



## Formaldehyde Europe 2009

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## SPECIAL REPORT FROM TURKEY

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### It's all about economy!

Whether we like it or not, the financial global crisis is having an impact on all of us – in business as well as in private life. It is impossible to be discussing business today, without also talking about how the current turbulent situation is affecting our daily life.

So what can we do about it? One thing is to continue to work hard, continue to focus on “more for less” and strive for efficiency. In terms of formaldehyde production, that is what Formox is aiming to help you do. This spring's conference in Malmö consequently focused on improving the economy of your plant and catalyst run – getting the most out of your investments! Some of you need to reduce your capacity and so we showed you how to do that in the most economical way. Some of you need to increase capacity, but cannot invest in a new plant at this time – and so we showed you what possibilities there are to get more out of your existing plants.

At this spring's conference in Malmö we also celebrated the 50th anniversary of the world's first Formox plant, a plant built and started in 1959 – and still in operation, living proof of long-term economy!

We are proud of our achievements leading up to our golden anniversary and in these turbulent times it can be comforting to know that Formox remains the same. As always, we are dedicated to helping each one of you, our customers, to achieve the best possible economy, based on your particular needs and circumstances, and we look forward to doing so for a long time to come.

We also hope that you, the readers of *informally speaking*, will find information in this issue to give you some ideas about getting more out of your plant, so that you'll come out of this financial crisis on top. Now that would really be worth celebrating...



Marie Grönborg  
General Manager  
Formox AB



# Formaldehyde Europe 2009

## Achieving good economy – even in a downturn

This year's formaldehyde conference came in the midst of a sudden and dramatic recession in the world economy – circumstances that few could have foreseen a year ago in Toronto. People buying fewer homes. Money becoming tight. Demand dropping everywhere. And travel becoming restricted. So restricted, in fact, that for a while it looked like there might not be a Formaldehyde Europe 2009. But the invitations indicated that the conference would focus on economy, and we got an unexpectedly high turnout, not just from Europe, but from as far away as Argentina, Iran and South Korea. Here's a summary of what they learned . . .

### DAY 1

#### Formox update

The first presentation was by **Marie Grönborg**, who gave an update on Formox and a review of the 50-year history of developments in Formox technology (see table, page 6).



**Marie**

"Naturally we are proud of these achievements," says Marie, "and especially because it has been possible to apply so many of them to older plants, to boost capacity and efficiency, so that you keep getting more value, year after year."

"It has never been the Formox approach to sell you something and then say goodbye. We don't believe in selling you catalyst as a commodity, but as performance. That's why our offer of technical support goes on and on, for as long as you need it. We feel that this is especially important in times like these."



**Lucien**

Marie also reviewed the latest changes in the Formox organization and the topics for the seminar. Concluding her remarks, Marie told the participants "I really appreciate being able to celebrate our 50th anniversary together with all of you. I hope we will continue to work together – shall we say for another 50 years?"

#### Methanol update

The next speaker was **Lucien Mols**, from StatoilHydro in Norway, a major supplier of methanol in Europe, and the world's third largest net seller of crude oil. The company was formed as recently as 2007, as the merger of two much older companies, Statoil and Hydro, Norway's two biggest gas and oil companies. The company owns huge oil and gas fields in the North Sea, with pipelines to the European continent.

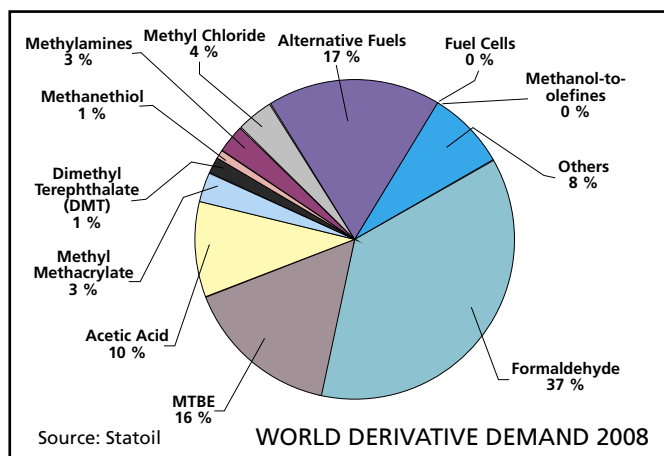
On the MeOH side, "formaldehyde is our biggest customer," states Lucien, "with a 37% share [see his pie chart], and demand is increasing. We project a 5%/year increase in demand over the next few years."

So where will MeOH prices be going? "We can expect an explosion in demand in China, to match the growth in the housing and automotive sectors. Another demand factor can be the new megaplants and the risks they entail. Since a single plant represents about 5% of global methanol demand, any outages will mean price spikes, while the addition of new megaplants will cause drops, so there will be more price vulnerability than before."

Lucien also noted that methanol will be used more and more as an alternative fuel. "And the energy market is so big it could easily swallow methanol production if prices got low enough. Basically, methanol prices are the same everywhere in the world. It's the added cost of the logistics that differs."







## HCHO market update

**Bob Crichton**, boldly claiming to have “predicted 5 out of the past 2 recessions [sic],” was next up to give his annual review of trends and forecasts. He noted a strong correlation between GDP (gross domestic product) per capita and formaldehyde consumption; greater prosperity meant more cars, more homes and more furniture in those homes.

“This downturn is more serious – and more global – than the ones we’ve had in the past,” says Bob. “It has been referred to as ‘synchronized sinking’ (as opposed to synchronized swimming), since nearly all the world’s economies are going down at the same time. But the bump might not be as big as you expect. And post-recession growth will be good. The question is how much? And when? All of the normal forecasting tools are out the window.”



**Bob**

Bob warned about focusing too much on global trends. “If you look at trends in the individual regions, volume growth in wood panels can be up to 50% higher than calculated from global averages. The true figure is probably somewhere in between.”

There are, of course, very many HCHO producers, but about half the world’s production is accounted for

|    | COMPANY                        | MTPA 37%  |
|----|--------------------------------|-----------|
| 1  | Hexion                         | 4,077,843 |
| 2  | BASF                           | 1,975,986 |
| 3  | Dynea                          | 1,501,643 |
| 4  | Kronospan                      | 1,283,439 |
| 5  | Georgia Pacific                | 1,150,500 |
| 6  | Arclin                         | 984,794   |
| 7  | Perstorp                       | 965,872   |
| 8  | Celanese                       | 960,271   |
| 9  | Metafrax                       | 898,000   |
| 10 | Sadepan Chimica                | 875,100   |
| 11 | Jiantao Chemical Co            | 780,000   |
| 12 | Polyplastic                    | 540,400   |
| 13 | Ercros                         | 525,000   |
| 14 | Yuntianhua Group Co            | 512,400   |
| 15 | Finsa/Foresa                   | 482,000   |
| 16 | Yantai Wanhua Pu Co, Ltd       | 333,200   |
| 17 | Mitsui Toatsu                  | 299,000   |
| 18 | Togliattiazot                  | 298,000   |
| 19 | Acron                          | 280,000   |
| 20 | Shenqiang Joint Formalin Plant | 280,000   |

by the top 20 companies (see Bob’s list), and we are continuing to see consolidation in the industry, according to Bob.

On the consumption side, the biggest growth is in China. “By 2018,” Bob predicts, “Asia will

have about half of the total global formaldehyde consumption – which I expect to rise to around 50 million MTPA.”

## FormaCare update

The next speaker was **Reinhard Strupp**, the Secretary General of FormaCare, a member of Cefic whose main task is to try to assure that legislators and other decision-making bodies take a scientific approach to regulations concerning formaldehyde – basically to “demystify” formaldehyde and to demonstrate that industry is a responsible partner in this process. Consequently, nearly all of Europe’s HCHO producers are members of FormaCare, and membership is also open to producers elsewhere.

“We are currently facing three main challenges,” says Reinhard. “The first is to try to stop the authorities from introducing new indicative occupational exposure limit [IOEL] values in Europe at levels that are scientifically questionable and that fail to strike the right balance between health-based necessity and socio-economic value to society.”

The EU is heading in the direction of 0.2 ppm TWA (with a peak value of 0.4). FormaCare is recommending 0.3 ppm TWA (peak 0.6), or postponement of the decision until the results new ongoing studies are available. But the authorities do not seem too likely to change, and it is a delicate balance for the European Commission since member states are split on the suggested values. Despite the fact that “indicative” means that member EU states can decide to adopt these values or not, their influence is very strong, and could have a very negative impact, particularly for downstream users. Consequently, FormaCare is undertaking joint actions with downstream users, frequent exchanges with the EU Commission, and talking with trade unions (there could be a major impact on jobs in downstream industries).

The second challenge involves both IARC’s review of formaldehyde and unwillingness to modify their recommendation of 2004, and France’s proposals for new classification and labeling of formaldehyde. “If these measures are adopted,” warns Reinhard, “there is a very real danger of deselection of formaldehyde [i.e. producers would be forced to used other paths] because our industry could face an authorization process at the EU level. Here we’re working to streamline scientific input and arguments, and to underline that new science rehabilitates formaldehyde – which IARC must take into consideration. We’re also striving for a pro-active dialogue with French authorities at political/ministerial and scientific/working levels.”

The third challenge involves a new recommendation from the EU on indoor air levels – possibly as low as 1 ppb – which are not even achievable! Moreover, the EU Commission has indicated that it will also base its considerations on the results of the WHO work, which began last year. Consequently, FormaCare is closely monitoring developments at national, EU and global levels, planning workshops with the authorities and seeking to fill scientific gaps with new studies. “It is also essential for us to influence public perception of formaldehyde,” says Reinhard, “so we are developing media relations with key messages. Even though we feel we have the facts on our side, it’s a very tricky situation!”



**Reinhard**

**FormaCare**  
The formaldehyde sector group of Cefic

[Editor's note: As FormaCare's work is both relevant and urgent for every HCHO producer on the planet – not only in Europe, we strongly recommend visiting [www.formacare.org](http://www.formacare.org) (the FormaCare website) regularly to keep up to date on these important issues!]

## REACH update

Paul Walter then provided an update on REACH (Registration, Evaluation, Authorization and Restriction of Chemicals) regulations, which place responsibility on manufacturers and importers of chemicals to identify and manage risks linked to the substances they manufacture and market in the EU.



Paul

"Substances need not be registered at once," says Paul, "but must follow a schedule running until 2018 – provided that they were pre-registered before December 1, 2008." Although non-EU manufacturers have no direct obligations under REACH, importers who are established within the EU must comply with the regulations, and non-EU companies exporting to the EU on their own are advised to appoint an "only representative" [sic] within the EU who fulfills the obligations.

"European formaldehyde, aminoplastic, polyol and resin industries are cooperating in the REACH platform within FormaCare, which has proven to be a highly effective and convenient approach for the 26 companies that have signed up for the platform."

Formox is following the developments closely in order to provide up-to-date advice to customers. All REACH-relevant substances for Formox products have been pre-registered.

## How's your footprint?

"It doesn't matter whether global warming is fact or fiction!" claims Ola Erlandsson. "The effect on industry is the same – because new



Ola

legislation is treating it as fact, so it's what we have to deal with!" The buzz word here is "carbon footprint" – the total amount of carbon dioxide or other greenhouse gases associated with a chemical (or with production of a chemical) during its entire life-cycle.

"The carbon footprint is an easy way of showing how much greenhouse gas has been released in the

different steps to produce a product, and it's also a good tool to reduce greenhouse emissions," says Ola, who proceeded to demonstrate that the carbon footprint of a Formox plant can, under certain conditions, be negative (see box)! This is mostly thanks to the fact that a Formox plant generates steam that offsets the carbon footprint of steam generated by coal-based power.

"Although the carbon footprint is not the answer to all environmental concerns, it can be a useful tool – and may soon be a necessary one – to enable you to stay on the right side of the law."

|  |                                       |
|--|---------------------------------------|
| <b>Formox plant: 65 kWh/ton, 600 kg steam/ton, 93% yield</b> | <b>kg CO<sub>2</sub>/ton 37% HCHO</b> |
| Direct MeOH loss (6%)  | 36                                    |
| MeOH production  | 12                                    |
| Electricity (coal-based)                                     | 65                                    |
| Steam (coal-based)   | -120                                  |
| <b>Total carbon footprint</b>                                | <b>-7!!</b>                           |

## Cutting power costs

Next on the agenda was a presentation by Michel Bellais on the subject of power generation and ways to cut power costs in Formox plants. "We've always tried to decrease the power needed per ton of formaldehyde, and in fact we've succeeded in reducing it by almost half since that first plant back in 1959," notes Michel.

The main improvements have been the introduction of the process gas recirculation (which allows higher inlet), changes in the catalyst and packing material (lower pressure drop) and pressurization. Formox also makes extensive use of variable frequency drives to boost efficiency, but the really interesting area to look at is steam....

"Might we cut power costs further by directly using the locally produced steam energy in the plant?" wonders Michel. But he cautions, "Nothing beats steam when it comes to heating in downstream processes, like distillation or evaporation." (For example, Perstorp's Formox plants in Sweden produce one-third of the total amount of steam needed for the downstream processes.)

But steam can also produce power when expanded in a turbine connected to a generator, so it can be used to drive a recirculation blower, thus saving some power.

Michel then outlined ways of directly harnessing steam power:

- steam turbines (single and multi-stage) for electricity production
- steam turbine-driven blowers

Finally, Michel looked at harnessing the power in the tail gas and updated us on progress with the turbo-charger concept.

So what is the best solution for your plant? "Steam is always more valuable as a source of heat than as a source of power," claims Michel, "but how valuable is it? Can you export it? Can you use it constantly or only intermittently? And what are your local power costs? In other words, the payback on energy reduction schemes will vary. So please discuss it with Formox!"

## Lower production – cost-effectively!

Michel was followed by Fredrik Rietz, who spoke about running a plant with the best performance and lowest cost when less production capacity is needed. "This is something that has recently become important for many of you following the crisis in the financial market," observed Fredrik. "The highly flexible CAP concept makes it possible to maintain good performance in a wide range of operating conditions, even below 50%, by adjusting the temperature of the cooling medium."

The optimal way of operating a plant at turndown from the variable cost perspective may be different at different

sites for several reasons. There are, of course, plant design differences, but also site-specific reasons, as well as



Michel



Fredrik



local differences such as different prices for raw materials etc.

"But it's generally an advantage to operate at high inlet even at turndown," says Fredrik. "A lower inlet probably means higher methanol yield and a longer catalyst lifetime, but at the higher inlet the savings on electricity mean more in terms of operating costs – but it is important to adjust the HTF temperature correctly."

If you are considering running at a turndown rate, ask Formox for a review of the conditions for your specific plant. It could save you a lot of money!

## Hot tools

The next speaker, **Anna Wemby Björk**, pulled a brand-new "tool" out of the Formox "toolbox": a new configuration of the hotspot



Anna

logics that gives increased availability of the plant. "Up to now, the methanol trip is activated if any hotspot position exceeds 475°C in most of the plants designed by Formox, Anna points out.

Such trips cause problems and downtime in the event of jumping hotspots or position failure. The new logic looks at the pattern of the hotspots rather than single values. This means fewer trips, but no loss of system integrity or

catalyst performance. "With fewer unnecessary trips, the plant will have higher availability and you can save money!" (See separate article, page 17.)

One of the other "tools" Anna reviewed was increasing capacity via pressurization. "It may sound strange to talk about reducing production one minute and increasing production the next," admits Anna. "But different customers have different needs – even in a downturn, and everyone wants to save money. If you need a bit more production but don't want to invest in a new plant at this time, we can help you!"

Anna also showed how the installation of a frequency converter for controlling the process gas flow gives freedom to always operate at high inlet, regardless of production rate! "For those who have a variable production demand, it is definitely worth considering speed control on the recirculation blowers," explains Anna, "so you always operate at the lowest possible specific power consumption. And the payback time is short in any country that has high power costs – which means most places today."

## CAP flexibility

**Ronnie Ljungbäck** first reviewed the increasing versatility and flexibility of CAP over the past 6 years, enabling significantly higher capacity – and often higher yield – in existing plants with only minor modifications. "As if this was not enough," says Ronnie, "we have also shown that it can be operated at lower capacities without really suffering in terms of performance." But before deciding how to run, there are a lot of questions:

- What type of plant design do you have?



informally speaking – spring/summer 2009

- Will you need lower capacity only part of the year, or more permanently?
- Are you dependent on the plant for steam?
- Do you need to keep the plant heated?
- Do you need to supply a fast unexpected delivery?
- How big is your storage capacity?
- And can you handle off-spec material?

"Your answers to questions like these will determine whether it is best to run intermittently (the most economical way if you cannot vary the process gas flow) or at a lower production rate continuously," notes Ronnie.

Ronnie then proceeded to show how Formox can put together a CAP for just about every one of those scenarios, all with optimized operating economy. "Formox is constantly working meet the challenges of any plant or conditions. As a result, we can adjust your present CAP to meet lower demand, if that is what you need right now. It's important to operate at an as high MeOH inlet as often as possible, and always focus on the yield!"

## Put your DCS to work!

The final presentation of Day One was by **Henrik Lendrup**, who gave listeners some ideas about how your DCS system can be made to help achieve better and more user-friendly control, run more efficiently and save money.

"Today's DCS is a powerful computer with the capacity to monitor all kinds of values, not just process values and alarms," notes Henrik. "Many of us have to look for the right data, retrieve it, then sit down and start figuring out what it means and what to do about it. The DCS can do most of this hard work directly – and really improve your operating economy."

Henrik gave lots of examples of the kinds of parameters you can track easily, right in the DCS, to enable you to optimize your operation, even including specific production, when it's time to change catalyst, lab results etc. "Your performance indicators can tell you at an early stage when things are beginning to be less than optimal. And the information you get directly in your DCS can be made much clearer, so more of your staff can understand what's happening and make any necessary adjustments. But this is not for entertainment. If you can monitor the performance of your plant better, you will have greater control of what happens, and this will ultimately mean better operating economy for you!"

Formox is currently developing a package to cover the standard



Ronnie



Henrik



| Formox – 50 years of development, 1959–2009 |          |                     |                |               |   |
|---|----------|---------------------|----------------|---------------|---|
| Year  | Yield, % | Capacity kg/hr/tube | Power, kWh/ton | Steam, kg/ton | Developments  |
| 1959  | 89       | 9.5                 |                |               | First Formox plant started (Perstorp, Sweden). 3,100 tubes.   |
| 1966  | 90.5     | 9.5                 | 95             | 330           | 55% HCHO. First reactor in stainless steel, 4,600 tubes. Granular catalyst. First licensee plant started (Foresa, Spain).   |
| 1972  | 91.8     | 11                  | 80             | 380           | Recirculation installed. 11,500 tubes. 11 licensee plants on stream. Calcined catalyst, first tablets tested.   |
| 1984  | 92.7     | 11                  | 75             | 450           | >55% HCHO. Catalytic ECS with steam generation. Combined vaporizer/gas-cooler. 25 licensee plants on stream. KH-26/44 introduced.   |
| 1986  | 92.4     | 14                  | 68             | 650           | Lower yield with catalyst tablets, but lower pressure drop. First methanol pre-vaporizer introduced. 33 licensee plants on stream.  |
| 1998  | 93       | 17                  | 65             | 700           | Pre-vaporizer further developed and standard. Pressurization to 0.3 bar g. Improved loading plans with mixed layer on top of pure layer. 73 licensee plants on stream.            |
| 2003  | 93       | 21                  | 53             | 700           | CAP concept with possibility to increase methanol inlet to 10 vol%.   |
| 2004  | 93       | 25                  | 59             | 690           | HI (high intensity, pressurization to 0.5 bar g), introduced as peak capacity.  |
| 2005  | 92.5     | 27                  | 47             | 690           | Dual concept introduced as expansion possibility.   |
| 2009  | 93       | 25                  | 30-60          | 750           | HI as nominal capacity. Several low power options. Improved loading plans and tools for monitoring performance. Largest reactor with 17,400 tubes. 110 licensee plants on stream. |



The table to the left lists some of the major milestones in the history of Formox.

The picture to the right shows the very first Formox plant ever built – all decked out with balloons for its 50th birthday celebration. This plant has been expanded and upgraded over the years – and it's still going strong!

DCS functions. Beyond that, there is so much more your DCS could be doing for you. "All you need is an experienced DCS programmer with a couple of days to work," concludes Henrik. "Or you can turn to Formox, and one of our experts will be happy to assist you."

[Note! In the question session, it was pointed out that if you have an older DCS, you may be able to add a software package to monitor process data and trends in your computer.]

### Time to CELEBRATE!

The dust had no sooner settled after the last presentation when it was time to board a chartered coach to make the one-hour drive to Perstorp. Along the way, **Max Henning** – our illustrious retired "Mr. Formaldehyde" – played the starring role in a film about the 50-year history of Formox. On arrival at the industrial park in Perstorp, the bus brought everyone to the site of the company's five (5) Formox plants. These include the first

### The anniversary celebration tour

The tour (the 12 pictures below and at the bottom of the next page) started with a bus ride (1) to Perstorp, and a visit (2) to the old plant #1, where Max Henning (3) explained some history and released the 50 balloons (4). Everyone then had a look (5) at the five Formox plants before heading back to the bus (6) for a trip to the Formox lab (7,8), followed by a champagne toast (9) at Stensmölle. After short speeches by Marie Grönberg and Perstorp's Mats Persson (10), everyone enjoyed snacks (11) before the trip to the restaurant (12).







Formox plant ever built – 50 years ago – and still going strong.

After a quick look at the plants, the release of celebratory balloons and a tour of the impressive pilot plant section (see article by Johan Holmberg, page 14), the bus brought everyone to Stensmölå for snacks, champagne and speeches. And then it was back to the bus and off to a great dinner at a countryside restaurant, with lots of food, beverages, conversation and laughter. And nobody was left behind when the bus returned to Malmö that night.

## DAY 2 The next CAP?

The first speaker the next morning was **Johan Holmberg**, on the topic of new loading plans (no reflection on the evening before). “In general, the highest yields are obtained



Johan

with a loading plan that is optimized for the prevailing operating conditions,” says Johan. “So it is important to have accurate information regarding all process parameters. In theory, the best results would be obtained by matching the methanol flow in the various reactor coordinates with the type of catalyst and degree of dilution in an infinite number of catalyst layers – to make the reaction conditions as close as possible isothermal. Clearly this is impractical; however, Formox has investigated increasing the number of layers and Johan went into some detail on the outcome of these studies of what could come to be known as CAP 2.0. This type of CAP is already in use in several plants and is showing good results.

“It opens up for increased control over the reactor parameters, thereby also opening up for a longer period of high-yield operation,” claims Johan. “And using





KH-26L as pure catalyst where possible is expected to result in higher yields. Moreover, the pressure drop development is expected to be modest, resulting in lower power costs."

Johan also pointed out that the new Formox loading machines are designed to handle such loading plans, so the loading of the reactors will be as smooth as before.

### How we do it

The next speaker, **Philippe Thevenin**, outlined what it takes to develop a catalyst. "It's a long story that is made up of several steps [see diagram]," says Philippe, "and I'd like to give you some insights about catalyst development in general, about how we proceed at



Philippe

Formox, and finally how these different steps will take us from our laboratories to your reactors."

Formox currently has a number of projects in different stages of the development process. One such project is to investigate the catalytic properties of new materials that could be used for our reaction.

"We are now in the first phases of catalyst development," comments Philippe. "It could be that among the various compositions we are evaluating, in a few years there will be a new and even better material in your reactor tubes."

To get all the way from our laboratories to your plant, however, the new material must successfully pass all the different stages, with all the different

requirements they imply. "Formox has the resources for every step of this development process," adds Philippe, "from state-of-the art micro-reactors to several full-scale plants. This assures that all solutions delivered to your plant have been previously tested and evaluated in our laboratories."

### New reloading tools

"The whole process from the arrival of the new catalyst to returning the spent catalyst to Formox can be seen as a chain where every part depends on the other," says the next speaker, **Anders**



Anders

**Malmberg.** "So you need to plan your shutdown so you can have full storage tanks in case you need uninterrupted downstream production or continue to sell your product."

Reloading is a key cost factor in operating economy in several ways. Some loads are run long beyond the economical lifetime of the catalyst, so the "gain" of having a longer run is eaten up by the much greater cost of lost yield – and the

risk of damaging the catalyst so much that it cannot be recovered. Then there's the downtime itself. And finally, the accuracy of reloading, which is crucial for a good run.

Anders revealed a new unloading tool that can do 12 tubes at a time, as well as the latest multi-chamber loading machine that can handle the latest, more complex loading profiles. Both tools were on display for a closer look during the break.

"With good planning you can increase efficiency and reduce downtime, while also laying the foundation for how your next load will perform," says Anders. "And there are a number of questions you should ask yourself:

1. Would you benefit from modifying your loading plan?
2. Does your unloading procedure run smoothly?
3. Do you unload in a way that gives you the most value from your spent catalyst?
4. Do you have all of the necessary tools?
5. Do you have access to a vacuum truck?
6. Could using a set of two or three steel tubes shorten your unloading time?
7. Could the new Formox 12-tube unloading tool save you time?
8. Could you save time and money, and get greater accuracy and performance by using the Formox reloading service?



During the break, there was great interest in the new multi-chamber loading machine (top) and the multi-tube unloading machine (middle). These were shown by the Formox reloading team from Bemek (left to right): Bengt-Åke Hansson, Allan Larsen and Stig Hansson.



You are most welcome to contact your Formox representative in good time to discuss these and other questions!”

### A smaller plant?

The next speaker, **Ola Erlandsson**, started by mentioning something Bob had said. “Last year, Bob issued a challenge – that if you can build a better plant, or an equivalent plant for the same money, go ahead. Our primary goal is to serve formaldehyde producers with whatever technology you need, whether that includes plants and catalyst or only catalyst.”

But Ola insisted that there is something special about a Formox plant. “Our plants are designed to give the lowest possible total cost per ton of formaldehyde, and to prioritize safety, reliability, low emissions, and good working conditions. What’s more, anyone who bought a Formox plant 10 years ago can produce 50% more formaldehyde in that same plant today!”

“In spite of this, we realize that many people regard our plants as expensive, which is true – if you only look at the initial investment cost and not at the total cost of ownership. But if you have difficulties in borrowing money, or face high interest rates, that initial cost can sometimes be more critical. So we have begun to look into a low-cost alternative.”

Ola cautioned that you tend to get what you pay for. “We think we can cut corners – without compromising safety, of course! – and be able to offer a simplified Formox plant in the 100-200 TPD range at a 35% reduction in investment cost by the end of this year. But what you save in investment cost will in most cases be offset by higher power consumption and lower steam production. Still, this might be a solution if you have a problem with financing. And as always, we will do our best to give you the most value for money.”

Ola also reported on some new recommendations for HI (high intensity) operation, which readers will find in a separate article on page 18.

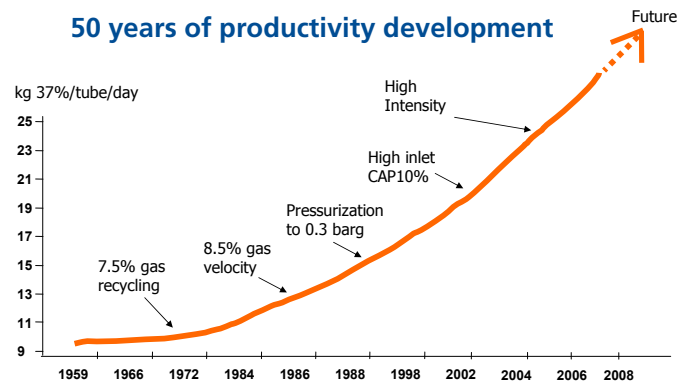
### Time to buy? In a recession?!

The final presentation of the conference came from **Lars Andersson**, also on the subject of



Lars

### 50 years of productivity development



new plants. “We have a troublesome situation on the market right now, not only in Europe but globally. But there is in fact a bright side, in the form of lower raw material prices and shorter delivery times for equipment since the workshops’ order books are not full....

Lars pointed out that since the first commercial plant was built in Sweden 50 years ago, the capacity per tube has been increased by some 265% (see graph). And that first plant is still going strong!

Lars then reviewed the standard Formox range, covering capacities from 70 MTPD all the way up to 828 MTPD, and all the flexibility that means for formaldehyde producers.

“So if you are expecting to need more capacity when the upswing comes, now could be the time to get ready!”

### Halftime!

For many of the participants, the end of the conference was only the halfway point, as they chose to stay on for a day and a half of training. “Very important and helpful” was one participant’s comment. “Time well spent because of the opportunity to reflect on and review current and past experiences” said another.

### Asia next

No sooner is Formaldehyde Europe 2009 over than it’s time to start planning the next conference – Formaldehyde Asia 2010. See the last page of *informally speaking* for details!

Many of the conference participants stayed on for a day and a half of training.



# Let's talk TURKEY



Is it only a coincidence that the American expression “talk turkey” means to discuss something openly and frankly, especially business? In any case, Turkey is a country that is playing an increasingly important role in international business and trade. It is also a country where a number of formaldehyde producers are achieving considerable success.

Your friendly *informally speaking* editor visited the country this spring to meet with two Formox clients, as well as the Formox agent in residence, **Hasan Gökman**, from *Intra*. Hasan frequently visits our Turkish customers to help with technical problems and review catalyst needs. Sometimes these visits are together with **Lars Andersson**, the Formox Account Manager representing Turkey, so Hasan helps Lars with the Turkish language. The customers (and Lars) are very happy about that....



## Turkey – a unique gateway

According to **Haluk Yıldız**, General Manager of Kastamonu Entegre (see next page), Turkey's forest products industry holds a unique and favorable position for many reasons. Here's his take on it:

For one thing, Turkey has a rather big population – over 70 million – and it's also a young population. Then there's the important fact that we have rather low housing standards that are now rising, which means a big and growing domestic need for completely new housing. (This differs from developed countries that already have good housing.) And everybody in Turkey wants a house! Turkey already has the 2nd biggest MDF capacity in Europe (after Germany), and there is plenty of room to grow.

Then there is Turkey's location, straddling Europe and Asia both geographically and culturally, with direct shipping lanes to and from the Mediterranean and the Black Sea. This makes Turkey a natural gateway between the EU, all of the former Soviet republics, and the Middle East. We can ship by boat, train and road very economically to and from all of these markets. And these are markets with great needs, including countries with plenty of oil but no forests. Iraq, for example, is likely to require a huge amount of panels once reconstruction gets going after the war.

We thus see our market as being 250 million people. And Turkey has had an annual growth rate of 7% for many years. All this puts Turkey in a great position to provide services to European companies looking to the East for new markets, as well as to other foreign investors.

Counterclockwise from top left: A bustling street in Istanbul; a city of contrasts; the Topkapı palace; the skyline as seen from the north; a candy market; the busy harbor; inside the famous Grand Bazaar.



### Facts about Turkey

**Population:** over 78 million

**Area:** 780,600 km<sup>2</sup> (a little bigger than France & the UK combined, i.e. a little bigger than Texas)

**Capital city:** Ankara, in central Turkey, 4.5 million

**Largest city:** Istanbul, 13 million

**GDP:** \$403 billion (2006)





# KASTAMONU ENTEGRE



Kastamonu Entegre (Kastamonu Integrated) is one of Turkey's largest producers of forestry products. The company is based in Istanbul, but takes its name from the site of its first chipboard production plant, the city of Kastamonu, some 500 km to the east (see map).



The company was founded in 1969 and is a member of the Hayat Group (established in 1937), which is primarily active in the chemicals and wood-based industries. In 1994, Kastamonu Entegre opened Turkey's first continuous MDF plant.

Today Kastamonu Entegre has a total of eight plants, of which five are in Turkey and one each in Bulgaria, Romania and Bosnia-Herzegovina. The sites in Turkey include four salt-cooled formaldehyde plants with a combined capacity of 170,000 TPA, primarily for MDF chipboard (particle board) and décor film impregnation for the melamine faced boards.

During our visit to the Group headquarters in Istanbul, we interviewed the General Manager **Haluk Yıldız** (top photo) and the Plant Director **Dr Ertuğrul Çaşur**.



## How has the global financial crisis affected Turkey's wood industry in general and Kastamonu Entegre specifically?

"The crisis came a little later to Turkey, so our turnover actually increased by around 20% in 2008. We've started to feel the effects in 2009, but so far our turnover is almost at the 2008 levels. Part of this is that we've managed to add some new customers, so we've been able to compensate.

"The automotive sector is in a worse situation, with tough exports to Europe. Textile exports to Russia and Ukraine have also been hit hard, but the wood panel sector actually has some advantages. This is because we export a lot to the Middle East, where the combination of closed economies and markets that are not at all saturated makes it an area that is not so severely affected.

"Kastamonu Entegre is fortunate to have many types of products where we are unique or #1, which puts us in a good competitive position. But of course we are also affected, and are postponing investments in 2009 – possibly also in 2010 – to be on the safe side. We have to wait and watch."

## How have your needs for formaldehyde changed over the years?

"We first started producing formaldehyde in 1996, to meet the needs of our own resin production. All resins we produce are consumed by our own plants, and we have been adding capacity all the time. Today we have about 25% of the total Turkish capacity, and we produce nearly 2 million m<sup>3</sup> of MDF and chipboard.

"Unfortunately there is no wood in the Istanbul area, so MDF plants concentrated near Istanbul work with imported wood from Russia and chips from the Americas – not a good long-term solution. That's why we have eight sites – to keep transport costs down and be near the forests and near the markets.

## So what will things look like 10 years from now?

"We're very positive about Turkey's future. We're an improving, young market in one of the most important zones in the world [see page 10].

"As for Kastamonu Entegre, we already have a program based on a very active role in the Black Sea and Mediterranean areas, including Ukraine, Russia, the Balkans, Iran and Iraq. When we meet again in 10 years, you'll see us in all these areas – with production there too. And of course we will continue to develop in our domestic market as well. So watch for investments in both board/resin and formaldehyde production.

"We do not, however, plan to enter the Western European market, preferring to focus on the areas where we have unique advantages."

## How important are environmental issues?

"Since Turkey aspires to join the EU, our government has started – especially in the industrial zones – to actively support environmental measures. We have made a lot of investments to meet the EU requirements concerning the environmental issues.

"This has meant huge improvements in critical areas within the last 15 years. Fish have returned to formerly polluted waters. It's all related to our rising standard of living, our culture, financial situation and level of education. But it takes a little time to adapt old plants – it has to be done in steps."

## How about your cooperation with Formox?

"We started with a load of catalyst in 2000, and have been using Formox catalyst ever since, in all four of our reactors. We get very helpful technical assistance all the time, both reloading assistance and the review of our process parameters.

"Your plants seem to be very good too, but even your smallest plants are bigger than anything we've built so far...."



LEFT: Hayat Group headquarters in Istanbul. RIGHT: The huge board facility in Gebze. Photos courtesy of Kastamonu Entegre

### FACTS

#### about Kastamonu Entegre

- Founded in 1969.
- Member of the Hayat Group (founded in 1937).
- Ranking number 7, among the top 10 wood-based panel producers in Europe, and number 12 in the world.
- 4000 employees (more than 7000 in total Hayat Group).
- Total HCHO capacity 170,000 TPA from 4 salt-cooled plants.
- 2 million m<sup>3</sup> board production capacity, primarily MDF and particle board.
- Downstream products: board materials, laminate flooring, doorskins, decorative panels etc.
- Find out more at [www.kastamonuentegre.com.tr](http://www.kastamonuentegre.com.tr).

# YILDIZ ENTEGRE



Kocaeli Yeniköy (see map), in the İzmit area about 100 km east of Istanbul, is the site of five reactors belonging to Yıldız Entegre (Yıldız Integrated), one of Turkey's leading companies in the field of forestry products. The company was founded by the Yıldız family in the early 1890s, in the Anatolian (Asian) part of Turkey, as an exporter of timber. Today the company is a leader not only in timber products, but in MDF and a wide variety of downstream forest-based products, including laminate flooring, profiles, doors and panels. And the company is also "integrated" back into resins – the reason for the 5 reactors mentioned earlier.



Yıldız Entegre's production is mostly for the considerable Turkish market, with about 15% going to exports, mostly to countries in Eastern Europe and the Middle East.

During our visit to the Yıldız Entegre plant in Kocaeli Yeniköy, we interviewed the production manager, **Yaşar Ari**, a man with more than two decades of experience in formaldehyde production.

aldehyde production.

## How has the global financial crisis affected Turkey's wood industry in general and Yıldız Entegre specifically?

"Production in the industry has clearly decreased due to the crisis, mainly in exports. A lot of producers are currently running at 50-60% of capacity. One of the big difficulties is payment collection. You don't want to increase your financial risk by selling to companies that might not be able to pay, and granting longer payment terms only increases the risks. It tends to be the smaller companies who have the least reliable credit.

"But Yıldız Entegre has the advantage of being owned by the same holding company as one of our biggest customers – Starwood. And our owner is a true entrepreneur, with new projects all the time. There have been financial crises before [1996, 2001], but instead of shutting down, Yıldız has expanded!

"Some planned investments are on hold right now, but we believe they

will be realized as soon as demand picks up again. We're a very fast investment company, using our own money entirely – no subsidies, no bank underwriting."

## How have your needs for formaldehyde changed over the years?

"To take an example, just 10–15 years ago the total demand for resin was about 3000–4500 m<sup>3</sup>. Today each one of our plants produces that much, so it just keeps growing."

## So what will things look like 10 years from now?

"I'm an engineer, not an economist! In Turkey, as in many other countries, some banks are being rescued by the government. But the real crisis in Turkey right now is in the automotive industry. Still, I'm optimistic about the future.

"Our owner's philosophy – 'Keep on investing' – is going to make Yıldız Entegre even more competitive once this crisis is over!"

## How important are environmental issues?

"Very important for Yıldız. We believe in using updated technology, and we are taking all precautions for environmental safety and protection."

## How about your cooperation with Formox?

"We've had almost no problems with Formox catalyst, and any issues that have come up have been solved quickly. So we have no complaints – except maybe about the price!

"But Formox is good about sharing information. We appreciate the technical support we get from Lars [Andersson] and Hasan [Gökman]. The kind of support we get from you is really important – making sure the loading is done correctly, and even getting advice that helps us to run our plant better, and to increase the catalyst lifetime.

"It's easy to solve problems when you discuss them, not keep them to yourself. You have to expand your horizons!"

RIGHT: Hasan Gökman, the Formox rep for Turkey, together with Yaşar Ari.  
BELOW: A tour of the Yıldız Entegre plant.



## FACTS

### about Yıldız Entegre

- Founded in 1890.
- Approx 1150 employees in the Group, 43 of whom work with adhesives.
- Total HCHO capacity 780 MTPD in six salt-cooled plants.
- Adhesive production capacity: 240,000 TPA.
- MDF production capacity: 1,000,000 m<sup>3</sup>.
- Downstream products: adhesives for board production, MDF, door panels, laminate flooring, profiles, décor paper etc.
- Markets: 85% domestic, 15% export.
- Find out more at [www.yildizentegre.com](http://www.yildizentegre.com).



# Methanol quality

by Ola Erlandsson

## How important is methanol quality?

Methanol quality is important for product quality and the catalyst lifetime. Formox normally recommends a good industrial quality to be able to give performance guarantees. This is also the way that the Formox plants in Perstorp are operated, and we have seen very little methanol contamination.



The oxide formaldehyde catalyst is not as sensitive to contaminations as other types, and many of our customers operate with lower methanol qualities without experiencing any major problems. The economical savings that can be done in this way are significant even if the performance of the plant is slightly lower. Typical sources of low-cost methanol include:

- manufactured lower grades, coal-based etc.
- waste flows from downstream production, often diluted.
- contaminated methanol

### General limits for some contaminants

|  |  |
|--|--|
| <b>Water content</b>   | Up to 5-20 % is probably acceptable. High water content can in many cases be compensated for with higher HTF temperature. Be observant of corrosion in the methanol system and iron content in the methanol and in the product.  |
| <b>Ammonia</b>   | Ammonia will reversibly poison the catalyst active site. Operation with equivalent to 0.3% ammonia has been done in UFC plants without problems. Other nitrogen compounds like pyridine could show a more irreversible behavior.   |
| <b>Li, Na, K, Ca ions</b>  | They are known to irreversibly deactivate the catalyst. Small amounts will have a significant impact if they reach the catalyst. The Formox plants in Perstorp have run with seawater-contaminated methanol containing 10 ppm Na. Most ions stay in the vaporizer when the methanol evaporates. Cleaning will be necessary.  |
| <b>Sulfur</b>  | Plants are known to operate with methanol containing small amounts of sulfur. High sulfur contents (80-100 ppm) have been reported to cause corrosion damage. There is probably a big difference depending on whether the sulfur compounds are moving with the gas or if they precipitate in the vaporizer. The catalyst itself is very sensitive to sulfur. Formox recommends a maximum of 1 ppm for starts of tests. |
| <b>Chlorine</b>  | The Formox plants in Perstorp have operated with seawater contamination at 10 ppm. The vaporizer has to be regularly cleaned and the corrosion risk has to be monitored.   |
| <b>Oil</b>   | Oil and lubricants can block the catalyst active sites. Experience with oil leakage from Roots blowers has shown that significant amounts (10-50 kg) can be added to a reactor with mainly clogging problems on the tube sheet.  |
| <b>Ethanol</b>   | Ethanol will partly form poisonous acrolein that will end up in the product. We recommend a 50 ppm limit on ethanol in methanol. It is possible to operate with up to 1 % if necessary precautions are taken in the plant.   |
| <b>Note! These are general guidelines. Each case must be evaluated independently, depending on local conditions.</b> |  |

However, problems can occur, e.g. catalyst deactivation (both reversible and irreversible). Moreover some contaminants physically block the catalyst. There can be product quality issues (what you put in will come out) from both the original contaminants or from side products from unwanted reactions. The risk for vessel damage due to corrosion or blocking can increase. We need to avoid or limit these risks by taking a few precautions before we decide to switch to low-cost methanol.

## 1. Analysis

It is necessary to quantify the amount of contaminants in a suggested methanol supply. This can be done based on a supplier's specification or on analysis. A specification will typically give the highest occurring values and might not be representative for the average methanol received. In addition to normal analyses, Formox recommends looking for a number of compounds (see table), depending on the source and product requirements.

The results need to be evaluated to see if it is possible to use the methanol. The general lack of data makes it very difficult to estimate the risks. Formox can give some support with experience gained from different operating conditions of our catalyst. Tests will always have to be conducted to decide whether the methanol is usable.

## 2. Tests

The general results from the analysis must be verified by testing, to be sure of a positive result. Short-term tests can be made by Formox in a pilot plant if a methanol sample (or a specification that we can mix a sample from) is sent to Sweden. This, however, will only show whether there is any severe catalyst poison in the contaminants. Full-scale tests then have to be made in the plant, preferably with older catalyst to minimize the economical impact if we experience irreversible deactivation problems.

The full-scale tests should start with diluted contaminated methanol and a strict surveillance of plant data. The concentration can then be increased in small steps. Stop immediately if a lowering of the catalyst performance is noted and check if it is reversible by feeding pure methanol. Running with only air and full HTF oil heating can also help reactivate the catalyst. Inspect the vessels inside and remove some catalyst to see if any deposits have formed after some days of operation. Clean if necessary and be observant of any indication of corrosion damage.

## 3. Final decision

It is not possible for Formox to guarantee that it is safe to operate with contaminants in the methanol. We can, however, give advice and help design test plans that can be used in the decision-making process.

In our experience it is usually safer to reuse waste methanol that originates from processes downstream from a formaldehyde plant. More problems may be expected if the waste methanol has some other origin.



# The world of pilot testing

by Johan Holmberg

## The importance of pilot tests

Essentially, a great deal of the information that can be obtained from a pilot test can also be obtained from full-scale measurements. However, such tests are more expensive, take much longer time and do not always result in fully conclusive answers. It is also sometimes desirable to perform experiments under such conditions that will result in bad performance and this is (due to production demand and the need for high performance) not acceptable in full scale.

Pilot measurements are and should be the key step between the lab and full-scale. Pilot testing has the advantage that it is possible to simulate extreme reaction conditions and make desired changes without having to consider the effects in economical terms, but only the need for development and results. Furthermore, it is possible to fully monitor the performance as exactly as it is on a pilot scale.

Full-scale testing at some of our own sites can never be avoided, since we aim to only present fully tested concepts to you as customers. However, the aim is that when a concept is tested on full scale, this should be more or less merely a formality.

## Pilot reactors

We have eight pilot reactors that can not only be operated as single reactor tubes, but also as a dual reactor system. The pilots are designed to work exactly like a full-scale reactor – but with only one tube. The process gas flow to the reactor is simulated by using mass flow regulators and pumps, the reactor is cooled by using standard HTF oil, and we have the ability to operate the pilots under severe conditions, varying the process gas flow, pressure and temperatures within a very great span. Unlike in full-scale plants, operating only one tube gives us perfect control over the tube flow, the cooling and the temperature profile. All pilots are equipped with all types of temperature and pressure transmitters and instrumentation. It is important that the reaction conditions and reactor performance are monitored as accurately as possible – without disturbing the reaction conditions.

To ensure safe and stable operation, all flows are checked on a daily basis, as is performance. Adjustments of the reaction conditions are also done on a daily basis. Performance is normally expressed in terms of HTF temperature, pressure drops, hotspot temperatures, yield and losses. The yield and losses are monitored using a gas chromatograph, while all other parameters are directly logged by the PLC system.

It is not an easy task to design and develop a pilot-scale reactor. There are a number of considerations and aspects that must be taken into account for it to be fully representative of a standard plant, so experience and knowledge are important parameters in the design phase. Past and present experience also constitutes the basis for the continuous development and evaluation process that we have.

Asymmetrical aspects can also be considered, but in this case it is actually a disadvantage to have full control over the tube conditions. In a full-scale plant there might be differences between different tubes in the reactor. However, this is something else we are of

course able to test. We can easily change the conditions so as to reflect not only the average tube but also the tubes that are exposed to other conditions, which helps us create catalysts and loading plans that are able to handle the standard deviations there might be in a reactor system.

## The testing procedure

There are three key phases of an experiment: planning, execution and evaluation. All three are crucial for an experiment to be successful. “You get what you ask for”, i.e. if the question is incorrect, it doesn't matter how well the experiment is performed. Or if the experiment is not correctly performed – or if you cannot interpret the results – then the experiment is also useless.

For pilot tests to be successfully planned, performed and evaluated, it is crucial to have both the experience as well as a solid theoretical background. At Formox it is a team effort. We work together with all aspects in order to ensure that we can achieve the desired results. This group has a great deal of both practical and theoretical experience, which ensures that we get the right concept out from the lab to the plants.

But even when pilots have been correctly designed, there are a significant number of things that can go wrong when an experiment is performed. Many times experiments are not done under standard conditions and the experiment requires a great deal of extra attention, monitoring and follow-up. So before going forward we always evaluate all steps in the process before taking a catalyst or concept to the next level, which is testing it at one of the Formox plants in Perstorp, Sweden.

## Customer-specific

In closing, I would like to mention that besides using the pilot reactors for our catalyst and loading plan development to be able to deliver better and improved concepts/catalysts, we also have the ability to perform customer-specific measurements, such as MeOH quality analysis.





# Polyurethanes & HCHO: an ever-expanding partnership

by Bob Crichton

It has been some time since we last looked “downstream”; indeed the 2000 Olympic Games in Sydney provided the backdrop for our last look at polyurethanes. Formaldehyde is one of the building blocks for such products and the Games were used to illustrate some applications. Formaldehyde plays its part through MDI (methylene-diphenylisocyanate), currently the most important of the isocyanates used in polyurethane formulations – the other is TDI, toluene-di-isocyanate. Crude MDI is formed by the reaction between phosgene and methylene dianiline (MDA). The MDA is formed by the reaction between formaldehyde and aniline.

**MDA** – methylene dianiline – is an important chemical in its own right being used in the preparation of azo dyes, the curing of epoxy resins and neoprene as well as a rubber preservative.

The crude MDI is distilled to remove the heavier products (polymeric MDI) before the isomers are separated – pure 4-4 MDI being the most useful. This is reacted with glycols, diols and alcohol terminated polyethers to produce a

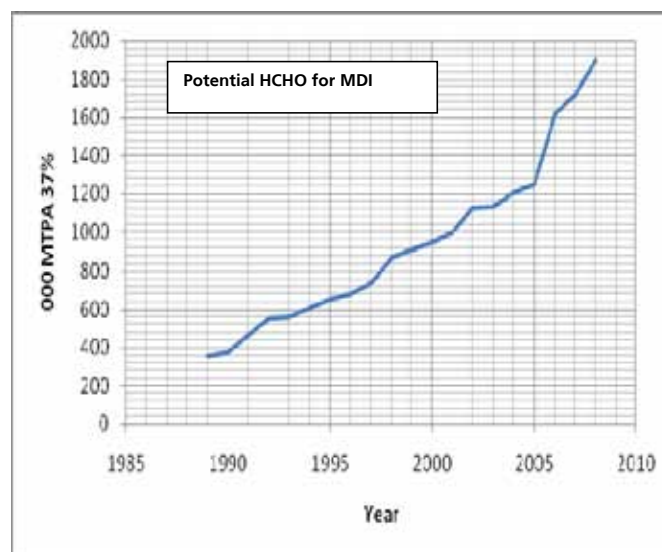
group of polymers where the chain is linked by the “urethane” group (-NHCOO-); hence the name. However, polyurethanes are not like many other polymers, such as PVC, polyethylene or polypropylene – in other words not a distinct chemical product – but rather a family of extremely versatile polymer systems that can be made into flexible and rigid foams, fibres, elastomers, surface coatings, sealants, adhesives and even solid mouldings. There are very few manufacturing sectors that do not use polyurethane in one way or another.

And with the market in polyurethane systems growing fast due to new applications, MDI was very much a growth chemical back in 2000; indeed the previous piece concluded that if industry predictions were to be believed MDI would require an additional 90,000 MTPA of formaldehyde (37% basis) every year simply to keep pace with demand. Now, almost 9 years later, we can find out if this promise has been fulfilled.

As the diagram shows, the answer is an emphatic yes – the potential for formaldehyde consumption in the manufacture of MDI has almost doubled since the year 2000 – an average annual addition of 120,000 MTPA rather than the 90,000 estimated back then.

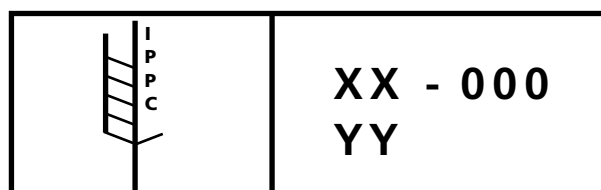
But what about the future? Well, current projections are for MDI to almost double again over the next ten years – an average annual growth rate of 9%. Indeed MDI will represent 23% of the total rise in formaldehyde consumption for downstream chemicals over this ten-year period and will move up the pecking order to rank second only to POM.

In today's economic climate growth of this order is difficult to imagine; but with the drive to ever lighter components, particularly in the automotive industry, it is a very real possibility. As a result it seems that MDI will continue to require a world-scale formaldehyde plant every year for some time to come.



## IMPORTANT NOTICE! Check your pallets, please!

European authorities have adopted pest-control measures that apply to all wooden pallets. In order to avoid problems and delays when returning spent catalyst, please use only pallets with ISPM15 standard marking (see figure). These markings are found on all pallets we ship the fresh catalyst material on, so you may use the same pallets to return the spent catalyst. Should you have any questions regarding the marking, please don't hesitate to contact us.



**XX** = country code.  
**000** = certification number  
**YY** = treatment (HT = heat treatment;  
 MB = methyl bromide fumigation)

# Speaking of anniversaries

This issue covers our 50th Anniversary, as well as the recent Formaldehyde Europe 2009 in Malmö. It seemed appropriate, therefore, to link the two and record the fact that it is 15 years since we held our first seminar in Europe – that was in Helsingborg in 1994. A year later saw the first seminar in Asia – Kota Kinabalu in Sabah, Malaysia. [Editor's comment: 1995 was also a significant year as it saw the first issue of *informally speaking*!!]

But the European Seminar was not the first Formox-sponsored seminar; this was much earlier and was held in Atlanta, Georgia under the auspices of the Formaldehyde Producers Association in the USA. This conference went on to become Formaldehyde Americas. And so the conference cycle was born – Formaldehyde Americas, Formaldehyde Europe and Formaldehyde Asia in rotation.

Do these sessions have any technical merit, or does it even matter? The main purpose, after all, is to provide a forum for people with the same interest to exchange views on operating a formaldehyde plant safely and efficiently. This was why that very first seminar in Atlanta was set up; here the emphasis was very much on plant operational safety and this is a tradition that has been carried forward to today. But looking back, the European seminars have seen some notable "firsts".

The second seminar in 1997 saw the introduction of pressurization, a technique that allowed the plant operator to increase production by over 25% at relatively low cost. The next seminar, in 2000, was the first "open" event – prior to that the European event was for licensees only. CAP, a technique that enabled Formox plants to be expanded by a further 20% at even lower cost, was introduced in 2003.

In 2006 consolidation was the order of the day; flexible operation by varying process parameters. But there was a hint of what was to come in terms of high intensity operation and turbo-charged operation.



by  
Bob Crichton

Editor's note: The picture is Bob all right – speaking of anniversaries!

It was good to see that the 2009 seminar returned to form and that Formox was able to mark the 50th anniversary of the process by announcing that high intensity operation was now sufficiently well developed to be offered on the 2009 range of plants.

## TIMELINE

|      |   |               |
|------|---|---------------|
| 1994 | Formaldehyde Europe                                 | Helsingborg   |
| 1995 | Formaldehyde Americas                               | New Orleans   |
| 1995 | Formaldehyde Asia                                   | Kota Kinabalu |
| 1995 | 1 <sup>st</sup> Issue of <i>informally speaking</i> |               |
| 1997 | Formaldehyde Europe                                 | Helsingborg   |
| 1997 | Formaldehyde Americas                               | New Orleans   |
| 1998 | Formaldehyde Asia                                   | Phuket        |
| 1999 | Formaldehyde Americas                               | New Orleans   |
| 2000 | Formaldehyde Europe                                 | Helsingborg   |
| 2001 | Formaldehyde Asia                                   | Singapore     |
| 2001 | Formaldehyde Americas                               | Miami         |
| 2002 | No seminar – but Max Henning retired!               |               |
| 2003 | Formaldehyde Europe                                 | Helsingborg   |
| 2003 | Formaldehyde Americas                               | Miami         |
| 2004 | Formaldehyde Asia                                   | Singapore     |
| 2005 | Formaldehyde Americas                               | Vancouver     |
| 2006 | Formaldehyde Europe                                 | Helsingborg   |
| 2007 | Formaldehyde Asia                                   | Bangkok       |
| 2008 | Formaldehyde Americas                               | Toronto       |
| 2009 | Formaldehyde Europe                                 | Malmö         |

## What about your HTF insulation?

by Andreas Wickman

HTF (heat transfer fluid) oil, which typically has a boiling point of 257°C at atmospheric pressure, is widely used as a medium to remove the heat from the exothermic reaction in the reactor. The use of a boiling liquid is preferred because it provides efficient temperature control and gives a high heat transfer rate. Also, the HTF vapor produced in the reactor is condensed in the HTF condenser, making the formaldehyde plant a net producer of steam. Insulation of vessels and piping is essential since heat losses to the surroundings will lower the steam production. If your plant is located in a cold climate you need to avoid cold spots, as HTF solidifies at 12°C.

In order to avoid possible problems, checking the condition of the insulation material should be a part of your regular maintenance schedule. If you need to replace your insulation or if you are in the process of constructing a new plant, we have the following general recommendations for you:

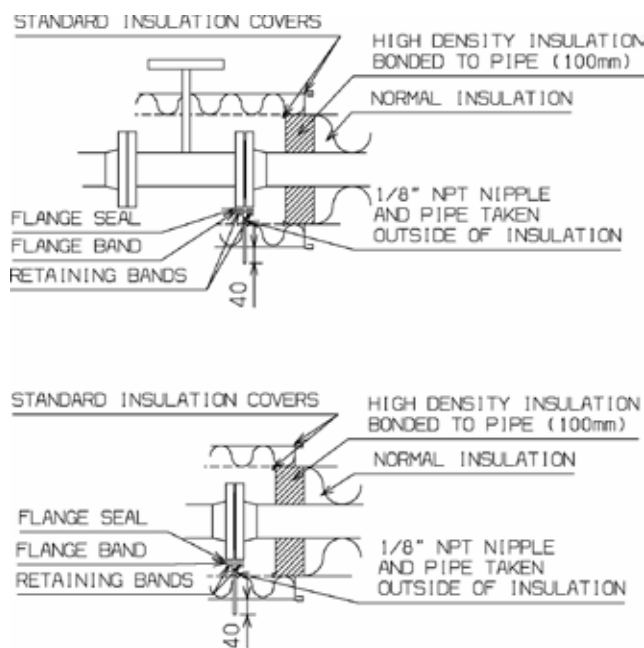
- The surface to be insulated must be clean and dry before any insulation is applied. Grease is removed by using detergents or solvents. Wire brushing or pickling is appropriate for removing loose rust, scaling or dirt when necessary. Make sure that all preformed insulation material is dry and undamaged before application. Remember to leave nameplates and code stamping exposed on the vessels.
- All binding wire used should be of galvanized steel. Aluminum alloy, galvanized or stainless steel should be used for strapping





bands for fastening. Selftapping screws and rivets should also be of either aluminum, galvanized or stainless steel, as should all items used at manholes, e.g. quick-release fasteners. Note that all manholes on equipment must have removable covers. Silicon-base (or similar) is the choice for all sealers or adhesives.

- The insulation material recommended is mineral wool or glass fiber. Note that when mineral wool is used in high-temperature applications (340°C), it should be wire-reinforced. All foamed plastics used should be of self-extinguishing grade.
- Aluminum cladding should completely cover the insulation in order to be used as external protective covering.
- Always bear in mind that HTF is a highly flammable material, and leaks in valves or flanges are thus potential fire hazards. The following specific recommendations are given to help you avoid such incidents:
- A high-density, non-absorbing insulation material (at least 100 mm thick), bonded to the pipe, should be positioned before the flange and the normal insulation material.
- A 1/8" NPT nipple and pipe, taken outside the insulation to divert any leaking liquid from the flange, should be held in place and tightened with a seal, flange bands and retaining bands.



This drawing shows typical insulation of HTF pipes and valves

## Hold on there, HOTSPOT!

by Anna Wemby Björk

High availability of the plant is a key parameter to improve productivity. Formox is now launching a brand new tool in this field: increased availability of the plant by changing the configuration of the hotspot logic. In most of the plants designed by Formox, the methanol trip is activated if any hotspot position exceeds 475°C; this trip can cause problems and downtime in the event of jumping hotspots or position failure.

The suggested new configuration better matches the actual behavior when facing hotspot problems. The new logic looks at the pattern of the hotspots rather than single values. It will cause fewer trips, but without jeopardizing the integrity of the system or the performance of the catalyst. With fewer unnecessary trips, the plant will have higher availability and you can save money. Here's how the new configuration works:

- Suppose you get a situation with one hotspot position higher than 475°C. In today's configuration, the methanol trip would be activated. With the suggested new configuration? Nothing!
- What about two hotspot positions higher than 475°C? Still nothing happens.
- At three hotspot positions higher than 475°C, the system recognizes that a pattern could be starting to emerge, so there is an alarm – but still no trip.
- Not until five you get hotspot positions above 475°C is the methanol trip activated (see figure). There is now a clear pattern.

The new configuration can also handle other scenarios:

- If you get hotspots above 475°C in two positions in the same multitube, you get an alarm. When there are three hotspots above 475°C in the same multitube, the methanol trip is activated.
- And what about a failed multitube? You can by-pass a failed



position without tripping the plant, but more than 3 failed positions will be treated as a multitube with two hotspot positions higher than 475°C. This will indicate that the multitube must be replaced. And when a multitube is replaced, the system must be stopped.

The new configuration can be applied in all plants with a DCS and where a floating HTF level trip is already configured. If you've ever been shut down unnecessarily

by a jumping hotspot, you'll understand what good news this can be. Talk to your Formox representative for details!

### Hotspot pattern – 5 hotspots

| Pos. | 1   | 2   | 3   | 4   | 5   | 6   | 7   |
|------|-----|-----|-----|-----|-----|-----|-----|
| 1    | 277 | 279 | 276 | 280 | 278 | 276 | 277 |
| 2    | 305 | 299 | 301 | 310 | 303 | 307 | 315 |
| 3    | 345 | 341 | 320 | 351 | 315 | 475 | 339 |
| 4    | 339 | 334 | 475 | 340 | 347 | 342 | 320 |
| 5    | 320 | 318 | 325 | 321 | 319 | 335 | 319 |
| 6    | 323 | 330 | 338 | 318 | 475 | 318 | 330 |
| 7    | 475 | 312 | 309 | 475 | 307 | 329 | 346 |
| 8    | 315 | 301 | 298 | 303 | 298 | 302 | 310 |
| 9    | 286 | 284 | 283 | 287 | 281 | 386 | 290 |

# What's NEW with HI?

## Ola Erlandsson

One of the ways Formox has found to boost the production rate of existing plants is to run at high intensity (HI). Capacity is increased by raising the pressurization pressure to 0.5 bar g. The higher density of the gas on the suction side of the recycle blower will then result in a higher process gas mass flow if the gas velocity is kept constant in the plant. The higher gas flow makes it possible to increase the methanol flow so that the methanol concentration is kept at 10%. Operating at HI conditions will increase annual production by 15% compared with operation at 0.3 bar g.

But HI also means a higher operating cost. So this should be compared to the cost of investing in new capacity, buying from another source, or the cost of lost orders due to insufficient capacity. HI is also an excellent tool to handle temporary high demand for formaldehyde. In other words, it can give you more flexibility in terms of your capacity.

**intensity!!**

- The increased load will require higher safety relief valve capacities of the steam and HTF valves.
- The higher back pressure and flow will put more load on all the blower motors. The maximum load for the motors has to be checked.
- The higher production will consume more methanol and BFW. But there will also be higher steam production.
- There will be a higher demand for cooling water to the absorber and the capacity of the plate heat exchangers needs to be checked. Here you need to look at the cost of replacement or whether you can add plates.
- Control-valve capacity and line sizes are other things that should be checked.



### All the time – sometimes

What's new is that we used to only approve running at HI as a short-term peak capacity because of uncertainties regarding the long-term catalyst performance. These uncertainties have now been resolved and tested in full-scale runs. As a result, Formox now approves HI operation for the full catalyst run. But please note that this approval applies only to Formox plants supplied since 2004, as most of these are already prepared to run at HI. These relatively new plants usually only need some adjustments of the alarm limits. There are some exceptions, so the overall design must be checked before the higher production rate is started. Formox can easily check the conditions for your plant.

If you have a Formox plant built earlier than 2004 or a plant of another design, there are still certain possibilities to run at HI, particularly if your plant is pressurized with a Roots blower. If your plant has a pressurization fan, you might be able to place a new fan in series with the old one.

In each case, there are number of things that must be checked and perhaps adjusted before you can run at HI production. The cost of making the adjustments will determine whether HI could be profitable or not in your case.

- Check with Formox that you have a catalyst loading plan that can handle HI conditions. In many cases it is possible to operate with our CAP without modifications.
- Check that your plant's design pressure on the suction side of the recycle blowers and the ECS unit can handle 0.5 bar g. Note that the operating pressure on the discharge of the recycle blower will also increase by 0.2 bar g.

### More cost or free ride?

Then there is the question of operating costs. Running at HI increases power consumption per ton of formaldehyde, due to the higher back pressure for both the pressurization blower (0.3 → 0.5 bar g) and the recycle fans (due to higher density). The power for the pressurization blower will also go up due to the higher fresh air flow. The total power consumption will increase by ~6 kWh/ton compared to a plant operating at 0.3 bar g.

You also need to take into account that catalyst consumption per ton of formaldehyde will increase by ~10% for loads that are run at high intensity conditions. And the HCHO yield will be about 0.3 % lower. The other operating parameters will remain the same.

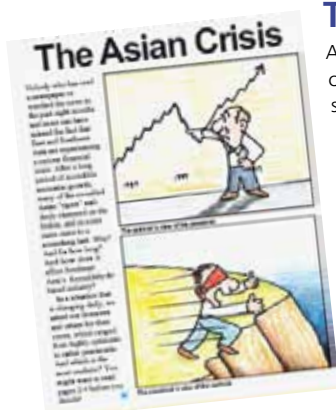
But there's more good news too. The addition of a turbocharger in new plants would eliminate the power cost for the pressurization blower. This means that in terms of power costs, you could run at HI for free!

### Conclusions

Generally speaking, the increased cost per ton formaldehyde makes HI operation economical only when a higher production rate is needed. And it is often only feasible in plants built in 2004 or later.

You should, however, compare the additional HI operating cost with the cost of investing in new capacity or the cost for losing an order due to capacity problems. HI is also an excellent tool to handle temporary high demand for formaldehyde.

But the introduction of the turbo-charger for pressurization in new plants is going to make HI operation very competitive . . .



## This thing about memory lane

An anniversary is of course always a suitable time for reflection – about where we have come from and where we are heading. Sometimes when we're caught up in the middle of something (particularly a crisis), it can be hard to see that.

In reviewing the past 14 (fourteen!!) years of *informally speaking*, I came across this story and cartoons I made for the front cover of the spring/summer 1998 issue – 11 years ago right now. (If you haven't seen or don't remember this issue, you can find them all on our website ([www.formox.com](http://www.formox.com)). It was in the midst of another financial crisis, particularly in Asia. To many people, things seemed hopeless then. But they weren't. In the years that followed, Asia has prospered tremendously.

Today we can also hear a lot of pessimistic forecasts, as well as some optimistic ones. Maybe both views are realistic. Maybe they are equally realistic. Then ask yourself who enjoys life more, the optimist or the pessimist? And who will be better prepared to take earliest advantage of the opportunities that will certainly come as soon as there is an upswing? Something to think about? With best wishes from the editor!





# PROJECTS & START-UPS

Yes, the global financial downturn is affecting everyone. But it's far from a standstill. The ongoing projects are proceeding more or less on schedule, and there are even some new orders. And we are also busy helping formaldehyde producers get more out of their existing plants too!

## New Projects

- **TOA Dovechem Industries Co., Ltd.** has ordered a replacement of a methanol vaporizer.
- An agreement has been signed for a basic engineering package for an FT<sub>2.5</sub> plant for a client in Asia.

## Ongoing projects

- The new FS<sub>2.5</sub> plant for **Kanoria Chemicals & Industries Ltd.**, in Visakhapatnam on the east coast of India, is in the detailed engineering phase. The plant is scheduled to go on stream in 2010.
- The new FT<sub>2.5</sub> plant for **CNOOC TIANYE Chemical Ltd.** (the China National Offshore Oil Corporation), in Huhhot, Inner Mongolia, is on schedule with planned start-up in early 2010.
- Construction of the FS<sub>2.5</sub> plant for **Yunnan Yunwei**, in Zhanyi, China, is well under way and is due to start up this summer.
- Installation work is ongoing for **Formosa Plastics**, Taiwan. The start-up is expected to take place in Q3-2009.
- The formaldehyde and resin plant for **Duratex** in Brazil is in the shipping phase. The new facility is scheduled to go on stream in December.
- The major project for **Ticona** in Germany is near the end of the detailed engineering phase and the first construction activities have commenced on site.
- **QAFCO** will make a further addition to their capacity with a new FS<sub>1</sub> UFC plant for their site in Mesaieed, Qatar. Formox is delighted to have been selected again to provide the basic engineering. As before, we are working together with a major international EPC contractor to ensure that the end-user's requirements are fulfilled.



The main equipment for the new Ticona plant was delivered via the Main River in April.

## Start-ups

- The new FS<sub>1</sub> plant for **Nafta Petrochem**, in Lendava, Slovenia was successfully started in April.
- The new FS<sub>2.5</sub> plant for **Shaanxi BDO**, in Huaxian, China went on stream in April.
- The new plant for **Karbodin** in Russia should go on stream just after publication of this issue. (Karbodin is a joint venture between Metafrax and Dynea.)

## The **UPs** & **DOWNs** of Mo prices by Ronnie Ljungbäck

In our previous follow-up of global-market molybdenum prices in June 2006, we wrote that the analysts expected the price to drop in the end of 2006, but the analysts were apparently wrong. Instead, the price remained relatively stable at US\$25-20/lb, and then in May 2007 it made a move upwards to a level of around \$33, where it held until last October. Since then, the price first dropped to \$7.70, but has now (May 2009) bounced up to around \$10.

The large drop in Mo price might well make you wonder why we cannot decrease our catalyst prices more? After all, the Mo price is now only about 30% of what it was in October! Besides the fact that molybdenum accounts for only slightly more than half of the catalyst, the answer is simple. When the Mo prices went soaring upwards, we implemented new price models, so that the net price of the catalyst would remain relatively unchanged, despite big

variations in the world market Mo price. These, together with our efficient recycling system, have enabled us to keep the net prices of catalyst relatively stable, regardless of the fluctuations on the Mo market. The benefits of these models will become even more apparent when the Mo price starts to rise again. The analysts believe that we will see prices of \$10-20 /lb during the coming year, but then they might be wrong again . . . What you *can* count on is our keeping reasonably stable net prices, thanks to your returning spent catalyst and our catalyst recycling system.



## Faces & places

We've had very few staff changes since the last issue of *informally speaking* – just one departure, two new positions and zero new arrivals.

- **Fredrik Rietz** has been appointed as our Product Manager for Plants.
- **Maria Yngvesson** has left her role as a process engineer to take on the position of project manager.
- **Ulf Andersson** has left his position as an account manager to work at DAAB, a company in the village of Perstorp. We wish Ulf all the best for the future.



Fredrik



Maria



This group from Nafta Petrochem travelled from their homes in Slovenia to visit us for training in early February. Their new Formox plant, which went on stream on April 1, was also deemed a suitable home environment for some local birds! (Check out the nest at the top of the tower!)



## Seminar news

The next seminar takes us to a completely new venue.

**Formaldehyde Asia 2010** is scheduled to be held in Bali, Indonesia, the first time ever in that country. The tentative dates are March 2–3, followed by a 2-day training program. The selection of the hotel is not yet finalized.

So mark your calendar and register early! We would like to remind you that all of our customers are welcome to attend! The same applies to our other forthcoming seminars:

- **Formaldehyde Americas 2011** – the dates and venue have not yet been decided.
- **Formaldehyde Europe 2012** – OK, we just finished one in Malmö, but we think long-term (just like our commitment to our customers).

Watch our **NEW** website ([www.formox.com](http://www.formox.com)) for further details!

### informally speaking

The newsletter *informally speaking* aims to provide information about formaldehyde 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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