading profile allows very flexible operation of the plant," says Ronnie. "By adjusting the temperature of the cooling media, it is possible to maintain good performance over a wide range of operating conditions, even below 50% of capacity."

The optimal way of operating a plant at turndown from the variable-cost perspective may be different at different sites due to plant design differences, site-specific reasons, as well as local differences such as different prices for raw materials etc. "But it's usually an advantage to operate at a high methanol inlet even at turndown, reducing the recirculation gas flow rate or pressurization pressure to reach the desired production rate. If the recirculation gas flow rate can be adjusted, a lot of power can be saved at turndown rate, thanks to the actual reduction in flow and the fact that the pressure drop will be lower."

Ronnie commented that at lower inlet, one can expect increased methanol yield and a longer catalyst lifetime. "However, from an operating-cost perspective, it is still beneficial to operate at the higher inlet, as the savings on electricity are important for the variable production cost."

When reducing the inlet to get the desired production rate, Ronnie advised that by adjusting the HTF temperature correctly, the yield can be somewhat better than at full production rate and 10% inlet.

"When reducing the production rate by decreasing the recirculation gas rate, the velocity in the reactor tubes decreases and thus the contact time increases. Then it is important to adjust the HTF temperature. If you have fresh catalyst, strive for similar peak temperatures in mixed and pure catalyst layers. And if you have any doubts about how to operate at turndown rate, feel free to ask us!"

Be stable!

The next speaker was Ms **Yang Dong**, representing Ruixue Fine Chemical Co. (www.rxfine.com), the only company in China that specializes in formaldehyde stabilizer manufacture, with almost 20 years' experience in the business.

"Our stabilizer features remarkable polymerization inhibition at small dosages – less than 50 ppm," says Yang Dong. She pointed out that producers can prevent polymerization by adding more methanol or raising the storage temperature, "but the best choice is a good stabilizer."

Ruixue claims to offer good storage stability and no caking in case of moisture uptake and heat absorption. Moreover, she claimed that the company's stabilizer fully dissolves in methanol at room temperature in no more

than 10 minutes. "It solves the problems of 37 wt% formaldehyde solution storage and transport in winter, and reduces the storage temperature of high-concentration formaldehyde solutions. This makes it an energy-saving, environment-friendly product," concludes Yang Dong.

The right boiler water

"Water treatment is an investment in longer boiler life," states **Clive Roscoe** of the Water Technologies division of Ashland Hercules (http://ppd.herc.com). "The quality of your incoming water determines the performance of your boiler, and proper pre-treatment is essential. It's basically 'garbage in, garbage out'."

Clive notes that Ashland takes a holistic view to water treatment, looking at the factors that affect efficiency, downtime and regulatory compliance. "Optimal boiler chemistry has a major impact on corrosion and deposit control, so it becomes a question of saving energy as well as extending equipment life!"

What are the effects of deposits resulting from inappropriate boiler and feedwater? "Deposits tend to form an insulating barrier," says Clive, "which leads to worse heat transfer, lower operating efficiency and even loss of tube metal integrity.

"Vertical waste heat boilers such as are used in formaldehyde plants are particularly prone to solids build-up at the base. For long-term operational integrity, proper bottom blowdown techniques are vital to prevent tube failures in this critical zone of the boiler."

Clive also note the importance of looking at often-ignored cycle chemistry. "Concentration [of contaminants] builds up with each cycle, and something like the build-up of iron can give you an indication of corrosion in your boiler. Of special importance to formaldehyde producers is seeing that you have less than 1 ppm of methanol entering your boiler."

But Clive cautions that you need good sampling techniques, and that without monitoring and control, even the best chemical programs aren't worth much.

"We can help you with these things," says Clive, "so feel free to get in touch. But whatever you do, please take care of your boiler!"

The upgrade option

Formox's **Anna Wemby Björk** and **Michel Bellais** then teamed up to show various opportunities to coax more performance out of existing plants, which is often a good way to postpone the need to invest in an additional plant.

"Our aim is, as always, to help you operate your plant with the greatest efficiency, the highest yield and productivity, the lowest energy cost, and without compromising safety," says Anna. "Formox upgrades can help you make significant improvements – with only minor investment costs – by increasing capacity and efficiency, and by measures to enhance personal and environmental safety."

One way to increase the capacity is to increase the methanol inlet concentration. Using Formox's CAP concept (see below), in combination with a methanol inlet of 10 vol%, gives a 20% capacity increase.

Another way is to increase the process gas flow rate. Pressurization to 0.3 bar g can give 25% more production compared to a non-pressurized plant, while going all the way to 0.5 bar g would give up to 40% more production.

Formox's efficiency-boosting packages are based on lowering production costs by optimizing yield (which means a lower methanol cost), minimizing power consumption, optimizing heat recovery, and optimizing process control (for higher availability and performance monitoring).

"So which options might be suitable for your plant?" asks Michel. "One alternative might be the perfect choice for one plant but not for another. But we'll be happy to make you a feasibility study to find out. And then we can undertake as much or as little of the work as you need – from recommendations and guidelines all the way up to delivery of the upgrading equipment and engineering tailor-made for you."

CAP 2.0 – the next level

If you read the previous issue of ***informally speaking*** (autumn/winter 2009), you will be familiar with the introduction of CAP 2.0, which is based on a CAP with two mixed layers using Formox KH-44L catalyst and a pure layer consisting of one or two layers of Formox KH-26 and KH-26L catalyst. Our next speaker, **Ronnie Ljungbäck**, was now ready to report on the experience gained from the use of the new loading plans in actual practice.

The new CAP 2.0 loads have been used at the Perstorp site in Sweden (where they have been operated at or above 10 vol% in methanol inlet) and at an increasing number of customer sites. Operation has been both pressurized and non-pressurized.

"From our experience so far, the results have shown that thanks to better control of the temperatures and the reaction rates, the pressure drop development is slower," reports Ronnie. "If we add the possibility in some cases to even reduce the total catalyst loading height, then the power saving will be even more significant. And thanks to the improved temperature distribution and thus control of reaction rates, longer periods of high yield operation and longer useful catalyst lifetime can be obtained.

"We've also seen an even shorter start-up time than with the already short time for the original CAP. And a higher yield has been reported from many sites. We haven't yet tested CAP 2.0 at even higher methanol inlets, but we hope to be able to get some results soon. Achieving this is one of the important tasks ahead of us!"

So is CAP 2.0 something for your plant? "I am sure it is," affirms Ronnie, "but please consult your Formox representative for an in-depth analysis of your plant and specific circumstances."

Experience proves it

Coming to the end of an information-packed day, **Ola Erlandsson** shared some experiences Formox has had with upgrading older Formox-designed plants to higher capacities. Ola then presented the different steps that can be taken and discussed the implications for the plants. As an example, he showed how a plant for a Malaysian client had been boosted from its original 100 MTPD capacity (at atmospheric pressure and with 8.5% MeOH inlet) all the way up to 175 MTPD (with 0.5 bar g pressure and 10% inlet).

"Increasing the MeOH inlet is the most obvious way to get more out of an existing plant," notes Ola, "and requires very little expensive rebuilding. But you do need a really good catalyst loading profile!

"It is more expensive to rebuild for pressurization, because you normally have to change the pressurization blower and check the pipes and vessels to make sure they can handle the additional pressure."

It is, of course, necessary to weigh in all of the costs – including the costs of not upgrading. Ola also told the participants about another lesson learned: "We now know we should never name a Formox plant after the capacity it has at the time of delivery. We'll almost certainly find ways to raise the capacity significantly after a relatively short time!"

A chance to unwind

After some discussion, it was time to get ready for refreshments, lots of chatting, and a buffet dinner, interspersed with entertainment by local Balinese dancers – who invited conference participants to join them. Balinese dancers excel at graceful, intricate movements of feet and hands. People in the formaldehyde business do not normally attain this level of dancing excellence….

But it was nice to unwind, get to know each other better and prepare for the next day.

DAY 2

Flexible & future-proof

The first and main presentation of Day 2 was by **Lars Andersson**, who outlined the plant selection process and what it means in practice. "Our latest design review resulted in a lot of good ideas we hope to use to further improve the Formox process," says Lars. "These ideas are currently still being evaluated, but we should be able to incorporate at least some of these important changes into the plant range later this year, and most of them in the 2011 design."

These developments include:

- at least three different reactor sizes, covering the most sought-after capacities
- at least two options for blowers, for recirculation and for pressurization
- different expansion options; twin reactors and dual reactors
- power/steam recovery options.

"Although the critical issue will undoubtedly be capacity, local steam and energy values will also be key issues, as will the balance between operating and capital costs," adds Lars.

Always a critical decision factor is whether to focus on the long-term operating cost or the initial capital cost, as well as future requirements, i.e. whether or not to build in expansion capability. Finally, some producers may require long intervals between catalyst changes, e.g. to match the maintenance requirements of downstream processes.

Lars pointed out that if you are likely to need more capacity in future, there are basically two options: to install a twin-stream plant from the outset (but wait with the second line until you need the additional capacity) or to prepare the plant for the addition of a second reactor later on, i.e. to leave space in the layout for the additional equipment.

Formox introduced "standard" plants back in 1991 – even before the start of informally speaking! – in order to be able to use well-proven component designs and keep costs down. But having standardized components still leaves room for a lot of variations to match different customer cases. [See the box "Standardization with endless variation"]

"What's best for your situation?" asks Lars. "That very much depends on local conditions, in particular the value of steam and energy, as well as what balance you want between operating and capital costs. We can offer you the basis – our 'standard designs' – or state-of-the-art engineering with reduced power consumption and expansion possibilities – our 'premium designs'. So it also depends on whether you are building for the future and how much expansion capacity you want to incorporate – and how much you are prepared to spend!"

[Editor's note: see also the article on pages 9-10.]

STANDARDIZATION with ENDLESS VARIATION?!

Does it sound strange to talk about offering freedom of choice in plant design while at the same time talking about a high degree of standardization? Then consider that in the world of language, you have a standardized set of "components" – the alphabet (26 letters in English) – from which the entire and endlessly varied body literature is derived. Consider that we human beings have just 46 chromosomes on which some 7 billion non-identical individuals are based. You want more? How about the fact that all matter in the universe (including formaldehyde plants!) consists of just 118 elements, only 94 of which occur naturally on earth…?

Assuring safety

The remainder of the morning – and indeed of the formal session of the conference – was devoted to greater safety and the sharing of experience. This included a presentation by **Ola Erlandsson** of a few incidents at customers' plants.

"Deflagrations typically occur either when there is a high methanol concentration during start-up or when the oxygen concentration is high during operation," says Ola. "And it always requires an upset condition or an instrument failure – if the instruments are working, the plant will always close itself down to avoid a deflagration."

Ola then outlined the causes and remedies of three incidents Formox has seen in recent years:

1. Methanol accumulation in the pipe below the vaporizer causes a deflagration during start or stop, typically when too much methanol is fed to the prevaporizer or the bottom feed on the vaporizer. **Formox recommends opening the drain point on the pipe during shut-down.**
2. Gas containing methanol was expanding backwards to the recycle fans during a blower trip and deflagrated when it was mixed with seal air (or fresh air from the pressurization blower). This can happen with combined fans with one motor, gearbox and plastic impellers. **Formox recommends having a check valve in the pipe after the recycle blower.**
3. A mismatch of oxygen between the two systems in a twin plant, where the piping of one system (with the highest back pressure) could feed both oxygen analyzers. A high oxygen value in the other line could then go undetected, resulting in a deflagration. **Formox has improved the sample gas pipe design.**

Ola also reported on an incident in which a leak had contaminated the methanol vaporizer demister, where the cleaning from the manhole did not reach the top part of the pall rings. "The contaminants together with the steel pall rings caused the methanol to burn in a small part of the demister, and the temperature increased locally above the melting point of the steel, ultimately causing both primary and secondary deflagrations."

To prevent this, **Formox recommends inspecting inside the methanol vaporizer demister (including the pall ring packing) and cleaning if necessary. You should also clean the methanol spray areas in the methanol vaporizer / prevaporizer during every catalyst reloading, using a high-pressure waterjet. Please make sure the water is drained before starting up [see also point 1 above]!**

On the subject of vessel damage, Ola pointed out two causes – and what to do about it:

1. Low HTF levels can cause reactor damage**. Formox recommends (and has developed) a floating alarm on the HTF level in the HTF condenser.**
2. Bad boiler water can cause corrosion damage on the HTF condenser tubes**. Formox recommends contacting a BFW chemical vendor, making analyses of the boiler water and making sufficient blow-down.**

What about personal safety? "We are pleased to say that Formox has nothing to report here!" concludes Ola.

Seeing the sights

Ola's presentation was followed by a discussion period and Bob's brief summary of the conference, after which the participants filled two buses for a tour of a Balinese temple, a number of handicraft workshops, and ending with dinner on the beach. A number of the participants were staying on for the advanced training session the next day, some were having individual discussions with members of the Formox team, and some were planning to enjoy a few of the sights of Bali on their own.

The overall rating of the conference was very high – particularly on the question of whether the participants felt they had obtained information that would help them to run their plants more profitably. That, as it turns out, was the main purpose of Formaldehyde Asia 2010.

Not all work

1. Balinese dancers at the Day One dinner
2. Balinese temple – first stop on our bus tour
3. Batik-making
4. NOT the editor of this newsletter!!
5. Silversmiths in action
6. Everyone wanted a shot of (at?) the dancers…

News from FormaCare

by Stan Erisman, member of the FormaCare Advocacy & Communication group

The French reclassification proposal expected for the end of September this year – and the EU debate on that proposal – could be a key to the future of Europe's formaldehyde-based business, and with ramifications worldwide.

A critical time

IARC's conclusion (October 2009) that there is a causal association between formaldehyde and leukemia has created a huge challenge for all of us. FormaCare of course takes this conclusion very seriously, but firmly believes that the weight of scientific evidence does not support it. Consequently, FormaCare is seeking every opportunity to present solid scientific arguments that will encourage regulators to maintain a balanced view.

It is important – and self-evident – for everybody in the formaldehyde-based industry worldwide to take a totally serious approach to any risks that might be involved in the use of products derived from or containing formaldehyde so that any issues can be addressed responsibly. A dedicated team effort is urgently needed all along the supply-chain.

FormaCare and FCI are providing ways to coordinate our efforts to deliver a well-argued, coherent message based on the fact that consumers, the economy and society as a whole benefit from our products in many ways and that all of our products are safe.

What's happening in France?

France is expected to submit a new proposal for harmonized classification and labeling for formaldehyde to ECHA by end of September. The proposal had been postponed pending IARC's decision, which came last October – in a split decision – that there is sufficient evidence in humans of a causal association of formaldehyde with leukemia. The French presumably see in this a strengthened case for a stricter classification of formaldehyde in Europe, but their proposal is still mainly based on nasopharyngeal cancer (NPC). It is possible that France might reach a different conclusion on leukemia than IARC, but this seems unlikely today.

Since the beginning of this year, FormaCare has been pursuing a strictly science-based strategy to shed light on the new causal associations proclaimed by IARC. There are no quick or easy answers, but FormaCare is determined to ensure that regulations will be preceded by and based on a balanced, unbiased evaluation of all available data and evidence. Scientifically unwarranted and premature decisions could affect our industry very negatively!

High-level dialogue has already commenced with the European Commission and with key member states, e.g. France, Germany and the UK. In this approach FormaCare very closely cooperates with downstream users from various sectors, in particular with our partners from the European Panel Federation (EPF).

What about indoor air?

Published work on new WHO guideline values for indoor air quality should be available by the end of June and will be taken into account by the European Commission. Currently it seems as if WHO will keep its current values (0.08 ppm = 80 ppb), and there is reason to hope that WHO's views will help to promote balanced evaluations of formaldehyde in terms of classification and labeling as well.

In June, FormaCare is planning to participate (via Cefic's Indoor Air Group) in a workshop of the European Commission, to discuss the latest policy approach aiming at a "Harmonized European framework on indoor material labeling schemes".

News from FCI

FormaCare's sister organization in the US – FCI – reports that the EPA (Environmental Protection Agency) is currently working on the IRIS (Integrated Risk Information System) assessment of formaldehyde. Last December the EPA notified FCI that the National Academy of Sciences (NAS) will be asked to serve as the peer review body for EPA's ongoing IRIS assessment of formaldehyde, starting this autumn and to be completed next year.

FCI has pointed out to the EPA that several key science issues concerning formaldehyde have not received sufficient critical attention, and has made it very clear that industry is taking its responsibility to help provide a scientific basis for public health protection. According to FCI, those issues are likely to be raised by the NAS committee that will review formaldehyde's IRIS profile….

What about you?

If you're in the formaldehyde-related business and not already a member of FormaCare or FCI, your support is needed…!

www.formacare.org
www.formaldehyde.org

Mo update

As reported in the previous edition of ***informally speaking***, molybdenum prices hiccupped to US$18/lb last July-September, then declined to just below $12. This was followed by a period of stability towards the end of 2009. Since the beginning of 2010, prices have again risen slowly, to $17 in mid-May.

So far the analysts have been fairly right about these developments, and are now predicting somewhere around $20-24 by the end of this year, then possibly a further increase to around $28 during 2011.

Are they right? No one can be certain about the future, of course, but you can be certain that Formox will maintain reasonable, stable net prices, thanks to you returning spent catalyst, and thanks also to our efficient catalyst recycling system!

Formox plant range 2010 – and beyond

When the "Standard Plant" concept was first introduced back in 1991, Formox sometimes used an analogy – "like buying a car from a dealer rather than trying to design and build your own" – but still giving you lots of options and choices. The new Formox plant range offers more choices than ever, e.g. the lowest capital cost or the lowest operating cost – rather like large "engines" or small – just as you can with your car. But unlike your car, you can also choose to build for the future and incorporate more or less expansion capability, so when the plant runs out of capacity you can add another reactor. It all depends on when and for how long you are likely to need additional capacity – and how much you are prepared to spend!

For good measure, Formox has also licensed a design to an equipment manufacturer in China (see page 11). So if your only experience of the current plant range was our 2010 *Assessment Data,* you might be forgiven for thinking that there was nothing new this year. But as Lars Andersson showed at Formaldehyde Asia 2010, you would be wrong. Not only did Lars introduce a new concept – premium and standard plant ranges – but also a new way of looking at the design process.

Premium or standard?

The essential difference lies in the type and source of the equipment. In the standard range, the vessels are mainly sourced in China and lower cost machines are used for recirculation of the process gas. In the premium case, equipment is sourced on the basis of performance and quality rather than price.

In addition, the premium version comes with full energy recovery and hence very low power consumption, an important consideration given the steadily rising cost of energy. However, as can be seen in the table below, advanced solutions such as these make the package relatively expensive. In the comparison shown in the table, the following items were assumed:

- A turbo-charger for pressurization rather than a conventional blower with electric motor.
- A two-stage recirculation fan with a one-stage steam-driven; the pass-out turbine producing low-pressure steam.

More choice – the performance curve

You are probably familiar with performance curves for pumps and compressors; now there is one for a Formox plant! Though the graph on the next page looks complex, it is actually an easy tool for selecting the plant and operating conditions best suited to a particular situation. *[Note! The graph and table shown here are further updates of those Lars first presented in Bali!]*

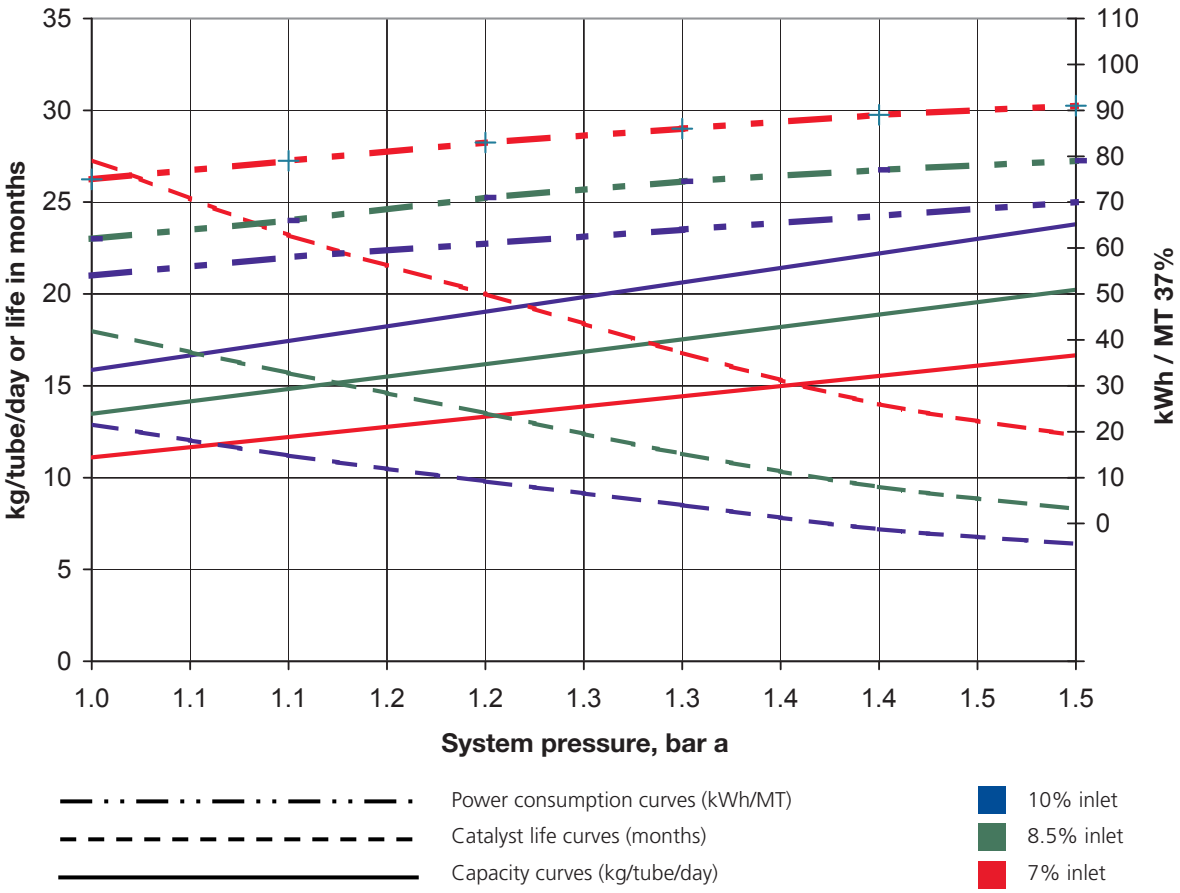
What the graph shows is how three performance factors (productivity, power consumption and catalyst life) are influenced by operating conditions – in particular, methanol inlet and system pressure.

The key data are the three solid lines in the centre; these show how productivity (expressed as kg 37% HCHO per tube per day) changes with pressure (shown on the x axis) and inlet (shown in the graph as blue, green and red lines). The dotted curves above these show how power consumption responds to the same operating variables. The dotted lines in the lower part of the graph indicate the likely effect on catalyst life (shown in months on the y axis).

Lars demonstrated how this graph might be used to select a plant; the case selected was 300 MTPD (37 wt% formaldehyde basis). Currently the highest tube loading possible is around 24 kg/tube per day. Hence 300 MTPD is possible with a 12,500 tube reactor (cases 1A and 1B in the table). However, this is achieved at the highest inlet (10%) and the reactor would have very little spare capacity.

300 MTPD							
Case	1A	1B	1C	2A	2B	3A	3B
Version	Standard	Premium	Standard "E"	Standard	Premium	Standard	Premium
Methanol inlet	10	10	10	8.5	10	8.0	10
System pressure, barg	0.5	0.5	0.5	0.5	0.25	0.4	0.1
Average yield, %	92-92.5	92-92.5	92-92.5	92.5-93	92.5-93	92.5-93	92.5-93
Power cons., kWh/t	74.5	30	74.5	85	30	88	35
Run time, months	5-6	5-6	5-6	7-8	8-9	10-12	10-12
Maximum rate, MTPD							
– as supplied	300	300	300	350	350	420	420
– with dual (twin) reactor	370	370	600	425	425	510	510
Relative cost	100	123	118	114	134	125	154

Note:
- Roots recirculation machines are assumed for cases 1A, 1C, 2A, 3A; radial fans for the other cases.
- Turbo-charger is assumed for cases 1B & 2B.
- A steam driven recirculation fan is assumed for cases; 1B, 2B, 3B



The only expansion possibility for this case would be a dual reactor system (a second reactor is added in series with the original one), or alternatively, an expandable design (case 1C – a twin reactor stream design with a common absorber and ECS system, but with one reactor stream deferred). For this case the IBL (inside battery limit) power consumption, with no power recovery option installed, would be approx. 70 kWh/MT, but the time between catalyst changes would be rather short – in the range 5 to 6 months.

Reducing the tube loading to 21 kg/tube per day increases the required reactor size to 14,500 tubes (cases 2A and 2B). From the graph you can see that there are a number of operating possibilities. Lars chose two: 0.5 barg at 8.5% methanol inlet, and 0.25 barg at 10% methanol inlet. The second alternative has lower power consumption due to the lower pressurization pressure, but for both the time between catalyst changes is a month or so longer than with case 1 (12,500 tubes). When operated at 24 kg/tube per day both these alternatives were capable of operating at up to 350 MTPD, albeit with higher power consumption and a shorter time between catalyst changes.

Further relaxing the tube loading to 17 kg/tube per day increased the reactor size to over 17,500 tubes. To achieve 300 MTPD, Lars compared 0.4 barg and 8% methanol inlet, with 0.1 barg at 10% methanol inlet. Both alternatives would achieve around 10 to 12 months between catalyst changes. And when operated at 0.5 barg and 10% inlet both would achieve around 420 MTPD – though, as in the previous example, power consumption increases and there is less time between catalyst changes.

These different cases are summarized in the table (previous page), which also shows the comparative difference not only between the various operating conditions but also between the "Standard" and "Premium" versions of the process.

Which reactor, which operating conditions and which configuration, standard or premium, is best for a given situation very much depends on local conditions, in particular steam and energy costs, and in the case of the larger sizes, how you value the potential extra output.

More to come?

Though this presentation by Lars concentrated on the plant selection process, he also gave us a glimpse of the future. He indicated that a recent major design review had resulted in a lot of good ideas to further improve the Formox process. Lars was in fact confident enough to predict that Formox would be able to incorporate at least some of the new ideas into the plant range later this year, and most of them in the 2011 design. The only clue we got was that Formox would be introducing another reactor size – between the FS1 and FS2.5 – and hence closing what had become a gap in the range.

In this article, "catalyst life" is defined as the time in months that full rate can be sustained at high yield, i.e. what Formox calls the "economical life". However, as most of you know, the actual life can be extended by slightly reducing the rate, mainly in terms of reduced inlet, mainly in terms of reduced inlet (less kg/tube), but may also be in terms of reduced flow, which – compared to operating at full rate – will give a higher yield.

IBL, yes! What about OBL?

by Bob Crichton & Fredrik Rietz

The term IBL (inside battery limits), as applied within Formox, means the equipment and materials for the formaldehyde plant – the most usual scope of contractual supply. But we can also help with other aspects of the project, e.g. meeting your OBL needs – those items outside the battery limits of the formaldehyde plant itself.

There are three main areas in which we can offer support:

- Layout planning – locating the formaldehyde plant, storage and utilities in an optimum manner
- Design details for tanks – the manufacture of high-concentration formaldehyde is only part of the story; the product has to be properly stored and attention to details is important, e.g. the piping design. Formox can assist with this aspect of the project and with other storage issues such as the collection and treatment of tank vent gases.
- Utilities – cooling water, instrument air and boiler feedwater need to be provided and Formox can assist in the specification of suitable equipment. Boiler feedwater is particularly important as poor quality water can result in premature failure of the HTF condenser.

But Formox's formaldehyde expertise need not only be applied to new plants. We have experience of many different types of plant modifications. If you have a problem with your plant or if some equipment needs to be replaced, why not discuss it with your local Formox represenative?

Formox can offer a plant audit (see pages 22-23) to help you identify potential upgrades and/or problem areas. For older plants, there's a good chance we have a modern solution that you can apply. And where you need to replace a worn-out item, rather than simple replacement, you may want to take the opportunity to make a cost-saving investment in new technology. For further information on this you need look no further than the latest *Upgrade* brochure (order a copy from your Formox rep!). Published in conjunction with the Formaldehyde Asia conference reported elsewhere in this issue, this brochure describes ways in which Formox catalyst users can improve efficiency and productivity – even if it is not a Formox design!

Need a resin plant?

The wood-resin industry consumes over 50% of the global production of formaldehyde, and perhaps you will not be surprised to learn that much of the formaldehyde used is manufactured using either Formox catalyst or is produced in Formox plants. What might surprise you is that many of the formaldehyde plants supplied by Formox have fully integrated resin plants for the manufacture of panel adhesives and impregnation resins. In fact, Formox has supplied such plants to some of the largest board producers in the world. The latest plant, one for Duratex in Brazil, went on stream in late April. If you are interested in a resin plant, please contact your Formox representative.

The Cathox™ option

Chinese-design oxide HCHO plants for the Chinese market

Formox is, as most people in the business know, a provider of state-of-the-art HCHO plants with high automation, broad operating flexibility and low total cost of operation, i.e. long-lifetime plants built to the highest standards, requiring little maintenance and giving world-class performance.

Now there is also a somewhat simpler approach – Chinese design oxide plants based on the Formox process, using Chinese standards and Chinese-sourced equipment. This option goes under the name Cathox (from "**Cath**ay", an old name for China, and "**ox**ide") and is available for the Chinese market at a lower investment cost.

Formox has granted the right to sub-license Cathox plants to **Hende Machinery & Equipment Co. Ltd.** under Mr **Hua Quifa** (picture). The projects will be run by Hende, with catalyst and technical support being provided by Formox. Cathox plants are available for a capacity range of 150-225 MTPD for production of HCHO and/or UFC.

PROJECTS & START-UPS

New Projects

- **Egger Technologia SRL** has signed an agreement for a Formox FS3 plant to be built in Radauti, Romania.
- **Xinjiang Markor Chemical Industry Co., Ltd.** (MarkorChem, see page 18) has signed up for a second Formox plant (a Formox FT3) to be built in Korla, China.

Ongoing projects

- Work on the first reactor line for a Formox FT3 plant for **Ningbo Wanhua Polyurethanes Co., Ltd**, China is in the construction phase, with the start-up scheduled for later this year. This will be their second Formox plant on this site. (See the separate article on pages 16-17.)
- Work on the basic engineering package for a Formox FT2.5 plant for a client in Asia is in progress.
- The new Formox FS2.5 plant for **Kanoria Chemicals & Industries Ltd.**, in Visakhapatnam, on the east coast of India, is in the construction phase. The start-up of the new plant is scheduled for this year.
- In the major project for **Ticona** in Germany, the construction activities are proceeding well.
- The Formox UFC plant for the **Q5** complex in Qatar, in cooperation with Saipem and Hyundai, is progressing well.

Start-ups

- The Formox FS2.5 plant for **Karbodin** in Russia was successfully started in March. (Karbodin is a joint venture between Metafrax and Dynea.)
- The Formox formaldehyde and resin plant for **Duratex** in Brazil went on stream in May.
- In Huhhot, Inner Mongolia, China, the new Formox FT2.5 plant for **CNOOC TIANYE Chemical Ltd.** (part of the China National Offshore Oil Corporation) is going on stream at about the time of the publication of this issue of ***informally speaking***.

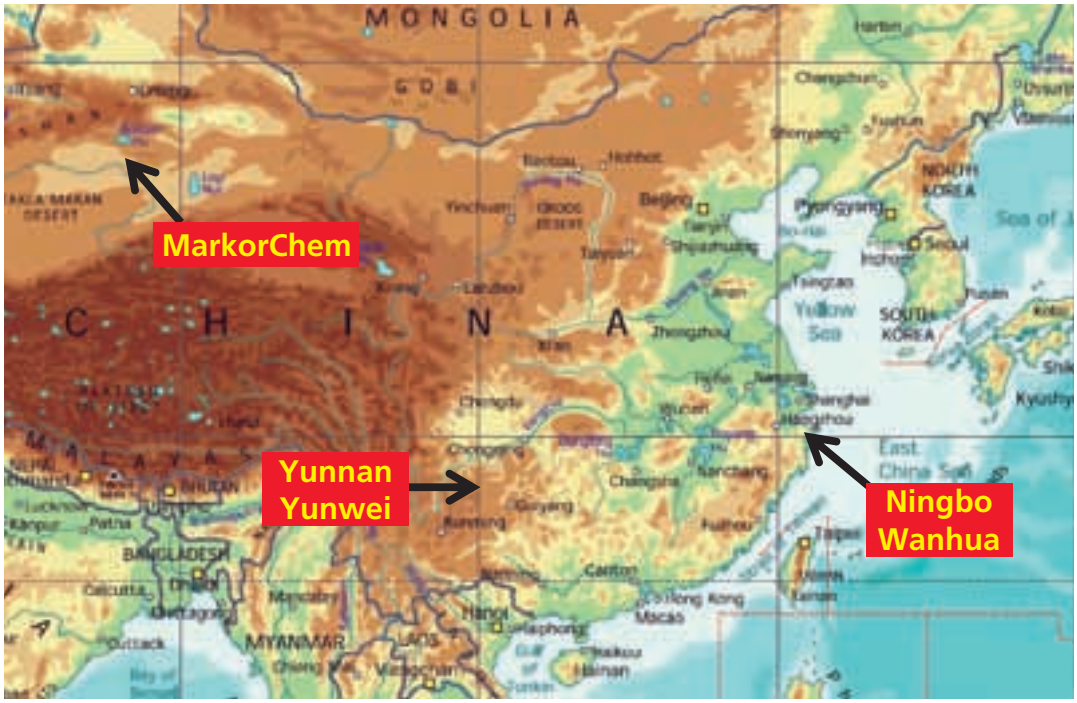
Training

Since the last issue of ***informally speaking***, we have held three different kinds of training programs:

- In late January we did training for a large group from Duratex on the company's new site in Brazil (2 pictures, right). At the back of the room in the lower picture were the booths for the simultaneous interpreters.
- Then in March we had the Advanced Training Course in Bali for the full day after the conference (lower left).
- Finally, in early June, we had a group from Kanoria (India) for training in Sweden (lower right).

Making growth a habit

Three and a half years ago, China was the cover story of this newsletter. Its phenomenal growth was a hot topic. People were wondering how long it could last, especially when the world was hit by a severe economic recession. China was hit too – its annual growth rate dropped from nearly 10% to a "mere" 8% – the kind of growth most other countries might envy….



This being a formaldehyde newsletter, we will not dwell upon the fact that China is the most populous country in the world with the highest sustained growth rate. What is of particular interest to us is the impact of China's growth on the world of formaldehyde.

In recent years, the updates on the HCHO and MeOH markets regularly reported in informally speaking have invariably noted "the China effect" – China's growing role in the consumption (and production!) of methanol, China's growing of production (and consumption!) of HCHO.

Historically, China's HCHO producers were small enterprises tending to use outdated and inefficient technology. Today, four of the world's top 20 HCHO producers are Chinese, and three of them are using the latest Formox technology.

Today Formox has 11 customers in China so far, and counting the plants under construction, the total installed capacity using the Formox process in China is close to 2.0 million MTPA (37%).

Needless to say, our highly professional team in Beijing, consisting of **Zhang Chenggang**, **Eric Li** and **Cao Ping** at the local company headed by **Zhao Dayang**, have their hands full. They are, of course, backed by the entire Formox team of experts.

In order to give our readers some further insight into these growing and successful players, and how they have been impacted by the recession, we have visited and interviewed three of them. You'll find their stories on the following pages.

Clockwise from top left: the Forbidden City, Beijing; the Temple of Heaven, Beijing; a little girl in folk dress at the Stone Forest in Yunnan province; a tiny section of the Great Wall; a busy produce market in central Beijing.

www.formox.com – soon in Chinese too!

Yunnan Yunwei is flourishing

First you fly to Kunming, principal city of the beautiful province of Yunnan in southernmost China. Then you take the highway and head northeast, about two and a half hours, to the village of Huashan (which means "Flower Mountain"). It's still early March, so there aren't many flowers to be seen. But one is flourishing: Yunnan Yunwei. Located around 2000 m above sea level, this high flying company is now a leading producer of formaldehyde and BDO in the region. There Stan interviewed Mr. **Li Bin** (Vice GM) and Mr. **Zhao Chenggang** (Vice R&D Manager) about the company's success.

How did Yunnan Yunwei get started?

Li Bin: "The company was founded nearly 40 years ago, in 1971, by the Chinese government, as the showcase business of the fourth 5-year plan. The location was chosen because of the availability and low cost of natural resources – water, electricity and limestone – as well as relatively convenient transport. Our original business was PVA [polyvinyl acetate] and limestone (for cement production), with capacities of 28,000 and 85,000 tons per year, respectively."

How has the business developed over the years?

Li Bin: "We're part of the Yunwei Group, and were listed on the stock exchange in 1996. Thanks to strong management, we've developed a good reputation and brand. Now our products include cement [500,000 MTPA], PVA [28,000 MTPA], calcium carbide [85,000 MTPA], sodium carbonate and ammonium chloride [200,000 MTPA] and VAC (vinyl acetate) [120,000 MTPA].

"Since we started our cooperation with Formox and got access to good formaldehyde technology, we've become a big player in BDO [25,000 MTPA] as well. Low cost has been and continues to be our biggest strength. We even have our own methanol plant of 300,000 MTPA capacity, derived from coal. And we have the low costs for water, electricity and labor."

Where are your markets?

Li Bin: "Domestic demand is so great, so we only sell within our local region – southern and eastern China. Since we got our Formox plant, we now also sell HCHO locally."

Zhao Chenggang: "I can mention that when word got around that we were going to open a Formox plant, three smaller local silver plants just shut down, because they knew they couldn't compete on quality or efficiency!"

From left: Zhang Chenggang (Formox, Beijing), Cheng Xiaoliang (Assistant GM), Mattias Fridolf (Formox, Sweden), Li Bin (Vice GM), Wen Yingming (R&D Manager), and Zhao Chenggang (Vice R&D Manager). The sign in the background says "Warm welcome to the editor of *informally speaking*" !

FACTS ABOUT YUNNAN YUNWEI

- Founded in 1971, listed on stock exchange 1996
- Located in Huashan village, near Zhanyi, about 200 km northeast of Kunming, in Yunnan province.
- 3100 employees, of which 18 in HCHO production; about 8000 in the Yunwei Group.
- HCHO capacity (in new Formox plant, on stream in 2009): 100,000 MTPA
- Main products: BDO (from HCHO), PVA, ammonium chloride, alkali, cement, VAC.
- Annual turnover approx RMB 4 billion in 2009 due to financial crisis; normally 6-7 billion.

How is your cooperation with Formox?

Li Bin: "Very good! Both the technology and the service. Your people are very efficient in their work, with very timely trouble-shooting, and good training. Our plant is running very well, and we reached the design criteria very quickly."

Zhao Chenggang: "We used to have a silver plant, but our investigations showed that we could get a lot better results with oxide. It was the right decision. The Formox people were very helpful during the whole project, and it was very successful. I'd also like to take this opportunity to express our appreciation for all your good hard work!"

The guys from Formox provide helpful advice in the control room.

How would you describe the impact of the global economic crisis?

Li Bin: "We are definitely one of the victims, as our market demands and product prices dropped by around 50%. This of course meant a sharp drop in our profits, and credit became a lot tighter. The worst period was in late 2008 and early 2009. Now the worst is over, but we're still only at around 75% of the pre-crisis levels. But now we have the capacity for generating future profit!"

How important are environmental issues for Yunnan Yunwei?

Li Bin: "We're constantly making efforts to implement good environmental practices. We invested RMB 6.8 million towards this last year, and we have achieved both OSHA [Occupational Health & Safety Administration] and ISO 14001 certification. Our aim is to build an environment-friendly enterprise."

Where will you be 10 years from now?

Li Bin: "Right now it's a bit hard to say, because of the crisis, but our success in BDO makes us confident about exploring downstream products – both of PVA and BDO. We're hoping to strengthen our market in eastern China, and maybe even expand into South East Asia."

The people at Yunnan Yunwei are hugely proud of their province and kindly took us on a tour of a few of the spectacular sights, like the famous Stone Forest (top row) and a magnificent complex of caves (bottom row). The lower-right picture shows Zhao Chenggang from Yunnan Yunwei (left), who was our guide for the tour, and Zhang Chenggang from Formox in Beijing.

Ningbo Wanhua keeps on growing

The huge, modern chemical industry complex that is Ningbo Wanhua Polyurethanes Co., Ltd. is located on Daxie Island, just outside Ningbo, a couple of hundred kilometers south of Shanghai. At the time of a previous article in *informally speaking* (see the autumn/winter issue 2006), the company was expanding its Formox plant from 120,000 to 240,000 MTPA in order to strengthen its role as a leading producer of MDI. That expansion was completed in 2007. Now Ningbo Wanhua is taking it to the next level, with the purchase of yet another Formox plant – also an expandable one. You get the feeling that somebody is doing something right. This was confirmed in my interview with Mr. **Zhou Yongjin** (CFO) and Mr. **Shen Yunshuan** (UT & FA Plant Manager).

The Ningbo headquarters of Wanhua

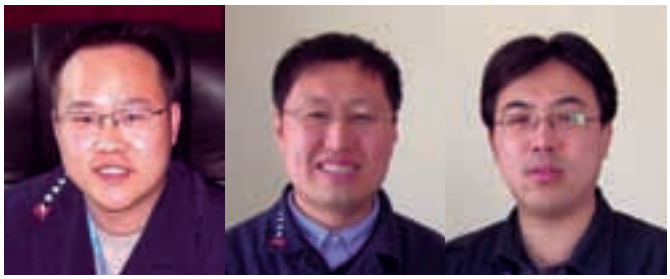
Just how fast is Wanhua growing?

Zhou Yongjin: "In the 10 years since we became a stock company in December 1998, our growth rate has been around 50% per year!"

What impact has the global financial crisis had?

Zhou Yongjin: "Although product prices dropped sharply, around 40%, raw material prices fell even more – around 65%. The Chinese government injected some RMB 4 trillion into the economy, mostly in the form of investments in our infrastructure, which has contributed a lot to Chinese industry. The approach has been based on the view that confidence is more important than money right now. And with the government's macro-management, there's been major promotion of household appliances to rural areas, which has also boosted sales and improved companies' performance. So it's both a challenge and an opportunity!

"It's not clear whether the recession is over worldwide yet, but here in China we're confident that it is, and that things are heading towards greater growth and profit."



From left: Zhou Yongjin and Shen Yunshuan, as well as HCHO plant supervisor Tan Jun

Shen Yunshuan: "We had to delay the start of the new Formox plant a bit, due to the recession, but the recovery has come sooner than expected, so now we're in a hurry to get the new plant up and running!"

The Formox concept of expandable plants seems to fit your strategy?

Zhou Yongjin: "Absolutely in line with our approach! We've gone the same way with our MDI production: build capacity, strengthen our market position, build more capacity etc. We're also expanding our methanol production, with a new plant for captive use going on stream by the end of this year. It will meet all our capacity needs."

How would you describe your cooperation with Formox?

Zhou Yongjin: "It's a strategic cooperation for us – very important. You have a dedicated, active approach that we feel we can count on. We get nearly instant feedback on all questions. It would be hard to be better!"

Shen Yunshuan: "We get really good technical support, both from your people in Beijing and in Sweden."

What is Wanhua's position on environmental issues?

Zhou Yongjin: "We always put safety and environment at the top of our priority list. I'm pleased to say that Wanhua is

The impeccable control room

Above: The existing Formox plant is a model of good housekeeping.

Left: Preparation of the site for the next Formox plant is well underway.

actually a model for China's 'green' chemical plants. And we feel that good care of the environment can really pay off financially too! For example, we had been faced with the problem of what to do with a lot of hydrochloric acid – a by-product of MDI production. We managed to find a company that uses it, so we were able to turn waste into profit, while sparing the environment."

Where do you see Wanhua 10 years from now?

Zhou Yongjin: "For one thing, we intend to be #1 in the world in MDI. Beyond that, our success in MDI will be a support to other business development work we have going, like some coal-based projects in Shaanxi province."

Shen Yunshuan: "Our new Formox plant, once we've expanded it too, will almost meet our formaldehyde needs – and we're guessing that by the time we get there, you'll have figured out ways for us to get even more out of our plants, so that will take care of us!"

FACTS ABOUT WANHUA POLYURETHANES

- Founded in 1983 in Yantai (Shandong province); expanded to Ningbo in 2003.
- More than 2000 employees in the Group, of which over 700 are located in Ningbo.
- Formox plants in Yantai (2002), Ningbo (2005); the latter expanded to double capacity in 2007. The new expandable plant scheduled to open in 2010, with expanded capacity to follow.
- Main downstream products are MDI and paraformaldehyde.

MarkorChem brightens up the desert

Xinjiang Uygur autonomous region, in the northwest corner of China, is the country's largest province, covering more than 1,600,000 km^2 (quite a bit larger than Alaska, and about 3 times the size of France), i.e. around one-sixth of China's total territory. It borders on Russia, Mongolia and Kazakhstan, as well as Kyrgyzstan, Tajikistan, Afghanistan, Pakistan and India. While its desert climate – just 155 mm of rain annually, boiling summers and icy winters – make it home to less than 20 million city residents, the region attracts many tourists home and abroad for tour and sightseeing. Korla, the capital of Bayinguoleng Mongolian Prefecture of Xinjiang, a city right in the heart of Xinjiang province, is the location of MarkorChem. The interview for this article was given by Mr. **Tang Jiawei**, Vice General Manager of MarkorChem, a chemical firm that mainly produces and sells BDO products.

What's the story behind Markor?

Tang Jiawei: "The Markor Group was founded in 1990 and quickly became one of China's biggest furniture manufacturers, exporting to Europe and America, with two big furniture manufacturing bases in Xinjiang and Tianjin. In 2001, with the Group's international brand strategy moving forward, Markor joined forces with Ethan Allen, a top US furniture retailer, and established the retailing of the Markor Home Furnishing brand.

"Riding on this success, Xinjiang Markor Chemical Industry Co., Ltd. was established in 2004, to utilize Xinjiang's abundant oil, natural gas and coal resources for development of the fine chemical industry, which is the focus of strategic expansion by Markor Group into new industries. Using natural gas as the raw material, we introduced an advanced process route to produce high-value-added fine chemicals.

What does MarkorChem produce?

Tang Jiawei: "Our main product is BDO (1,4-butanediol) using a process route with natural-gas-based acetylene production via a partial oxidation process, off-gas for methanol production, oxidation of methanol to formaldehyde. Acetylene then reacts with formaldehyde followed by hydrogenation, and BDO is formed as a raw material for fine chemical industries. Extensive usage covers solvent, pharmaceuticals, cosmetics, engineering plastics etc. Part of our BDO is further reacted to THF (tetrahydrofuran), which is used as a raw material for production of elastomeric polyurethane fibers. And we also produce some methanol from the off-gas of the natural gas based acetylene production."

How is your market situation?

Tang Jiawei: "Our BDO and THF products mainly go to domestic markets, for sale to downstream customers. We have very smooth logistics, with transports mostly by road and rail. We have no chemical exports so far. But we have already achieved about a 25% share of the BDO market!"

What impact has the global financial crisis had?

Tang Jiawei: "We've been running at close-to-normal production and sales levels, but BDO downstream industries were impacted by shrinking exports. And demand from auto and electric industries declined, so the downward trend in BDO prices has been hard to change.

"There's been an indirect influence on China in general, as the US debt crisis turned into an economic crisis. Even though China has a huge and growing domestic market, there is still as much as 60% dependency on the outside world. But the ongoing stimulation policies of the Chinese government have been able to maintain short-term control, and the situation is getting better."

MarkorChem's Formox plant

Photo courtesy of MarkerChem

Photo courtesy of MarkerChem

The modern and growing city of Korla.

How would you describe your cooperation with Formox?

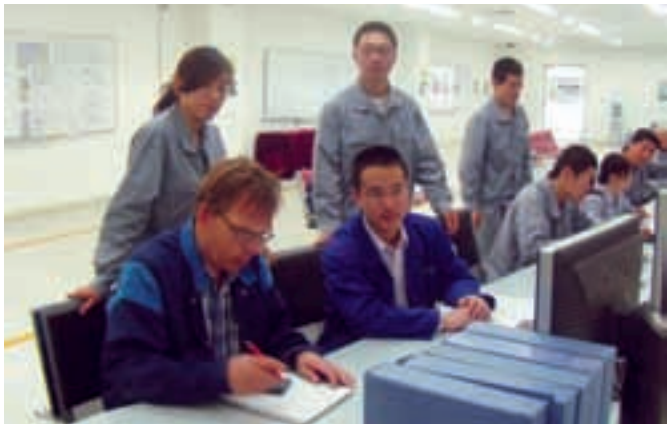
Tang Jiawei: "We chose Formox to be the supplier of our formaldehyde technology because you are well reputed in the industry worldwide, with your advanced technology and fine technical service team. Our experience has shown you to be very effective, very dedicated, and with timely response to our questions. On the whole, our cooperation with Formox is very satisfying."

What is Markor's position on environmental issues?

Tang Jiawei: "The environment is the basis for our life and existence! That's why it's closely connected with us. Environmental protection is the duty of everyone. This is the position of Markor, even without any governmental influence. After all, the government can only supervise; we are the ones who have to take action."

Where do you see MarkorChem 10 years from now?

Tang Jiawei: "We will continue to take advantage of our local natural gas and coal resources, working towards the fine chemical industry. The preliminary plans for our next phase is an expansion of BDO production, and possibly to enter some BDO downstream areas."



Formox's Ola Erlandsson and Zhang Chenggang following up on operations in the MarkorChem control room.

Not far from the MarkorChem site, one can go on a camel excursion in the desert. That's Tommy Johnsson from Formox on the lead camel…

FACTS ABOUT MARKOR

- Markor Group founded in 1990, MarkorChem in 2004.
- MarkorChem is located in Korla, Xinjiang province, in northwest China.
- Biggest product is BDO.
- 13,000 employees in the Group, of which 215 work at MarkorChem. Ten of those work with formaldehyde production.
- MarkorChem's Formox plant is a dual-reactor plant capable of meeting the company's needs for 60,000 MTPA of BDO.
- **BREAKING NEWS! MarkorChem has just ordered another Formox plant (see page 12)!**

Behind the smoke & mirrors

by Bob Crichton

Formaldehyde demand projections have been a feature of Formox seminars since the first event in 1994. The 6th Formaldehyde Asia seminar, held in Bali earlier this year, was no exception and I made what has become my customary presentation; looking at formaldehyde's growth prospects in the wood and chemical sectors. After the presentation, during one of our breaks, I was asked an interesting question….

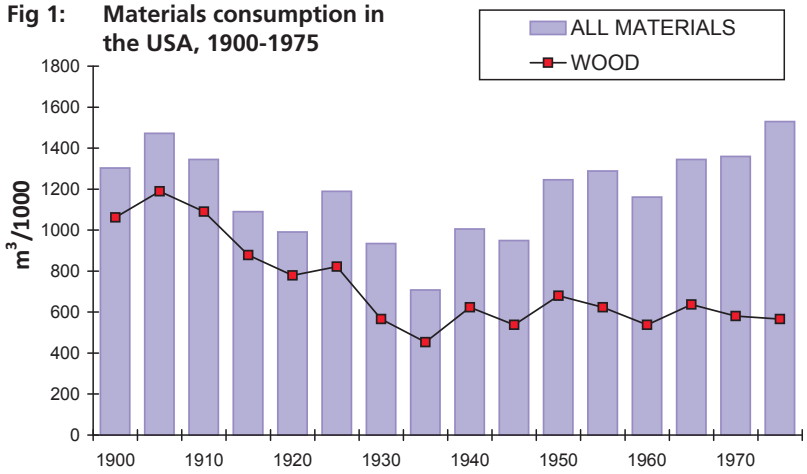
The question was this: Why do I look at the wood industry as a group and not as simply another outlet for resins – UF, PF, MF etc? This is a fair point, as indeed this is what most commentators do; UF, PF and melamine containing resins are treated individually and consumption by the wood industry is just another outlet.

Looking back I see that it is quite a few years since I explained the reasons for making this distinction and your editor kindly offered this opportunity to go over the story once again. And just as well he did; in researching the topic I found that I needed to adjust some of the assumptions on which the projections were based.

The quick answer is that it is possible to trend panel products and hence formaldehyde usage in the wood sector from a few basic facts. The inspiration was a paper published in *Hydrocarbon Processing* in 1978 in which the author (M. G. Marbach) stated that man's basic needs did not change. Technological evolution, he suggested, was simply the substitution of a new form of satisfaction for the old.

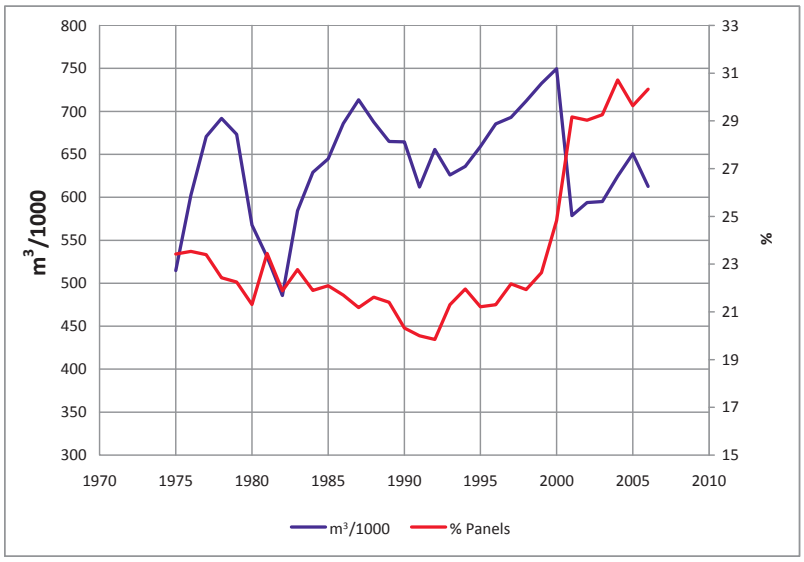
This conclusion was supported by statistical data from the US (Fig 1), showing that with the exception of the 1930s, the per capita demand for materials was remarkably constant. For example, excluding 1935, the average consumption of all types of materials over the 75-year period was 1200 m^3 per thousand of population (± 150). Or, to put it another way, materials demand is constant and only varies by ± 10% in response to the economy. When the economy is booming, demand is 10% higher than the mean; the converse is also true, 10% lower during a recession (although more extreme in a depression).

Fig 1: Materials consumption in the USA, 1900-1975



However, all materials compete to satisfy this demand, and with time the relative importance of different materials changes. Wood's share of the US market, for example, fell from 1.2 m^3 per capita in 1905 (80%) to nearly 0.6 in 1976 (42%). At the same time, polymerics (which accounted for only 1% of the demand in 1945) increased to 12% by 1975.

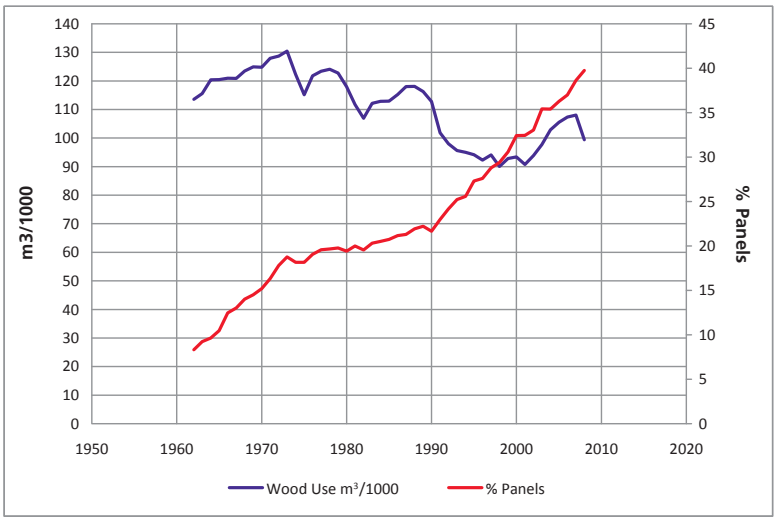
Fig 2: Wood consumption trends in the USA, 1975-2007



What we see is not a change in demand, but a change in the way demand is satisfied. And within the wood industry itself, there was a change; replacement of "real" wood by panels. And given that panel penetration rates could be estimated using "S" curves, it seemed not beyond the bounds of possibility that long-term trends in the wood panel business could be established from just a few basic facts. Given knowledge of the industry, in particular resin properties and usage in the different products, these data could then be translated into formaldehyde terms.

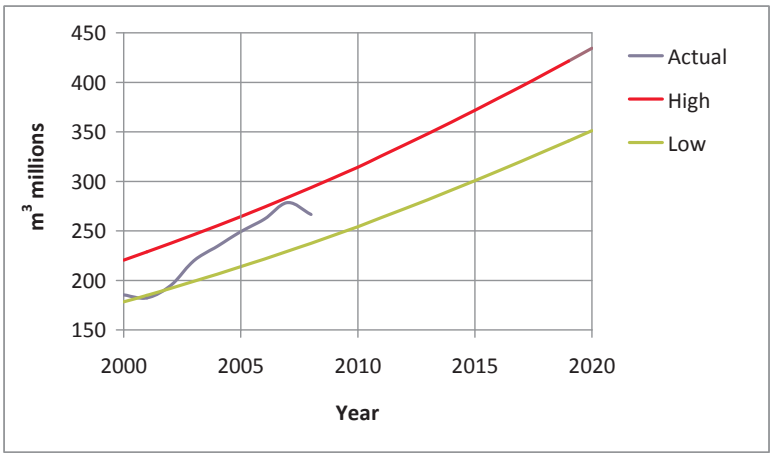
The source of Marbach's data is not documented but recent data for the USA (Fig 2) reveal the same general picture – though the average in the recent past has been slightly higher (0.65 rather than 0.60 m^3 per capita).

Fig 3 Global wood use & panel share through 2010



However, penetration of the timber market by panels (% panels in Fig 2), at least in the US, did not follow a pure "S" curve. Though the end point, 30%, might have been expected, the path was not. For a number of reasons, the market share of panels fell during the 80s – but accelerated after the recession of 90/91, a trend boosted by increased prices for "real" wood.

Fig 4 Projected global panel production



Due to the lack of reliable data, trending like this is rarely possible on the world scale. And even in the developed world not all countries are the same; wood's share of the materials market differs from country to country, reflecting building traditions which themselves reflect the historical availability of wood. Penetration rates are also influenced by the same factors.

However, it is possible to get at least an indication of future world trends. Looking at Figure 3, we see, for example, that wood consumption in the world as a whole fell from the mid 1980s to the mid 1990s while the market share enjoyed by panels was steadily rising. And for projections made in the late 90s (e.g. New Orleans seminar) an average worldwide wood consumption of 95 m³/000 population (± 5) was assumed. At that time the trend curve indicated a 32% market share for panels by 2009. In actual fact, Figure 3 shows that wood consumption not only turned out to be much higher, but the market share enjoyed by panels increased very much more rapidly, reaching almost 40% by 2008.

The reason why was touched upon earlier, namely that in many regions of the world wood is not a traditional material – there is very little wood to replace. As a result, the substitution method (panels replacing wood) is not a reliable forecasting tool. In these regions panel shares are high; indeed it is panels that are driving wood consumption. Here other factors are at work (e.g. IKEA's worldwide exports of Scandinavian-style wood furniture), and to get a true picture it is necessary to look at each region/country individually. GDP/capita provides a useful tool. Though this is an imperfect statistic, it is generally accepted that once national GDP exceeds $3000-5000/capita, the market for consumer goods in general (and panel products in particular) expands rapidly – increasing formaldehyde consumption. And in the 15 years since we first started looking in detail at the different regions, panel consumption has soared in Eastern Europe, China, Brazil and Russia. India is also starting along the same path.

Having said that, the global method at least gives an indication, and the panel volume projected using this method is shown in Figure 4. To convert this to formaldehyde, of course, you need to know the split between the various panel products, plywood, OSB, particleboard and MDF. You then need to know the resin type, molar ratio and usage (and take into account overlays) before you can calculate the implications for formaldehyde. Another factor is that it is not always clear where the formaldehyde consumption will arise; for example, it depends on whether regional demand is met by local production or imported panels. In short, there are many steps left before you can predict the effect on formaldehyde demand – but that story will have to wait for another day.

The main manufacturing site of the Perstorp Group is in a forest close to the small Swedish village of the same name; not the location you expect to find a chemical company. But its location has had a profound impact on the company's philosophy and indirectly, a profound effect on formaldehyde. And by this I don't just mean the need to have simply the best formaldehyde process in the world, though this was essential as Perstorp lost its competitive advantage, wood alcohol, in the 1930s. What I refer to is something else – a decision many years ago to try and expand the market for Perstorp laminate by putting it on the floor. Thus Pergo was born and this and the many emulations around the world have gone on to consume over 10% of the world's MDF and consume approaching 7% of all the formaldehyde used in the wood industry. So Formox owes a lot to Pergo – and vice versa. Amazing what can come out of a small village in Sweden!

Plant audits – a "healthy" way to save you money

A formaldehyde plant is a major investment. It can also be a very profitable, long-term investment if you keep it fine-tuned and perform all necessary maintenance, i.e. if you keep your plant in good "health". Formox can help you with this by doing a full audit – a detailed examination of your plant and its performance that lets you know exactly what needs to be done to give you the most for your money.

Plants audits have been found to be so worthwhile and valuable for Formox plant clients that audits are normally included in the purchase contract for the plant, typically performed after one, four and eight years of operation. After that (remember that the first Formox plant ever built – more than 50 years ago – is still running!), we continue to offer plant audits on request – and, it must be said, to the extent that one of our experts is available to perform the audit….

Something for everyone?

Plant audits are performed to help you to optimize your plant, to find improvement areas, and to receive operational suggestions and solutions to problems. Whether you have a Formox plant or another design, we will be happy to perform the audit – provided that you are operating with Formox catalyst. After all, our aim is to serve formaldehyde producers, and to help you get the best possible performance.

What is involved?

A plant audit is typically performed by a Formox process engineer and takes 3-5 days including preparation time and writing the report. The normal plant audit is done when the plant is in full operation. An extended audit can be performed during shut-down.

We start by reviewing with you all of your plant issues, requests, questions, expectations. Then we collect your start-up data, performance tests or other audit data for comparison, and draw up an agenda for the audit, including preparations.

After our process engineer has completed the audit, you receive a full report on every adjustment, preventive maintenance, replacement and repair that needs to be done. Very often these actions enable you to avoid small problems from turning into big ones. You also get direct feedback on operational improvements. In other words, a plant audit can mean big savings!

Mattias has a long checklist to go through

FIRST-HAND ACCOUNT

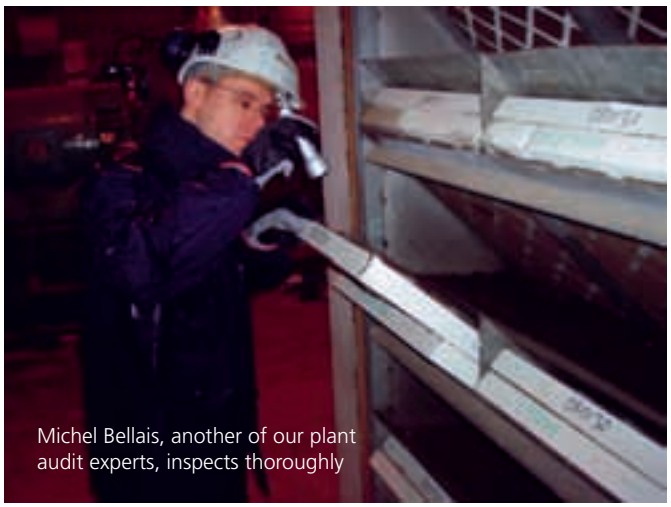
To give you a clearer picture of what happens, we asked one of our process engineers, **Mattias Fridolf**, to tell his story about performing plant audits:

"When I arrive at the site, I first sit down with the client and go through what I'm planning to do during the audit, and what help I might need to assure that everything goes smoothly. The client informs me about the relevant safety procedures and regulations for the site. We also discuss any special problems they want me to look at or any other questions they may have. Sometimes I might need to consult one of our electrical or instrument specialists. If I can't provide an answer on the spot, I see that the answer is included in my report.

"I usually want to discuss how things have been running at the plant, and the client often has questions about operation and maintenance. I ask for their methanol and formalin figures so I can calculate the yield, and I ask them to take samples to run in their lab, and preferably also a CO measurement, so I can help them make the right adjustments. (Newer Formox plants already have an installed CO meter in combination with the oxygen analyzer. If the customer's plant doesn't have one, we can bring along a portable CO meter for this measurement.) We also make a careful study of absorber efficiency.

"I then go all around the plant, checking the equipment to see that everything is normal. If I spot any deviations, I make notes of them and include them in my report. Such things might include missing insulation, leakage from pumps, vibrations in pumps etc. During my inspection I also check the positions of the valves, to ensure that they have the right settings and working properly. And I've found that many clients are surprised to discover that fouled air filters are giving them an excessive pressure drop.

"After my overall plant inspection, I then check each vessel in greater detail, to see that levels and flows are right, and if not, to find out why. When we inspect the fans and blowers,



Michel Bellais, another of our plant audit experts, inspects thoroughly

A Pitot measurement is just one of the steps

we also look at their maintenance programs, and verify that the operators check them at least once per shift. We also see that lubrication and oil changes are being done in accordance with the supplier's specifications. I explain why it's important for their operators to check the machines at least once each shift, and listen for any abnormal noises and strange vibrations. If you can spot such problems in time, repairs will probably be a whole lot cheaper!

"Pressure drop readings are taken over every vessel in the process gas lines to assure there's no para or anything else blocking them. Pressure drops mean higher operating costs, and broken or burned vessels cost even more!

"We of course check the emission levels from the ECS, as well as the noise levels from the plant.

"I'd also like to mention that we do a Pitot tube measurement of the process gas flow to verify the function of the process gas flow meter. We check the Pitot reading against the DCS and the meter. This is very important, as the plant operation is based on this process gas flow. If it's wrong, and you think you're operating at a certain methanol inlet concentration, but in reality are operating at another, you could be operating at a higher inlet without realizing it. This will result in faster deactivation of the catalyst and the yield will decrease prematurely. Probably not what you want!!

"The above applies to an audit of a plant during operation. If we're auditing during a standstill, we check even more. Then we can open everything up for inspection. But I won't go into all of the details here…

"After my visit, I write a plant audit report, summarizing my observations and measurements. I answer the client's questions (if I was unable to provide answers during the audit). And I write recommendations of changes or actions I feel should be taken. I give this advice verbally too, of course, but it's more 'official' in the written report.

"Much of the work involved in a plant audit is based on experience, and after a while you get to know what to look out for. Speaking for myself, I feel I benefitted a lot from having worked with maintenance of the Formox plants in Sweden, so I got to know where the problems can arise – and I can understand what our clients ask about and worry about.

"At the very least, a plant audit reassures the client that all is well. (Who isn't happy to get a clean bill of health from the doctor?!) But sometimes an audit will reveal a breach in maintenance or an error in operating procedure which, if it had gone uncorrected, would have cost the client a very great deal of money. So the clients are very grateful. And I think it's really fun to save them money!"

Problems caught in time can save a lot of money!

A completed checklist is the basis for a complete report to you

Faces & places

There have been two staff changes at Formox since the last issue of ***informally speaking***:

- **Mikael Ochraniak** has joined our team of instrument engineers. Mikael holds a degree in international electrical engineering from the Helsingborg Technical College and was previously working in the Norwegian oil industry.

- **Robert Häggblad** has just completed his doctorate in catalysis at Lund University and will be reinforcing our technology team.

- **Lotta Ekedahl** is our new accounting manager. Her previous position was as a controller for the regional police department.

Something to celebrate?!

I've come to the point in my life where I've learned the importance of not passing up any opportunity for celebration. The 22nd anniversary of the day I first met my wonderful wife – just a few weeks ago – simply couldn't go uncelebrated by me (and her), just to mention one example.

Another example is that this special issue of ***informally speaking*** marks the completion of a full 15 years of the existence of this publication. The idea for a newsletter was put to me by Max Henning in the spring of 1995, and together we published the very first issue in the autumn of 1995. Although Max has retired, we've managed – with a lot of help from my colleagues and from a lot of you – to publish faithfully, twice a year, ever since. Thanks!!

Over the years, we've brought you news about methanol prices and formaldehyde trends, as well as news about the many technology advances in the Formox process, plant design and catalysts that have given you so much more formaldehyde for so much less money. I'm sure it would have seemed quite impossible 15 years ago!

You've read reports in ***informally speaking*** about the annual conferences, about HCHO producers from all over the world, and about all kinds of downstream products. You've also received advice that has helped you to achieve smoother, safer operation, and heard about threats to and opportunities for our common friend: formaldehyde.

Even though you might not be familiar with all the work that goes into it, I think that a 15-year supply of all that information might be worth celebrating.
I hope you agree!

News about www.formox.com

Have you noticed the new little box in the top left-hand corner of our homepage – "Google Custom Search"? Here you can type in a search word and get results – even from the articles in ***informally speaking***! Try typing in "Russia", for example, and you'll hits for the page with contact information to our Moscow office, as well as every article in which Russia has ever been mentioned in this newsletter. We think you'll find it quite useful.

Seminar news

Our conference rotation continues from Asia to the Americas, and next year's conference will be **Formaldehyde Americas 2011**, to be held **in San Francisco, California, USA on March 15-16**. Further details will be made available during the autumn. If you are a Formox customer, you will be receiving an invitation, but feel free to ask you Formox representative for updates at any time.

Looking further into the future, the conference rotation program looks like this:

- **Formaldehyde Europe 2012**
- **Formaldehyde Asia 2013**
- **Formaldehyde Americas 2014**

The dates and venues have yet to be decided. Watch our website (www.formox.com) for further details!

informally speaking

The newsletter ***informally speaking*** aims to provide **inform**ation about **form**aldehyde in an **informal** forum and is published twice annually by Formox for its customers and contacts in the formaldehyde business. The information included herein is part of our customer service and in no way entails or implies any undertakings, legal responsibilities or liabilities.
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