informally speaking

THE FORMALDEHYDE NEWSLETTER FROM PERSTORP FORMOX spring/summer 2006

Beautiful weather (like this sunset in Helsingborg), great attendance, and developments on many fronts helped make the conference both rewarding and memorable.

in this issue...

Leveraging change

Our recent organizational changes – designed to give the greatest flexibility, maximize customer support, and encourage feedback within our team in order to speed up customer-driven development – seem to be working out well. We're also finding that we're able to focus more on R&D and improvements – and we've got some exciting things in the pipeline!

Some slight changes in our plant range have resulted in even more flexible plants, covering a wider production range and optimizing performance still further. But regardless of how well we set our own agenda for change, we are far from immune to what goes on in the world outside!

China's boom – and thirst for energy – have helped push oil and gas prices to record highs. The increased demand for materials (such as stainless steel) pushed metal (including Mo!) prices to record levels last year. Fortunately, Mo prices have receded quite a lot since then. And, as we know, the reclassification of HCHO by IARC poses potential threats to our industry, but we're all hoping that ongoing studies will add some clear scientific facts to the debate and help turn the tide….

Methanol prices have gone up, as have electricity prices in most of the world. On the other hand, the gains we have achieved in productivity in the past few years (e.g. CAP) have enabled producers to postpone investments, boost steam production and cut power consumption, thus going a long way to offset those price rises.

It's said that the only thing that never changes is that there will always be changes. The way we feel about it is that the important thing is to make sure that we can leverage as many changes as possible into changes for the better!

Mikael Ekblad
General Manager
Perstorp Formox

Memorable days in May
in Helsingborg & Perstorp

Hot on the heels of one of the coldest, longest winters in Swedish memory, spring suddenly burst like a worn-out rupture disc (please forgive the metaphor), just in time to give Formaldehyde Europe 2006 the perfect setting of intense greens, blue skies and pleasantly warm temperatures. How much the fine weather may have contributed to the good spirits and positive responses of the participants can never be known, but the conference was a big success. With a record number of participants (representing 23 companies and 17 countries), the two days packed in several metric tons of information – and some good fun. Here's a brief recap….

DAY ONE
More than ever

The first day of the seminar was held in Helsingborg, as usual. Following Marie Grönborg's welcome and outline of the agenda, Perstorp Formox General Manager **Mikael Ekblad** gave an update on what's happening within the Perstorp Group in general, and Perstorp Formox in particular. Mikael was pleased to note that Perstorp Formox currently has more projects underway than at any other time in history.

Mikael

He also noted that the price of molybdenum has fortunately come down considerably from its all-time high a year ago, but is still considerably higher than it was some years back, and is not likely to return to that level. "Despite the 4-fold increase in molybdenum prices, however, we managed to limit our price hike to just 10%," notes Mikael, "for all those who return their spent catalyst to us in reasonably good condition."

Balanced to tight – or too tight to balance?

Next up was **Paul Daoust** from Methanex Europe, with all the latest on our favorite raw material – and our biggest expense. Methanex currently has two production hubs: Chile (3.8 MMT) and Trinidad (1.9 MMT). Their plant in New Zealand is likely to close this year, but another (in Egypt) is scheduled to open in 2009.

Paul foresees a 3-4% annual growth rate in global demand over the next 5 years, "but this could be impacted by growing energy prices. Moreover, in the case of DME and olefins, which have always been oil-based, MeOH is becoming competitive as a raw material."

The biggest growth in demand is coming from China (rising from 7 to 10 MMT by 2010), and there is surprising growth in Eastern Europe and Russia. Growth in supply is coming from Latin America and the Middle East, with sharp declines in North America and Europe, particularly next winter, when there will be extreme pressures on high-cost producers to shut down.

"A lot of new capacity is being announced," says Paul, "which might lower prices – but it could also cause high-cost plants to close. And then there's China." Paul observed that although demand in China is soaring, their imports of methanol have actually decreased as a result of rising domestic production. "But much of this is coal-based and does not meet international standards, so their imports are likely to increase."


Paul

Some "balancing" can be expected, partly thanks to the decline (to nearly zero) in US consumption of domestic MTBE for fuel. "So the market in 2006 will mostly likely be balanced to tight," concludes Paul, "even

Participants gathered for an informal reception the evening before the conference…

…which was well attended by attentive attendees (yes, that's Max Henning front center).

if industry only operates at the normal average of 85%. But this assumes MTBE plant closures in North America…."

Bob's HCHO update

Bob Crichton launched into his time-honored coverage of the HCHO market with an apology: that much of what he had to say was identical to what he had covered at Formaldehyde Americas last autumn. Since that presentation was in turn admirably covered in the last issue of ***informally speaking***, this report will be limited to some tidbits of new information – and a reproduction of Bob's handy HCHO derivative chart (see page 8), as well as an extension of his HCHO consumption forecast (see table).

Bob

Uses of HCHO	HCHO consumption (MTPA, millions, 37%)		
	2002	2005	2012
Chemicals	10.2	11.5	14.3
Wood	10.1	13.5	16.5
Other	1.2	3.3	3.8
TOTAL	**21.4**	**27.9**	**34.8**

Bob claims that since 1990 there has been continuous growth in HCHO capacity, but it's not as even as it used to be. "In the last decade or so, there have been bigger swings – at least 3 major peaks, followed by more dramatic drop-offs, but still overall growth," says Bob. "This is probably because the world economy is both surprisingly buoyant and worryingly imbalanced!"

What about current consumption? "Nameplate capacity is over 38 million MTPA [as 37%], and capacity utilization, is close to 74% – around the level where we usually start to see new capacity being built," notes Bob. "And indeed this is what's happening. I think it would be fair to say that Perstorp Formox is busier than at any time in its history," adds Bob, confirming Mikael's observation (see above).

Using science & sense

The next speaker was **Dr Detlev Clajus**, the Secretary General of FormaCare, a branch of CEFIC that is seeking to make the case for good science in the increasingly emotional debate concerning formaldehyde classification and legislation. "FormaCare is working actively against deselection of formaldehyde in various applications, and to maintain confidence in formaldehyde," he asserts.

Showing examples of increasingly emotional advertising against formaldehyde in various newspapers, Detlev stressed the need to fight hysteria with solid science. Given the fact that only 8 cases of nasopharyngeal cancer (an extremely rare form) among workers in the formaldehyde industry have been documented over the years, and that these cases are based on exposure that occurred some 50-60 years ago (when exposure limits were far, far higher than today), and that 6 of the 8 came from one single plant (where the workers were also exposed to numerous other substances that might have been the cause), the case for carcinogenity seems at best far-fetched.

Unfortunately, such meager evidence is driving a lot of legislative proposals now before the EU – including one that would limit the content of formaldehyde in food packaging to levels that are "non-detectable"! [See editor's comment, next page.]

Detlev

"We want to communicate that formaldehyde is natural, necessary and beneficial – and that it's hard to replace," says Detlev. With over a *million* jobs in the EU that would be directly affected by HCHO restrictions (and 2½ times that many jobs indirectly affected), there is a lot at stake.

"We also want to point out that formaldehyde concentrations in wood panels are now approaching the levels of natural wood – having been 30 times as much just 20 years ago," notes Detlev. "This is just one example of what a good job the industry is doing at regulating itself!"

As a counterweight to the old studies on which reclassification was based, FormaCare is sponsoring a number of extensive new studies being conducted by some of the world's leading scientists, and scheduled for completion within the next 12 months. Dr Clajus is confident that the results will clearly demonstrate that while formaldehyde must always be handled with great caution (like so many other things in our lives), there is no scientific basis for the emotional alarms that could have huge economic and employment conse-

The balcony with a view over to Denmark was a favorite place to be during breaks, especially in the lovely May weather.

Another view of some of the key people in the HCHO business.

quences. Detlev has promised that when the results of these studies are in, they will be made known on the FormaCare website (www.formaldehyde.org) – and via ***informally speaking***!

Food for thought

The EU is proposing a ban on food packaging that imparts "detectable" levels of formaldehyde to food products. Do they – and consumers – realize that nearly all fruit, vegetables, meat etc. naturally contain easily measurable levels (far greater than "detectable" levels) of formaldehyde? Perhaps we shouldn't eat food at all….

– Stan Erisman

Catalyst matters

Speaking of self-regulation in industry, Perstorp Formox is releasing revised and new MSDS (material safety data sheets) for its formaldehyde catalyst products. Has the catalyst been changed? No! Then why the new MSDS? **Paul Walter** explained the reasons in the next presentation. "As part of our ongoing R&D efforts to improve catalyst performance, we undertook some new tests using Raman spectroscopy and X-ray diffraction, and discovered that in addition to ferric molybdate, our catalyst contains some molybdenum trioxide as well. And since the EU classifies MoO_3 as "harmful", we have issued new MSDS for our catalyst as well as the mix."

Paul

Paul also stresses the importance of applying proper workplace procedures to prevent exposure, e.g. protective clothing and the use of breathing masks to prevent inhalation of dust, a particularly important factor when unloading spent catalyst.

Paul doesn't consider it likely that this will mean any changes relating to trans-border shipments, "but in case you have concerns, or if your authorities require documents (such as our permits to recover spent catalyst), please contact us and we'll do our best to assist you!" [Note! The revised MSDS are available in a number of languages on the Perstorp Group homepage (www.perstorp.com).]

CAP recap

In the final presentation before the lunch break (all that in one morning?!), **Marie Grönborg** recounted the progress that has been made since CAP (catalyst activity profile) was first introduced at Formaldehyde Europe 2003, also in Helsingborg. "It's now quite clear," says Marie, "from all the evidence – both from our own plants and those of our customers – that CAP offers the possibility to increase production capacity at low (or no) investment cost, and at the same time get a lower DVC [direct variable cost]."

As the principal organizer, Marie had her hands full.

Marie also pointed out that operating with CAP does not in itself shorten catalyst lifetime, unless the methanol inlet is also increased. Even then, "high back-pressure is a more common cause," claims Marie. In any case, CAP offer significant financial benefits. Even if you end up spending a little more on catalyst, you'll be producing 20% more formaldehyde for the same amount of methanol, so you'll save up to €110,000 per year. (Marie's example is based on a 100,000 MTPA plant operating at 8.5% inlet.)

Marie listed a number of important considerations and recommendations when operating with CAP, for example:

- to equip reactors with multipoint thermocouples that allow continuous monitoring of hotspots;
- to ensure good methanol distribution in the gas;
- to ensure a homogenous mixed layer, e.g. by rolling drums carefully before loading;
- to ensure sufficient heat removal in the reactor by having the HTF at its boiling point (not sub-cooled) and by having liquid HTF cover the catalyst in the entire tube length;
- to remove deposits (if any) on tube walls before reloading;
- and should any questions arise, to contact your Perstorp Formox representative.

Take it easy?

After an intensive morning and a relaxing lunch, it would be understandable if some people felt like taking things a bit slower. For formaldehyde producers who sometimes find themselves in circumstances where they need to run their production at slower rates, **Birgitta Marke** showed what could be done to do so economically.

"One of the best things about our

After all that input, it was time to get out – fishing!

The boat was a great place for fresh air and a chat…

…and even for catching fish! Most of the catch consisted of garfish (Belone belone belone *in Latin – that's no baloney!). And most of those who tried…*

Birgitta, Magnus & Andreas

new plant range – in combination with the CAP concept – is that it's designed for great flexibility," claims Birgitta. "In other words, it can be operated over a wide range of production rates, yet with good performance figures and sound economy."

Birgitta related the results of a number of tests Perstorp Formox has conducted at its own plants in Sweden. "We've found that the production cost is lowered if we maintain 10 vol% methanol and instead reduce the recycle flow to 70%," says Birgitta. "And it's actually more economical to operate at part load than to run at design load intermittently."

Reducing the methanol concentration, however, greatly increases power costs and reduces steam production. "If you value the steam produced, this will be a costly option," cautions Birgitta. She feels that the best approach is a 3-step procedure:

1. Reduce the recycle flow.
2. Reduce the pressurization pressure.
3. Reduce the methanol concentration, but only as if a further capacity reduction is needed.

Birgitta pointed out that her analyses were based on a plant with recycle blowers with frequency controllers. "If you don't have frequency controllers, it might be worthwhile considering them," she advises, "especially if your production requirements vary. And they've come down a lot in price in recent years."

Keep on pushing

Magnus Hernelind, our tireless researcher, was the next speaker, and gave detailed accounts of several of the latest projects to achieve even more than what is hitherto possible with CAP. One of the recent milestones is the successful application of CAP in clients' salt-cooled reactors (see also page 10).

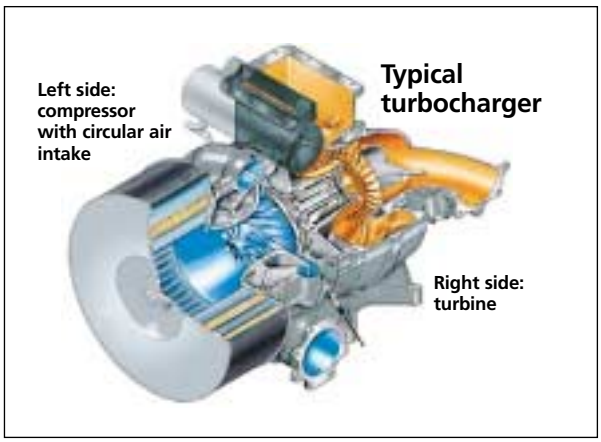
Magnus also told about Perstorp Formox's ongoing project to develop "HCCAT" – a high-capacity catalyst that would replace the mixed layer with pure catalyst, to avoid segregation of catalyst and inerts. "We were actually well beyond pilot runs and into the commercialization phase – not far from a market launch – but had to stop it due to short lifetimes in our full-scale runs," say Magnus. "But that's what R&D is about: trial and error. Success is about never giving up! We're going to find the answer, and you [our customers] won't be able to buy it until we do!"

Energy income???

The next presentation was delivered by **Andreas Magnusson**, who is working on a very special research project – one that could turn a formaldehyde plant's power costs into power income! That was no misprint!! Before joining Perstorp Formox, Andreas worked at ABB in Switzerland on the thermodynamic design of steam turbines – skills that he is now seeking to apply in formaldehyde plants.

"In recent years, various measures Perstorp Formox has undertaken have cut power consumption from around 95 kWh down to 60 kWh per ton of 37% formaldehyde," notes Andreas. "We're planning to go even further and even make the formaldehyde plant a *net producer of electricity*!"

Science fiction? Not at all, according to Andreas. "We've looked at two basic options: the use of a turbocharger or the use of a steam turbine.



…actually caught something, for once!

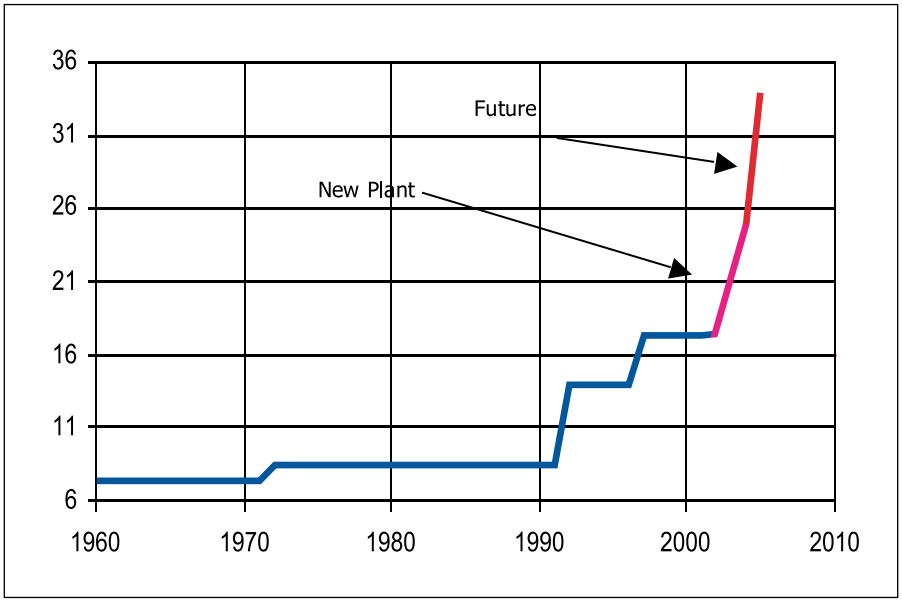
Those who didn't fish toured the grounds of the beautiful Sofiero…

…and were later joined by the fishermen for dinner (not fish!).

The latter would be either for driving a generator or for driving one of the recirculation blowers directly."

Studies conducted in collaboration with the Department of Energy Sciences at the Lund Institute of Technology gave some surprising results. "We found that a turbocharger could be viable even at the low pressures we typically employ, and that the price was not much higher than a normal pressurization blower, including the motor and frequency converter."

The turbocharger uses the pressure after the ECS and will replace the pressurization blower. Even though the solution is still under investigation, there's a patent pending. But Andreas cautions that it will still be some time before it can be launched. So why talk about it now? "R&D is an essential part of our approach," says Andreas. "It's also important for our customers to know that we're not resting on our laurels, but are continuing to do everything in our power to cut the cost of producing formaldehyde!"



Past and future productivity gains (in kg 37% HCHO/tube/day)

Last but never least….

The final presentation of Day One involved a return to the podium on the part of the always-entertaining **Bob Crichton**. And another update. This time around it wasn't the formaldehyde market, but the range of Perstorp Formox plants.

Bob started by reminding the participants of the tremendous gains in plant productivity that have been achieved since the first Perstorp Formox plant was sold back in the 60s (see graph above). "With every new design, we aim to reduce the cost of ownership," says Bob.

To cut costs, Perstorp Formox has been striving for increased standardization of plants. "At the same time, the ability to operate flexibly is the key feature; the plant is designed from the outset to be flexible." In other words, a Perstorp Formox plant is not only designed to perform optimally at a certain capacity, but within a rather broad capacity *range* – and to allow future expansion by adding an extra reactor.

"A major change is that our new reactors have longer tubes," observes Bob. "The downside of higher intensity operation is higher catalyst consumption. Clients are always happy to see plants work harder, but there have been a few complaints about short turnaround times – even though reloading goes so much more quickly nowadays. So by making longer tubes, we can load more catalyst and get longer runs. And don't forget, our R&D guys are working on longer-life catalysts too!"

Time to unwind!

Hour after hour, presentation after presentation. Interesting, exciting stuff, but how much can more than 70 participants take in one day?! The answer was in the form of a choice: to join the now-traditional fishing trip or to take the potentially calmer route by touring the gardens of Sofiero. Either choice was a welcome opportunity for relaxation and a bit of socializing before the joint gourmet dinner at Sofiero. After dinner, the participants found a variety of ways of preparing for the following day's session….

DAY TWO

The second day of a Formaldehyde Europe conference always poses problems for the poor editor of ***informally speaking***. (Note! This observation is totally unrelated to the previous sentence!) This is because the group takes a bus to Perstorp (no problem so far), and then split up into two sub-groups – licensees in one, all others in the other. The editor, lacking the essential cloning skills, cannot split up. So the account of Day Two will be a rough sketch. If you were in

Day Two was in Perstorp, at Stensmölla (for the licensees)…

…and included a tour of our own plants (for everyone).

either sub-group, you know you got something. If you didn't come to Formaldehyde Europe 2006: Sorry, you really missed something!

Plant tour in common

Both sub-groups' sessions included a tour of the Perstorp site and the five (5) HCHO plants there. This is where Perstorp Formox conducts all of these full-scale trials we tell you about – to prevent customers from being used as guinea pigs! The tour also included a visit to the methanol storage tanks, where a number of smart safety measures have been installed (as reported in earlier issues of ***informally speaking***, of course!).

Mike

Worth disc-cussing

The licensee session comprised a lot of information on rupture discs (see also page 14), including a presentation by **Mike MacClancy** from Continental Disc, a company that's been focusing on such products since 1966. Starting with the fundamentals, Mike pointed out that a rupture disc is essentially a non-reclosing valve, i.e. one that must be replaced after it opens. On the other hand, while relief valves have leakage limits, rupture discs are designed not to leak at all.

"We have rupture discs all around us," says Mike. "We just don't think about them in those terms. Airbags in cars are a good example."

Continental Disc's rupture discs are of composite material with a 6-petal opening and don't fragment on opening. They also have alignment pins in the holder to prevent incorrect installation.

"But a rupture disc is only as good as the process it's installed in," says Mike. "What we've learned is that the Perstorp Formox process is very well engineered, so very few spares are needed."

Another feature of Mike's discs is the flat seat, which enables a rupture disc to be removed for inspection, then returned to serve again. They are also equipped with vacuum support to prevent them from being sucked into the system, and a Teflon liner on the outside to protect against dust that might cause leakage.

Mike also cautioned formaldehyde producers to make sure to use proprietary discs in proprietary holders so as not to lose certification. How important is this? Mike puts it thus: "It's the first thing the insurance companies look for…." In another word to the wiser, Mike reminded the participants that cleanliness is the key to maintaining a leak-tight assembly. Put another way: Keep it clean, guys!

A fond farewell

All good things must come to an end, as the saying goes. The two sub-groups were reunited for a farewell lunch. Questionnaires were filled in – an overall amazing 8.7 average rating (on a scale of 10) – and people said goodbye to old as well as new-found friends. But some stayed on for training, others for individual discussions. And the rest of us will have to wait impatiently for Formaldehyde Asia next year (see page 16)!

No, that's not a bridal arch for love-stricken HCHO staff!

On the steps of Stensmölla, a farewell group shot after a great conference!

Molybdenum follow-up

Mo prices are considerably lower than the peak at $40/lb last year, and despite an increase in early May, the current price is approximately $26/lb, and prices are expected to continue to fall during 2006. More capacity will come on stream in 2007 and it is also believed that stock has been built to keep prices high, so Mo from that stock might now be released before the new capacity enters the market and drives prices down. The analysts feel it's highly unlikely that prices will return to the historical level of $4/lb, but will probably settle in the range $10-20/lb. (The analysts were wrong in predicting a major price drop last spring, however, so who knows if we will actually see any lower prices this year either?)

How do fluctuations affect you?

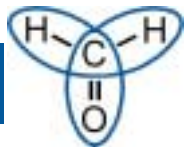
With more than an 8-fold increase in the Mo price, we had to add a surcharge to catalyst prices last year, related to the Mo price, since our catalyst contains more than 50% Mo. If molybdenum prices increase, the catalyst price will increase – and vice-versa. But the net effect on customers who return spent catalyst to us is minor, since we credit all recovered Mo.

The situation this year is that Mo prices are lower, MeOH prices remain high, and electricity prices are continuing to rise. So the big thing in overall HCHO production economy cost is neither catalyst lifetime nor price, it's catalyst *performance*. If your catalyst gives you a higher yield and lower specific power consumption, it's going to be worth paying a little more per kg of catalyst and changing a little more often!

MeOH HCHO derivatives

REACTANT
INTERMEDIATE
END PRODUCT

FORMALDEHYDE



Direct use as biocide & preserving agent

UFC → **SLOW-RELEASE FERTILIZERS**

Urea

Phenol → **ADHESIVES for panels**, **AMINO molding compounds**, **PHENOLIC resins & molding compounds**

Melamine → COATING RESINS → **COATINGS**

POLYOLS
- Acetaldehyde, Propionaldehyde, n-Butyraldehyde, i-Butyraldehyde
- Penta, TME, TMP, NPG
- → ALKYD RESINS → **COATINGS**
- → **SYNTHETIC OILS**

+Formaldehyde (polymerize)
- → Trioxane → Polyoxymethylene → **PLASTICS**
- → Paraformaldehyde

PHOSGENE → MDI (methyl di-isocyanates) → POLYURETHANES → **PLASTICS**

Aniline → **Indigo dye**

Acetylene → 1,4-Butanediol, NMP → POLYESTERS → **PLASTICS**

Ammonia
- → SYNTHETIC PYRIDINES → **HERBICIDES**
- → Hexamine → HCHO SUBSTITUTES → Small-scale SPECIAL RESINS → **PLASTICS**

ISO-BUTYLENES → **Isoprene**

Hexamine → **EDTA – CHELATING AGENTS**

Phosphorous trichloride → GLYPHOSATES → **TEXTILES**

NITROPARAFFINS → **NITRO ALCOHOLS**

Chart compiled by Bob Crichton

Better blowdown

by Andreas Magnusson
& Maria Yngvesson

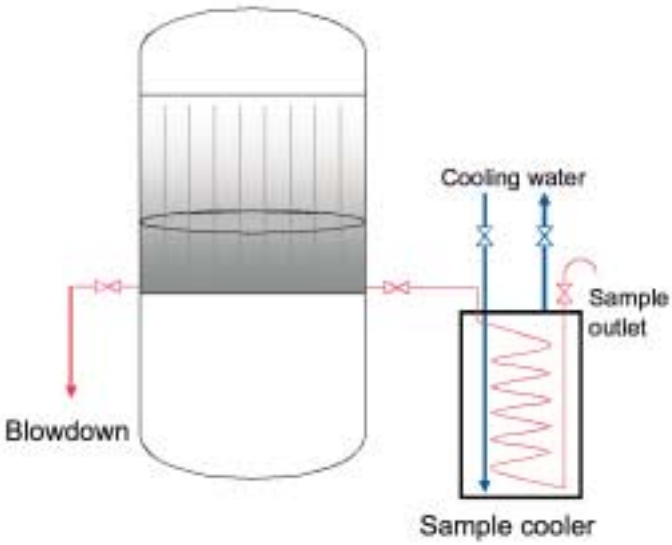
The most important parameters for a "healthy" HTF condenser and steam generator are the quality of the boiler feedwater (the water feed to the HTF condenser and steam generator) and the boiler water (the water in the HTF condenser and steam generator). Here's some information on how you can control the quality of the boiler water with blowdown and sample analysis.

There are two kinds of blowdown: intermittent bottom blowdown and continuous blowdown. The intermittent kind can be either manual or automatically controlled by a timer. The purpose is to maintain the solid content and sludge of the boiler water within prescribed limits.

Bottom blowdown is required whether or not continuous blowdown is installed. Continuous blowdown removes dissolved solids and enables excellent control of the boiler water quality. In boilers with slow conversion of water to steam, the continuous blowdown outlet should be where the steam generation is, i.e. close to the water surface. However, in Perstorp Formox plants, where the conversion is high, this outlet can be placed closer to the bottom of the vessel.

The keys to knowing the quality of your boiler feedwater and boiler water are sampling and analysis. It's important that any sample taken from the steam-generating equipment is cooled before being exposed to atmospheric pressure. Otherwise the sample will flash and the concentrations measured in the remaining liquid will not be representative. All plants supplied by Perstorp Formox today have sample coolers. The sample cooler can also be used for continuous blowdown.

Blowdown (both intermittent and continuous) and boiler water analyses give you excellent control of the boiler water and thereby the possibility to prolong equipment lifetime and reduce maintenance costs. The amount of blowdown is highly dependent on your boiler feedwater quality. With sample coolers installed and analyses performed, you can change the rate to a value that's optimal for your plant.



Installing a sample cooler is rather simple and not very expensive. Basically, you need a spare nozzle in the HTF condenser/steam generator below the water surface, cooling water and some piping work.

Please note that Perstorp Formox strongly recommends that any problems with extreme foaming, scaling, corrosion or pitting should be dealt with by a company specialized in boiler water chemistry. We absolutely do **not** recommend experimenting with home-made solutions!

For further information about acceptable limits of boiler feedwater / boiler water parameters and equipment installation, please contact your Perstorp Formox representative.

Reload in good time!

Planning your next reloading well in advance brings lots of advantages! For one thing, there is more time to design the optimal loading plan – which means time to run simulations and to compare historical data from similar plants and operating conditions. Of course it's nice that your supplier can also fill unplanned, rush orders ("I need it tomorrow!!!"), but such orders will inevitably not be backed by the same level of technical review. There's no getting around the fact that it takes some time to collect data, check results, set up simulations and evaluate it all.

Your good planning gives us the time to review your specs with you (possibly at a meeting), your operating conditions, your preferences and your reloading procedures. It's also beneficial to have the right time for delivery, and to schedule your reloading resources, e.g. our reloading service.

But of course, if you are unable to plan far ahead, we can usually find a satisfactory solution anyway. And our reloading service is *usually* available. Catalyst delivery anywhere in the world is possible (cost-based) to assure your continued production even if you haven't had time to optimize. (In emergency cases, it might be necessary to compromise on mix contents.) The point is this: If you don't have time to plan ahead, we can still solve most of your problems. But if you do have time to plan ahead, you have a lot to gain by placing your order well in advance!

Sadepan proves it!

A follow-up on CAP & High Inlet in salt-cooled reactors

In the previous issue of ***informally speaking***, we reported on a special seminar in Istanbul dealing with the possibility of applying CAP and High Inlet in salt-cooled formaldehyde plants. We claimed that it was possible. The best possible proof of this claim would not only be that someone has used it, but that they liked it so much they want to use it again. We now have that proof. **Sadepan Chimica**, one of Europe's major formaldehyde producers, uses salt-cooled reactors. And they're also using CAP and High Inlet – again.

To get the story first-hand, your friendly editor visited the Sadepan site in Castelseprio, just outside Milan, in northern Italy, and spoke with **Dr. Paolo Bellotti**. Dr. Bellotti is not only responsible for production at Sadepan's site in Castelseprio, but also provides technical advice on catalyst performance for the company's site in Genk, Belgium. Both sites are using CAP and High Inlet – very successfully.

A few facts about Sadepan Chimica

- Sadepan Chimica belongs to Gruppo Mauro Saviola, founded in 1963.
- The Group produces formaldehyde, glues and resins, slow-release nitrogen fertilizers, as well as particleboard (1.5 million m^3/yr), MDF and "kit" furniture for do-it-yourself assembly. They also design and develop board surfaces.
- Sadepan is one of Europe's major HCHO producers. The company has 2 sites in Italy (Castelseprio and Viadana) producing 420,000 MTPA 36% HCHO. A third site, in Genk, Belgium, has a capacity of 200,000 MTPA 36% HCHO.
- The Group's particleboard operations have an extensive recycling program that takes 100% of its wood raw material obtained from old furniture, woodworking industries etc.
- Sadepan's HCHO plants are of their own design, with salt-cooled converters.
- Sadepan has been using catalyst from Perstorp Formox since 1986.

Dr. Paolo Belotti

Why did you want to run at high Inlet?

"We decided to use High Inlet in order to increase our plants' capacity and decrease energy consumption. First we had to test our formaldehyde unit by running with a high ratio and also with high linear velocity for a short time, using a standard catalyst [Perstorp Formox KH-26L], in order to be sure that the converter had enough cooling capacity.

"We had been running at a methanol/air ratio of 8.0 wt-% and a linear velocity of 1.62 m/s. At High Inlet, we moved the ratio up to 9.8 wt-% and the gas flow rate down to 1.48 m/s."

You've also started using CAP. Why?

"The advantages are comparable to the High Inlet method: increased plant capacity and decreased energy consumption. In our experience so far, the formaldehyde and steam production are only a little bit higher than standard running conditions, but the reduction in energy consumption is very interesting."

What were the results?

"Very good! We achieved electrical power savings of 17-19% and got a specific production of 23.4 tons of HCHO [36%] per kg of catalyst, compared with a mean value of 19 on the previous run."

Is it more difficult to operate?

"No, it's the same. We just have to keep an eye on the thermo profiles [hotspots] and the oxygen value."

What has this meant for your overall economy?

"This year, the added benefit is €250,000! And we've also got better catalyst life – a 27% increase this year."

The Sadepan plant in Castelseprio

So you're going to continue with CAP and High Inlet?

"Absolutely!"

What about your support from Perstorp Formox?

"We get good technical support, thanks to a continuous exchange of information and data. We're also pleased with the reloading service."

Dr. Bellotti (right) together with lab chief Dimitri Donzelli

What's more important in this service – speed or accuracy?

"For us it's the accuracy. We use the reloading time for maintenance anyway, so the speed is not really a factor. But accuracy is everything. The only reason we don't use your reloading service in all of our plants is that the tubes in some of our converter designs make it impossible. But we would if we could!"

How is your safety and environmental performance?

"No problem today. We have good collaboration with the authorities. All Sadepan plants were certified last year in accordance with the UNI 10617 safety management system, and our plant in Viadana was also certified in accordance with ISO 14001 and EMAS."

What about your plans for the future?

"We have some ambitious targets for boosting our productivity even further, and we'll be testing some even higher inlet ratios. To reach these targets, it will be necessary to increase our collaboration with Perstorp Formox, for example in the form of help with the loading plans. We might also be expanding our capacity in Belgium. The authorities have already given permission, and the market looks good right now, so we'll see…."

Meet Mats

For the past eight years or so, **Mats Börjesson** has been traveling around the world at a faster and faster pace to help Perstorp Formox customers reload their formaldehyde reactors. To find out what happens during a reloading, to get some useful pointers, and to find out what makes Mats tick, it was the privilege of the editor of this journal to accompany Mats on a reloading assignment in Italy in March.

Just two days after Mats returned home to Sweden from a reloading job in Asia, we headed for Italy, arriving at a hotel near the site on a cool Tuesday evening. The cool weather is good news for Mats. "At the last place, the temperature inside where we were reloading was kind of hot," says Mats with a slight hint of a smile.

Even though it's usually a year or so between visits, the hotel people recognize and welcome Mats immediately. Mats isn't a man of many words, but he makes an impression. He's picked up some Italian over the years, speaks four or five other languages and communicates in about 12 of them.

Watch out for wet

When Mats and I head for the site early the next morning, it's foggy and damp, and Mats doesn't like the look of it. "Wetness and moisture make me panic," he says. "Water is no good for the catalyst. It punishes you directly, and I just can't over-emphasize that."

Mats tells me about another reloading job he was on. It involved an open reactor, and after a long first day's work, that crew had covered the reactor with a tarp. "It rained during the night," recalls Mats, "and when the client's crew removed the tarp, they weren't careful enough, so a lot of the rainwater ran off into the filled tubes. Nobody wants that to happen!"

Fortunately, our early arrival at the site means that the crew hasn't finished preparing the reactors, and there seems to be a good chance that the weather will clear up. There are two reactors to be reloaded in three days, before Mats returns to Sweden to change suitcases and head for the next reloading in North America. So Mats makes sure the catalyst loading machine has arrived safely (it has), and then we go up to see how things are coming along. The fog is beginning to submit to the springtime sun.

Who's who

Mats is immediately welcomed by the crew, like an old friend. The reloading crew at this site (Sadepan Chimica in Castelseprio, see separate article) consists of people from six countries (three continents), with probably as many languages. Not a lot of words are exchanged, but a lot of smiles and friendly gestures, warm handshakes, and approving looks. Even though they meet so infrequently, they obviously have no trouble picking up where they left off.

The guys in the crew seem to have a great deal of respect for Mats, and it's equally apparent that this is a crew Mats likes working with.

"My personal feeling is that it would pay off for a client to check what people they put on their reloading crews," Mats tells me. "I've seen some who've never worked with this kind of thing before, and they don't seem to care about the results. So there's carelessness. All it takes is someone to be careless with the hand-filled tubes and you can get some major consequences."

Clean tubes

Mats also stresses the importance of cleaning the tubes properly before filling them again. "In a few places I've been, I've seen so much stuff [Mats used another word…] left on the tube walls, you could hardly get new catalyst into the tubes," he notes, shaking his head.

But Mats has nothing but praise for the crew at Sadepan. "They're very careful about clean tubes, and that really pays off in the end. Considering the difference it makes, it's all the more surprising that everyone isn't more careful!"

Mats invites me to look down the tubes and see for myself. They're clean and shiny from top to bottom. "They get in there with a power-driven brush and clean each one," says Mats admiringly.

Roll those drums

The fog is a memory now and since the one reactor is ready for reloading, Mats starts preparing for action. The loading machine and catalyst drums are hoisted up to the reactor level, a plastic film is placed around the perime-

(1) The loading machine is hoisted up to the reactor (2) where it is assembled. (3) Mats fills enough for calibration (4), with the help of the client's team (5). Catalyst and mixed are now all lined up (6) and ready to go!

ter to catch any stray pellets. Mats and a couple of the crew members assemble the machine on the tubesheet.

Before beginning the process of calibration – making sure the right amounts of catalyst and mix are filled in the right order to the right levels – Mats also makes sure that the drums of mixed catalyst have been properly rolled.

"The whole point of having a mixed layer is to control the speed of reaction," says Mats. "But during transport of the drums, the catalyst and the inerts can become separated. If it was a bottle of salad dressing, you'd shake it, but the drums are a little heavy for that, so you just lay them down on their side and roll them back and forth for a little while. That's all it takes to get a good mixture again.

"In plants like this one, where you're running with a high methanol inlet, it becomes extra important that the mix is right, which makes it extra important to roll those drums before use!"

Consistency is everything

Rolling the drums to get an even mixture is one contribution to consistency. Another is a well-calibrated loading machine.

"The thing about this machine is that it's so consistent," claims Mats. "You just can't get that kind of evenness when loading by hand. There are, of course, certain tubes the machine can't reach, and these have to be loaded by hand. We've run some tests of the results, and it's easy to see where the machine stops and manual loading takes over – because of the variation.

"Consistency is everything," Mats continues. "If you get a reactor with all tubes fully and evenly filled, you're going to get an even pressure drop over the entire reactor, and this is going to improve your results."

Ready, set, go!

When calibrating the machine, Mats measures 12 tubes very carefully, layer by layer, making sure that the levels match those requested by the customer, usually as advised by Perstorp Formox.

While Mats is doing this, the crew members are placing drums and buckets in strategic positions in order to "feed" the machine once Mats is satisfied that the calibration is correct. And then it's show time! The machine is running, the crew members are working to keep pace with Mats. The noise level would make verbal communication difficult – even if everyone spoke the same language, which they don't – but it doesn't seem to matter. Mats' hand signals and gestures, even his eyes, seem to get through quite clearly to everyone. And considering that Mats has thousands and thousands of tubes to fill with pinpoint accuracy in just three long days, I find it best to keep out of the way….

Keep on going

When Mats is finished, both Mats and the customer will sign a document that the loading has been properly done. And then it's time to move on. Mats may reload some 40-50 reactors in a year, just about anywhere in the world, under all kinds of conditions.

Mats is a true professional, a craftsman who takes great pride in a job well done. But it's tough work. Having passed the 60-mark, Mats is looking ahead to retirement. He has reportedly built a sailboat in anticipation of that time. I asked Mats where a person might want to sail if they've already been all over the world back and forth? "I'll just follow my nose," says Mats with that hint of a smile.

And what about all the reactors that will still need reloading? "No worry," replies Mats. "When I started out doing this some eight years ago, I was pretty much alone, but now I've got several colleagues who are just as capable and careful, so everyone's going to be in the best of hands."

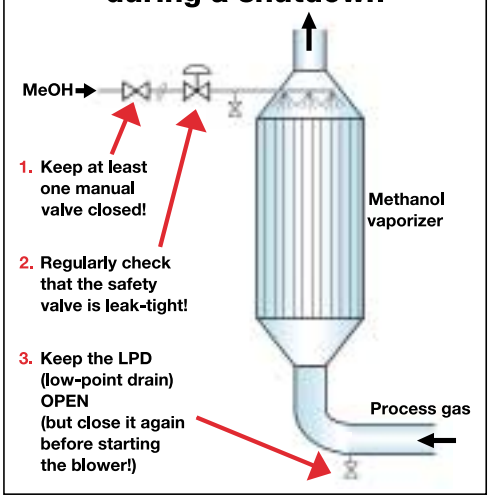
CC news

Have you noticed that there are several new and updated files in the online Perstorp Formox Customer Center? The titles include:

- Cleaning of reactor tubes
- Treatment of wastewater from cleaning reactor tubes
- Cleaning of cooling coils and absorber trays
- Basis for classifying hazardous areas in formaldehyde plants
- Fire hazards and protection in a formaldehyde plant

If you're a customer and haven't registered, you can do so online at www.perstorpformox.com, click on FORMALDEHYDE TECHNOLOGY, then on CUSTOMER CENTER.

Important points to remember during a shutdown



Advice

on the treatment & maintenance of rupture disc installations

by Birgitta Marke

All formaldehyde producers use rupture discs to protect the reactors against damage in the event of a methanol deflagration, but how sure can you be they're ready for action when you need them? There are a few things to consider – and some absolute "do's and don'ts".

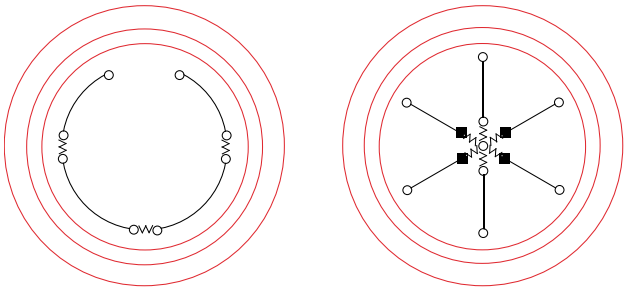
The bare minimum would be to inspect the rupture disc assembly every time you reload the reactor. Check visually that the discs are intact, and clean both the upper and lower surfaces. While you're above the disc, take a good look at the vent pipe. Ensure that the drain holes aren't blocked. Probably the quickest way to ruin your rupture discs is to leave water standing on them in the vent pipe.

Inspect the vent pipe for corrosion. This is especially important if your pipes are of carbon steel. Many of us have vent pipes that are more than 20 years old and, with time, they do age (like all of us…). To ensure that the vent pipe can withstand the severe conditions of a deflagration, you need to confirm the material thickness of your carbon steel piping. If you need to replace the vent pipe, consider installing a stainless steel pipe instead. This will increase your confidence in the system.

The rupture disc system is only as strong as its weakest component. It's important that the rupture disc holder has effective sealing surfaces, otherwise it will be impossible to achieve a tight system and you will suffer leakage of methanol-rich gas – which could ignite – to the atmosphere. If you have rupture disc holders in carbon steel you might need to machine the sealing surfaces to attain the necessary tolerances. However, a much better (but slightly more expensive) alternative is to replace the holder with a stainless steel version. This will also reduce your maintenance concerns – now you only need to ensure that the sealing surfaces are clean.

Rupture discs are manufactured with tight tolerances and should be carefully handled. Keep them in the box in which they were delivered, carefully read the installation instructions and ensure that the bolts are tightened to the recommended torque setting. Don't expect to be able to insert the rupture disc assembly between the two flanges like the cheese in a sandwich! A rupture disc is a precious safety component and must be treated as such.

What else should you consider? Our recommendation is to use a modern petal-type rupture disc. If you have hinged-type rupture discs, the ones that open like a toilet seat (see below), consider replacing them. When they burst open in the event of a deflagration, hinged discs are much more likely to fragment than the petal-type discs.



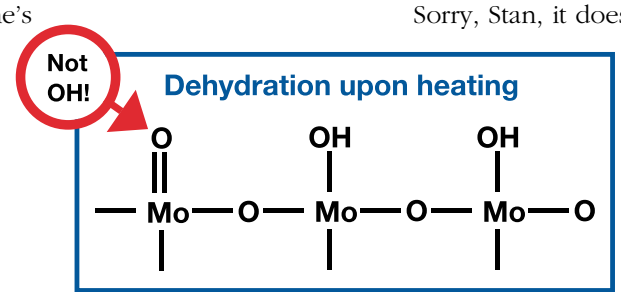
Hinged-type rupture discs (left) open like a toilet seat. Modern petal-type discs open like a flower. (The fracture lines are black).

Also remember that under all pressure-vessel regimes, the disc and the holder should be treated as a matched set. To get certification, you have to procure both items from the same supplier.

Obviously, rupture discs are among the relatively few thing people buy in the hope that they'll never have to use. But a malfunctioning rupture disc – or even one that fragments badly – is something you probably don't even want to think about. As the saying goes, "better safe than sorry!"

~~Corektions~~ Corrections

Good old Murphy's Law was at it again. In the autumn/winter 2005 issue, I erroneously added an H in one of Arne's diagrams (bottom of page 8, second diagram). The corrected version is shown here – and in the pdf version on our website.



Did I think I could make up for adding that H by deleting an N in **Vladimir Anshakov**'s name?!
Sorry, Stan, it doesn't work that way. And sorry, Vladimir!

Projects & start-ups

New projects

Project activities are on a very high level around the globe and we are happy to announce four more new projects since the beginning of the year.

- **Togliattiazot** in Togliatti, Russia has ordered a plant with a design capacity of 720 MTPD 37 % formaldehyde equivalent (the Perstorp Formox FT3 plant size), corresponding to 439 MTPD of UFC-85.
- Another Russian client has ordered their second plant (size FS3) to be built in the Moscow region.
- Although Perstorp Formox has been supplying catalyst to Japan for many years, we are now also pleased to announce the sale of the first formaldehyde plant project there, for **Kuraray** Co., Ltd in Kashima, Japan.
- **Nafta Petrochem** in Lendava. Slovenia, has ordered an FS1 plant, also the first Perstorp Formox plant in this prospering European country.

SAFCO's new UFC plant

Ongoing projects

- The project for **Nantong Jiangtian Chemical Co. Ltd** is proceeding as planned. The erection of the major equipment will start within a couple of months and the plant start-up is scheduled for the beginning of 2007.
- The FS2.5 plant to be built for **Shanxi Sanwei Group** in China is proceeding as planned.
- The project for **Xinjiang Markor Chemical Industry** in Korla, China, is also underway.

Start-ups

- We are happy to report that the **Casco Industries SAS** UFC/formaldehyde plant in France went on stream smoothly the first day of January.
- **SAFCO** in Saudi Arabia started their first UFC plant in March.

Revamps

- The pressurization project for a Malaysian client went on stream smoothly during March.

An auspicious milestone…

Over the last decade or so, Perstorp Formox has talked about having supplied formaldehyde plants, lots of them: "more than 60", "nearly 80", "over 90", nearly 100". In the last issue of **informally speaking**, just in time for going to press, we reached the magic 100 mark. With the ink barely dry on the agreement when the presses started rolling, there wasn't time to give this milestone its due attention, so now we will.

The lucky licensee, the purchaser of plant #100 is **Nantong Jiangtian Chemical Co. Ltd**, whose project by this time is already well underway (see above). There is a "typical" aspect in the distinction having fallen on Nantong; like so many other Perstorp Formox customers who come back for more, the plant is a repeat order, Nantong's 2nd. There's also a hint of the future – we're now building our 11th Plant in China!

So we're celebrating. And you can be sure that the fact that we're celebrating now isn't going to stop us from celebrating again when the 100th plant goes on stream!!

Anyone for a second-hand Perstorp Formox HCHO plant?

One of our clients has a small plant with a lot of "experience". They'd be willing to part with it for a reasonable price. Capacity: 45 TPD. If you're interested, we'd be happy to put you in touch with them.
Drop a line to:
info@perstorpformox.com.

Faces & Places

Another four new people have joined the Perstorp Formox team so far this year:

- **Andreas Olsson**, who holds a degree in chemical engineering from the Lund Institute of Technology, is working in our Process & Technical Support team. Andreas spent the past couple of years at Karlshamns.
- **Andreas Blomqvist** (Another Andreas? Do Swedes like that first name or something?) is now responsible for our CAD system and piping design. Andreas has previously worked closely with us through our sister business, Perstorp Engineering.
- **Per Fridlund**, who also joins the Perstorp Formox team from Perstorp Engineering, will be working with electricals and instrumentation.
- **Cao Ping** is the latest member of the Perstorp Formox team that is based in Beijing. Cao will primarily be assisting Zhao Dayang.
- **Jonas Lindborg** has been with Perstorp Formox for some years, but now has a new role as our Chief of Projects, i.e. responsible for our Project Department.
- **Karin Darelius**, who only just recently joined our Process & Technical Support team, has already left us for family reasons. We wish her all the best for the future!


Andreas O.


Andreas B.


Per


Cao Ping


Jonas

Training??

Some of the participants at Formaldehyde Europe 2006 had signed up for the Refresher Training Course that began immediately after the conference. Most of the training sessions were held here, in the Perstorp Formox conference room. The reason you don't see anyone here is that those involved in the training got so involved that they forgot to take a picture....

Goodbye, Edy!

Hello, Eddy!

No, you're not seeing double, and there's no cloning going on. But **Edy Lie**, our man in Singapore, is no more. In his place we are pleased to introduce **Eddy Lee**, a very competent and friendly guy – and one who was tired of causing people difficulties in spelling his name! If you haven't already met Eddy during his regular rounds, you'll get a chance to meet him at Formaldehyde Asia 2007 in Bangkok in February (see below).

Upcoming conferences

The next one is rather soon, so why not get out your calendar now?!

- **Formaldehyde Asia 2007**
  If you can join us for this conference, please be in Bangkok, Thailand on February 6-7. There'll be a reception the evening before (Feb. 5) and opportunities for refresher training and individual discussions the day after (Feb. 8).
- **Formaldehyde Americas 2007**
  Most likely in early October, but the time and venue have yet to be decided.
- **Formaldehyde Europe 2009**
  OK, it's a *long* way off, since we just had one. But if you like to plan far ahead, count on Helsingborg, early May.

Watch our website (www.formaldehyde.com) for further details!

informally speaking

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