# informally speaking

THE FORMALDEHYDE NEWSLETTER FROM PERSTORP FORMOX spring/summer 2007


# HCHO Asia 2007

# A century of formaldehyde

## – special feature with Max Henning

## in this issue...



## 100 and counting...

In the last issue of ***informally speaking*** we had a photo of the presentation of a plate commemorating the 100th Perstorp Formox plant sold – a plant that has now, by the way, been successfully started.

This time there's another 100 in our business. In 1907, the company now known as Perstorp – our parent company – began producing formaldehyde. For the unique story of a century of formaldehyde production, we turned to someone very many of our clients will remember well: Max Henning – for decades (until his retirement) our illustrious salesman, who also played a big role in introducing Perstorp Formox on the Chinese market.

In both cases (the 100th plant and the 100 years), we're talking about 100 and counting! Both 100s are very much about ongoing work-in-progress, because both stories are also about long-term commitment – to our customers and to the further development of every aspect of the technology.

Speaking of commitment, this issue also features an interview with two of the members of our project team. It's partly to give formaldehyde producers a rough idea of what happens when you sign up for a Perstorp Formox plant, but also to provide some insight into the ups and downs of traveling all over the world, meeting new people, new cultures, new everything. It takes a lot of know-how – and an open mind – to make it work really well.

Finally, we are pleased to note that in spite of all the heat HCHO has taken, largely undeservedly, one of our customers has chosen HCHO as the best and *safest* route to their end products – thus also improving HCHO's growth prospects in the chemical sector.

Mikael Ekblad
General Manager
**Perstorp Formox**

# Great days in Bangkok

This year's Formaldehyde Conference was held on 6-7 February in Bangkok, the exciting capital of Thailand, a city of great contrasts – from the sublimely peaceful to the totally chaotic, from wealth to poverty, from ancient to modern, from sidewalk merchants to big businesses and flourishing formaldehyde producers….

The following report is a rough summary of the presentations. For a full version of the seminars we host – like all of the networking, individual discussions and social contacts – you simply have to be there. Don't miss the next one!

## DAY ONE

In customary fashion, the General Manager of Perstorp Formox, **Mikael Ekblad**, opened the conference with a welcome to all participants, a presentation of the conference agenda and an update on the situation at the Perstorp Group in general and Perstorp Formox in particular. "Since the last Asian conference, in Singapore, we've sold 15 new formaldehyde plants, representing 1.8 MMTPA. New capacity in South East Asia has also been added through the CAP loading plan and a number of pressurization projects."


Mikael

Mikael also noted that all variable costs for formaldehyde producers had also gone up since 2004, averaging 100% for MeOH, 25% for power per kWh, but only 10% for catalyst, despite a five-fold increase in Mo prices. "As a result," says Mikael, "it's more important than ever to produce with good yield and to look at the economical lifetime of the catalyst, not the technical lifetime!"

Mo prices peaked in May 2005, then dropped only 35% – much less than expected. And it looks difficult to predict how big and how great future fluctuations will be. "But it certainly helps keep catalyst prices under control if spent catalyst is returned to us promptly and in reasonably good condition. That way, we don't have to purchase so much fresh molybdenum, which means we're less affected by fluctuations in metal prices."

### "The whole truth…"

"…and nothing but the truth" was the title of the next presentation, by the illustrious **Dato' Siew Ka Wei**. He is the head of Perusahaan Kimia Gemilang Sdn.Bhd., mercifully known as PKG, a company that supplies much of South East Asia with methanol – as a trader, not a producer, "so you can't blame us for the price increases!" PKG buys off-take from many producers (600,000 MT last year), which, according to Dato' Siew, is why PKG has never had to declare *force majeure*.

Dato' Siew shared the podium with **Muhtar Hashim** of Anton Kimia Sdn.Bhd., who predicted that methanol "capacities will more than satisfy the forecasted consumption figures" for South East Asia. Muhtar felt that the region can expect to see some rationalization of production, but reported that a "staggering" amount of new capacity has been announced, likely to result in an over-supply scenario. "But China will be a buffer – their demand is huge, even if construction is expected to peak this year."


Muhtar

Dato' Siew

Dato' Siew reminded the participants that MeOH is purely a commodity, with supply-demand as the sole determining factor. "How can we predict the price of methanol? It's *impossible* to predict!" He pointed out that China is producing MeOH "like

*What better way to start a conference than with an informal reception the evening before?* *Formaldehyde Asia 2007 was one*

there's no tomorrow" from its own vast coal reserves, which is why China's huge MeOH consumption hasn't had a greater impact on global demand and prices.

"For China, the lack of receiving facilities is a limiting factor on imports – and a big advantage for local production." The price trend is downwards, according to Dato' Siew, "but will not drop to levels like $200 unless (or until) major new capacity is on stream."

In closing, Dato' Siew claimed that Methanex's hold on the market is much reduced. "It's a more level playing field now – a different ball game, with Saudi, Petronas and China having all become big players."

## Formaldehyde update


Bob

**Bob Crichton** was next, with a further update from his presentation at Formaldehyde Europe 2006 in Helsingborg (see ***informally speaking***, spring/summer 2006 issue). Bob started with a rundown of the world's major HCHO producers, pointing out that Kronospan has gone from its first plant (supplied by Perstorp Formox) in 1983 to become the world's 4th leading producer.

Bob reported that capacity and production were running ahead of forecasts. He attributed the unexpected increases to Asia – now heading the world capacity league for the first time. "The error factor can be summed up in one word: China," says Bob.

The worldwide capacity utilization is currently 75%, according to Bob, "normally a trigger for building new capacity, and so it is. In fact, I think it would be fair to say that Perstorp Formox is busier than at any time in it's history!" Bob noted that there's a greater wood consumption than ever, and a greater share of panels than ever – in China largely driven by domestic demand. World wood usage averages 100m³ per thousand of population, but the share of panels is increasing. Bob also pointed out that in chemical consumption of HCHO, polyacetal (POM) has reclaimed the top spot.

Overall, Bob sees continued growth for formaldehyde, possibly rising to 43 MMTPA by 2015. However, Bob feels that 2007 will be fairly flat – "unless and until North American demand picks up. And we can expect to see more peaks and troughs along the way to 2015."

## Regulatory update

The next speaker was **Paul Walter**, who brought us up to speed on regulatory issues, including info about the revised MSDS for catalysts, as well as what's new on the reclassification front (see also FormaCare update, page 7).


Paul

"The MSDS has been revised as a result of improved accuracy of testing and measurements, not because the catalyst itself has been changed," says Paul. "Since the catalyst contains molybdenum trioxide, we recommend reviewing all of your handling procedures to prevent exposure to dust, particularly during the unloading of catalyst – and to fulfill applicable regulations. If you require documents, e.g. on our permits to recover catalyst, please contact us and we will do our best to assist you."

## Continuous progress

**Mikael Ekblad** returned to the podium to review the technical developments since the previous Formaldehyde Asia conference in 2004, as well as a look at ongoing development work, reported regularly in ***informally speaking***. One such project, presented by our steam turbine expert, **Andreas Magnusson**, concerns trials with steam turbines and turbo-chargers to harness the excess steam from HCHO production for generating electricity, thus offering considerable potential for cutting power costs. "We have found several ways to reduce energy consumption in formaldehyde plants," say Andreas, "but what solution will best suit your site is probably not the same as for your neighbor. During the spring we will continue to work with principle solutions for our standard plants, with focus on direct-driven fans and the turbo-charger. Please keep a watchful eye on the pressure drops in your plant!"


Andreas

## CAP recapped

**Paul Walter** returned with the latest on CAP (catalyst activity profile), the "magic" loading plans that allow increased MeOH inlet and a 20% increase in plant production, while actually decreasing power consumption – "higher capacity *and* lower costs." Paul first explained *what* could be done with CAP, then **Erik Timander** explained how it works in different plants. "There are some differences in operating with CAP compared to without, and it's


*Erik offered this proof that skiing without a cap is possible, but he also pointed out that operating with a "CAP" is likely to give HCHO producers a lot of benefits!*

*of the best-attended seminars ever hosted by Perstorp Formox.*

*And of course everyone needs a coffee break!*

*Breaks are for networking!*

*After a long day's work, time for an outing on the river.*

*The river in Bangkok offers many amazing sights.*

important to understand them clearly – because of both safety and operating economy."

If you have a plant design that is suitable for CAP (your Perstorp Formox representative can help you answer that question), the correct process input is essential for designing the optimum loading profile, as is having the correct amount of HTF in the system (neither too much nor too little). "But that's not enough either," says Erik. "In order to prevent excessive temperatures, you have to make sure the heat transfer coefficient is maintained." Reductions in the heat transfer coefficient can be caused by restrictions in oil circulation, deposits in tubes or coking of the oil. "A wire brush is often enough to get clean tubes. If not, try water-blasting – and see that you deal with your wastewater properly."

Birgitta

### It's all about flexibility

The flexibility of Perstorp Formox plants is evidenced by the fact that older plants can be successfully upgraded to greatly increase the nominal capacity – without any major new investment costs. But there's also flexibility in the way you can run your plant. Some producers want to run their plants flat out, others may want to run at less than full capacity. **Birgitta Marke** showed how Perstorp Formox plants are designed to enable formaldehyde producers to do either – or both – with the greatest possible economy. "To a certain extent, CAP has turned everything upside-down. Yesterday's operating laws no longer apply. If you want to run your plant optimally at any speed, you need to re-educate yourself.

"The CAP loading plan can operate within a wide range, but to optimize performance, the loading plan should always be designed for your normal operating parameters. So if you only intend to operate at 8 vol% methanol, let us know – and don't ask for a loading plan for 10%!"

### Where are we now?

**Bob Crichton** asked this rhetorical question before outlining what plants and capacities Perstorp Formox offers today – and what huge gains in productivity have been achieved over the years, particularly since 1990. "In 2007 we shall offer only three reactor sizes (or five, if you count the two half-sizes [see table])", says Bob. "The ability to operate flexibly is the key feature. The operating pressure, air rate and methanol inlet concentration can all be varied to match production requirements at any moment in time."

| MTPD 37% | | | |
|---|---|---|---|
| Size | Rated capacity | Peak | Minimum |
| FS1 | 160 | 190 | 70 |
| FS2.5 | 300 | 360 | 125 |
| FS3 | 360 | 425 | 150 |
| FT2.5 | 600 | 715 | 250 |
| FT3 | 720 | 850 | 300 |

Higher intensity operation is now also a reality. "The downside is higher catalyst consumption, which has been somewhat controversial," admits Bob. "Though clients are more than happy to see plants work harder, there are sometimes complaints about shorter runs. So in the new designs, we've made longer tubes – and longer-life catalysts are under development."

Bob sums up the Perstorp Formox approach thus: "We build plants for an optimistic future – plants that give you the maximum flexibility to grow with your success and to operate over a wide range."

## DAY TWO

For the second day of Formaldehyde Asia 2007, the assembly split into groups for licensees and non-licensees. The latter received further general information from **Olle Johnsson** about Perstorp Formox plants, catalysts and technical service, while the licensees went into greater depth on information pertaining to their plants.

Olle getting ready to go

The presentations for the licensee group started with a film presented by **Hua Qiufa** of Huayan Petrochemical Machinery about the supply of entry-level oxide plants built in China. Then came a look at how to achieve good control of your boiler feedwater (BFW) system as related by **Erik Timander**. Next was information from **Ong Eng Meng** and **Zhang**

Hua

Ong

Zhang

*The Royal Orchid Sheraton Hotel by night.*

*The riverboat tour was followed by a lovely outdoor dinner.*

*And the conference ended with another fine meal – to go with all the food for thought!*

**Xue Ping** (both from Emerson) on digital automation and the RS3 lifecycle status. Emerson has a support commitment for RS3 for up to 10 years, but the clock has been ticking since October 2003, "so it's time to start planning the replacement of your RS3."

Ibrahim

Next came a presentation by **Ibrahim M. Al-Homoud** of SAFCO in Saudi Arabia. SAFCO has the world's largest ammonia-urea production facility for fertilizer, using a formaldehyde plant supplied and commissioned by Perstorp Formox in April 2006. He related a problem with brownish vaporizer blowdown condensate that could be resolved by optimizing the start-up procedure. "By feeding urea and caustic almost simultaneously with the MeOH, we got an on-spec product within 3-5 hours, compared to 3-4 days before."

Finally, **Birgitta Marke** provided a safety update covering proper HTF levels, special concerns related to pressurized operation and dealing with eddy currents (or was it Eddy Murphy? Or Eddy Lee?!).

As always, these seminars are so much more than the sum (or summary) of the presentations. The opportunities for meeting and exchanging information with other formaldehyde producers (and a few suppliers) are very important, as is the chance to have individual discussions and simply get to know one another better. In a word: worthwhile!

# + 1½ days of training

Formaldehyde Asia 2007 was immediately followed by a 1 ½-day refresher training course. Many of the participants at the seminar took the opportunity to attend.


The well-attended refresher training course was headed by Andreas Magnusson and Eddy Lee (above). Eddy also bore the main burden of the practical arrangements for Formaldehyde Asia 2007.

# Update from FormaCare

FormaCare is continuing its active efforts to assure that European and other decision-makers and legislators are provided with balanced and science-based information and documentation relating to formaldehyde. FormaCare (www.formacare.org), like its North American counterpart FCI (www.formaldehyde.org), offers considerable and regularly updated information on its homepage. Readers of ***informally speaking*** will find some brief excerpts here, reprinted with the permission of FormaCare.

### International Formaldehyde Science Conference 2007

This event should be of considerable interest to FormaCare members, which includes most of Europe's formaldehyde producers (and for whom there is no admission fee). The conference, 20-21 September in Barcelona, is being held to "gather and discuss all newly available scientific research and study results on formaldehyde from the various fields of research." FormaCare describes it thus:

"The Conference aims to present and discuss two key aspects of research into formaldehyde, which are of equal scientific relevance. The programme is therefore divided into one section that focuses on the epidemiology and one that explores the toxicology of formaldehyde. Each session starts with several expert lectures and presentations, to be followed by an expert panel discussion to summarise and complete the session. The lectures will be given by scientists who have recently concluded or who are currently working on new research into formaldehyde on both sides of the Atlantic. Furthermore, there will be a brief session on Occupational Exposure Limits.

"The *International Formaldehyde Science Conference* will help to provide a discussion on the issue of formaldehyde between scientists, regulators and those who will be affected by the decision. It is therefore an important step on the way to achieve a knowledge-based decision on the reclassification of formaldehyde. Importantly, all of the relevant players from national competent authorities will be invited to join the discussion since it will be them to decide on a scientific recommendation for a classification at EU-level."

### Other news

The FormaCare homepage also reports some news on the reclassification process. "The interesting news is that the first meeting of the Technical Committee on Classification & Labelling, originally planned for March, was cancelled altogether. Formaldehyde has therefore not been discussed by the TCC&L since November 2005. This, too, is a success of our overall advocacy and communication strategy. Even so, there is no reason to slow down our activities or even scale down our efforts. On the contrary: with the Science Conference we aim to take the discussion up to a new level substantiating our argument with scientifically sound evidence.

"Science is also key in our plan to intensify the dialogue with the IARC. The institute has finally published the long overdue monograph on the evaluation of formaldehyde and is now planning a scientific update on a number of their substance evaluations, including formaldehyde, starting in October. It is our clear objective to convince the scientists at IARC to take all stakeholder opinions into account and to include all new scientific data from our recent research on formaldehyde in their update."

FormaCare will be submitting a paper to SCOEL (the Scientific Committee on Occupational Exposure Limits) clearly stating that the preferred-value approach "is not based on scientific considerations. In the specific case of formaldehyde industry and downstream users, a 33 percent reduction of the OEL from 0.3 to a 'preferred value' of 0.2 ppm cannot be achieved. Therefore, FormaCare strongly proposes to refrain from the 'preferred value approach'."

**Did you know...**

...that formaldehyde can be the **safer** path to making many of our favorite products?! See next page.

## MeOH update


JP Lotzkar

The following article was kindly contributed by **JP Lotzkar** of Methanex.

"During the second half of 2006, there was a global shortage of methanol, caused by several significant unplanned industry outages. The major consequence of the shortage was a rapid escalation in the price of methanol. The Methanex Non-Discounted Methanol Price (MNDRP) in Q4, 2006 averaged $599/MT, while the Q1, 2007 MNDRP averaged $554/MT. Methanol prices were abnormally high and unsustainable, and subsequently, there have been a number of changes that had the effect of increasing supply and reducing demand, which would be expected to lead to a more balanced environment. This is what happened during Q1, which has led to a return to pricing levels that prevailed before the methanol industry shortage.

"The methanol market changed in Q1, as high methanol prices over the last two quarters encouraged some high-cost incremental supply and encouraged an increase in exports of methanol from China. China went from being a net importer of 300,000 MT of methanol in Q3, 2006 to becoming a net exporter of more than 200,000 MT in Q1, 2007. This was almost solely the result of price differentials between the Chinese domestic market and export markets. There was a huge incentive to export that we believe only exists in a high-priced environment. High prices also suppressed some demand, particularly in fuels applications. More supply and less demand are what led to a rebalancing of the global methanol market.

"It was our observation of these changes that led us to reduce prices back to a level where we felt supply and demand were likely to be in better balance. Over the last few months we have seen the announced shutdown of about 1.3 million MT of methanol supply which is no longer economical at reduced prices, and we have seen announcements of increased demand for methanol in energy applications like MTBE and biodiesel, that are the result of lower prices. The lower prices have reduced supply and increased demand. And while it is normal that there will be some volatility in pricing, we would expect prices to remain at a high level relative to historical norms.

"Contract pricing in all regions in May is about $330/MT, and we would expect stability in contract pricing for the balance of the quarter. Several significant planned and unplanned industry outages have contributed to low industry operating rates and have tightened the market during Q2. Current spot availabilities are minimal and spot prices have been increasing recently. Additional unplanned outages would be expected to further tighten supply availability."

# Lucite goes for new route to MMA

*The site of Lucite's new Alpha technology project – to include a plant from Perstorp Formox. Below: From a space-age aquarium to fashion-house runways and all the way to the golf course, a few of the Lucite's many products.*

Lucite International is a global leader in the design, development and manufacture of acrylic-based products, particularly those based on PMMA (polymethyl methacrylate), better known by their brand names Lucite® and Perspex®.

Lucite has a 25% market share in MMA (methyl methacrylate), which is the foundation for a wide variety of products from mobile phone screens, through solid surfaces for kitchens and bathrooms to coatings for use in both home and industrial environments. MMA polymerizes easily to form resins and polymers with high performance characteristics, e.g. great optical clarity, strength and durability – even in aggressive weather or corrosive environments. MMA can also be co-polymerized with other monomers for use in paints, coatings and adhesives.

MMA is actually the monomer that is the intermediate which is subsequently processed, via polymerization, by producers of PMMA, polymethyl methacrylate. Since Lucite as a company is the result of the combination of the former MMA divisions of ICI (via Ineos) and Du Pont, Lucite's PMMA goes under two widely known commercial brands, "Perspex" (originally from ICI) and "Lucite" (originally from Du Pont).

The conventional route to MMA begins with hydrogen cyanide and involves the use of significant quantities of concentrated sulphuric acid. Owing partly to the extremely toxic and corrosive nature of these chemicals, production and handling costs are very high. Consequently, Lucite launched a development program to explore another path using completely different feedstocks including formaldehyde. Lucite's new route, termed Alpha Technology, has undergone successful piloting at their Research and Development facilities at Wilton in North East England. Lucite claims that this technology has significant advantages over existing routes including attractive savings in manufacturing cost.

The first step in the implementation of Lucite's Alpha Technology will be at the company's facility in Singapore, more specifically on Jurong Island. Lucite, the global leader in its field, is critically dependent on the integrity of its feedstock stream (formaldehyde). In rolling out a cutting-edge technology for the first time on an industrial scale, Lucite chose Perstorp Formox to supply the formaldehyde technology and plant, which will have a nameplate capacity of 360 MTPD 37% formaldehyde (peak 425 MTPD).

Electrical power distribution and control philosophy will be foundation fieldbus – the first-ever HCHO plant to be integrated within this environment.

The photos on this page are courtesy of Lucite International.

# Safe handling of HTF

HTF – heat transfer fluid – is a vital ingredient in the operation of our formaldehyde plants. It enables efficient heat transfer, but also requires certain safety and environmental considerations. Here's a brief summary of what you should bear in mind.

## What it is

The HTF used in our process is a kind of oil. The most commonly used HTF oil is a eutectic mixture of two very stable organic compounds, biphenyl and diphenyl oxide. These compounds have practically the same vapor pressure, so the mixture can be handled as if it were a single compound.

The normal application range for HTF oil is from 15°C to 400°C, and its pressure range is from atmospheric to 10.6 bar. In the vapor phase it may be used from 257°C to 400°C. The maximum recommended film temperature is 425°C.

## The right temp

Improper use of HTF oil can cause thermal degradation, so we recommend taking samples from your oil and sending them to your supplier to check for thermal degradation or contamination about once a year. In other words, it helps to have good relations with your HTF oil supplier.

HTF oil has a freezing point of 12°C and it is therefore important to keep the temperature above this level to prevent hardening in pipes and equipment, which would then have to be thawed before reuse.

For storing the HTF oil, the recommended temperature in the storage tank is 20-40°C. Another matter of the greatest importance is to not exceed the flashpoint (113°C), which is the lowest temperature when any spark or open flame can cause ignition of the vapor phase over the liquid phase.

## Safety first

Always handle HTF with caution! Prolonged or frequently repeated contact with the fluid, e.g. in connection with maintenance work, should be done with proper protective clothing. The recommended equipment is a face shield, safety glasses, gloves, boots and body suit, depending on the risk of exposure during the operation in question. And if the maintenance or other work involves exposure to high concentrations of fumes, a gas mask should also be worn.

The HTF fluid has a striking odor that becomes quite disagreeable even at very low concentrations. Inhalation of a strong concentration of the vapors may cause headache and nausea, and can also be irritating to the eyes and nose due to the smell. The good side is that if you have a leakage of HTF in your plant, the odor can serve as a warning and make it easier to discover problem. Another good thing is that despite the foul smell, HTF oil has only a low order of inhalation toxicity and studies show no significant effects from long-term exposure.

But eye contact with HTF oil – whether in vapor or fluid form – can be very painful, even though it reportedly does not damage the cornea. Upon eye contact, wash the eyes under running water for at least five minutes, then visit a physician to make sure that no irritation remains. If you suspect that the oil might be contaminated with other substances, you might require other treatment.

Occasional skin contact with HTF oil is not a problem (unless it's hot!), but repeated contact can cause skin irritation. So be certain to wash with soap and water, at once if possible.

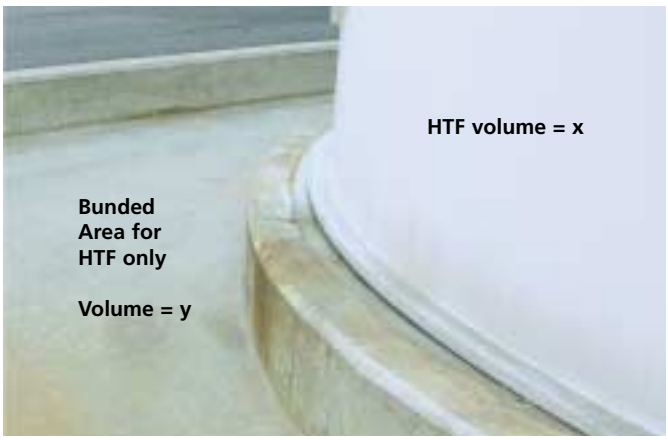
## Damage control

Perstorp Formox strongly recommends that every formaldehyde plant should have containment (e.g. bunds/dikes) to prevent any oil spills or leaks from polluting the surroundings. Pay close attention to the plant drain each time surface water is released from the plant to the drain system, to make sure that no HTF is present. Since HTF is heavier than water, with very low water solubility (14 ppm), the HTF will be found as a "lump" in the bottom of the drain.

We also recommend a second bunding line, inside the plant bund, around the HTF tank. This bund should be equipped either with a valve to the plant's surface-water drain or to a sump where spillage and surface water can be pumped out.

In case of leakage, it is crucial to keep the spilled oil inside the plant's entrainment dike. Although HTF oil has low inhalation toxicity, as mentioned above, it is highly toxic to aquatic organisms. In fact, levels below 1 mg/L can prove fatal to the most sensitive species. Consequently, all contamination – of soil, surface water or ground water – must be prevented.

Any leakage within the bunding should be cleaned up and removed – preferably with some form of oil-absorbent material – and then sent for destruction in accordance with local regulations and environmentally responsible operations.




*If you have an extra bund around the HTF tank, with a capacity equal to or greater than the volume of the HTF tank, then in a worst-case scenario, where all HTF leaks out, you will not risk getting HTF into the plant's surface-water drain. In other words, see that volume y is equal to or greater than volume x!*

## Your call

Each site is different – the layout, the drainage system, the demands of the authorities etc. The arrangements you make at your site to assure that you are prepared for worst-case leakage are, of course up to you. As suppliers of safe formaldehyde plants, we seek to alert our customers to potential hazards and encourage our customers to take steps to prevent them. After all, the prevention of accidents at chemical plants is clearly in the interest of everyone in the world!

# Teamwork WORKS!

By Bob Crichton

As you will have seen elsewhere in this issue, this year's seminar was in South East Asia. It seemed a long time since the last Formaldehyde Asia Seminar in 2004, and even longer since the event was last held in Thailand (1998). It was great to be back in the region and to see so many old friends.

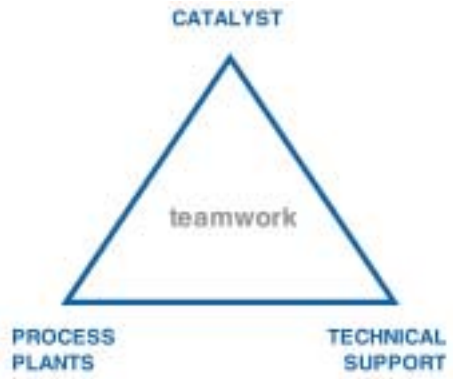
South East Asia is special in that it saw one of the first plants ever licensed by Perstorp Formox (to Norsechem in 1972) as well as the first sale (again to Norsechem, this time in 1992) of the new range of plants designed and supplied by Perstorp Formox.

Clients in the region were very quick to see the benefits of the new concept, so we sold a lot of plants in quick succession. And the remarkable thing is that all these plants, as well as most of the older plants, are still operating – and operating well. What is even more remarkable is that many of the plants sold in this area all those years ago can now produce up to 50% more. Indeed, the reactor size used in the 1992 sale referenced above is still in use today – rated at 160 MTPD but with a peak capacity of 190 MTPD – almost double the rated capacity of the original 1992 design.

So why are these plants now capable of so much more? You have read in ***informally speaking*** about pressurization, higher methanol inlets and CAP, but in truth, these developments are only part of the story. To take a simple example, if you were simply to increase the inlet on one of the older plants you would not get the expected result, because the catalyst loading plan (CAP) has to be matched to the inlet. In other words, the loading plan is the key to overcoming the limitations of the old design.

This is where another key ingredient in the Perstorp Formox formula enters the picture: technical support. Full technical support requires a full view of the big picture – catalyst, process and plant – so that changes and improvements can be successfully implemented and adapted to the needs of each particular client.

Pressurization is another example; simply adding a fresh air blower and increasing the pressure is not sufficient. As with high inlet, the capability of each component in the design needs to be assessed and the correct CAP selected. The driving force is a long-term commitment to each client – even to catalyst customers using their own or another oxide process. It's about helping each customer to get the most out of each plant or load, year after year, decade after decade.




But knowledge of catalyst and process parameters by itself is not enough either. This fact was brought home to me in Bangkok, at Formaldehyde Asia 2007. Yet another factor is needed – one that emerges from the interaction of the first three: teamwork. Increased productivity was made possible – in South East Asia and around the world – by close cooperation among the different disciplines within Perstorp Formox *and* by building long and strong team relationships with clients. It is these long-term client relationships that led to the teamwork so evident in Bangkok. Teamwork has kept plants running profitably for more than 20 years. Teamwork has given the upgrades that delivered the productivity gains. And the good news from the Bangkok seminar was that we can expect the same teamwork to deliver even more productivity gains in the not-too-distant future.

## New drum labels

To facilitate reloading a bit by making it easier to quickly identify which drums contain what, Perstorp Formox is introducing a color coding system as follows:

- **BLACK – CATALYST ONLY**
- **RED – INERTS ONLY**
- **BLUE – MIXED**
- **GREEN – ECS CATALYST (PPt-47)**

Now, as long as you're not color-blind….

# 100 years of formaldehyde

by Max Henning

Formaldehyde was accidentally discovered somewhere between 1859 and 1867 by Alexander Mikhailovich Butlerov, a Russian chemist who was actually trying to produce methylene glycol by reacting methylene iodide and silver nitrate. In 1868, the German chemist August Wilhelm von Hoffmann managed to produce HCHO by leading a mixture of methanol vapor and air through a test tube containing a glowing platinum wire. He also managed to identify the substance as the previously missing aldehyde with just one carbon atom. His method would be the starting point for all subsequent large-scale production. And 100 years ago – in 1907 – began the production of HCHO in the small village of Perstorp, in southern Sweden.

## How did Perstorp get involved?

The company now known as Perstorp was founded in 1881, initially with dry distillation of beech wood (from the surrounding forest) for the iron industry and carbon black. From the stack gases it was also possible to extract acetic acid, acetone and wood alcohol – usually referred to as methanol.

In 1902, Perstorp began using the heavier tars to make creosote, used for treating typhus and TB, and by the Japanese army for gastrointestinal disorders during their war with Russia in 1904-05. During that same war, large amounts of formalin were being used as a disinfectant, so Perstorp's founder, Wilhelm Wendt, decided to start making the stuff. Dr Julius Schwyzer was hired from Germany in 1905 to build and run the plant.

*Mr Butlerov in bronze*

## The first process

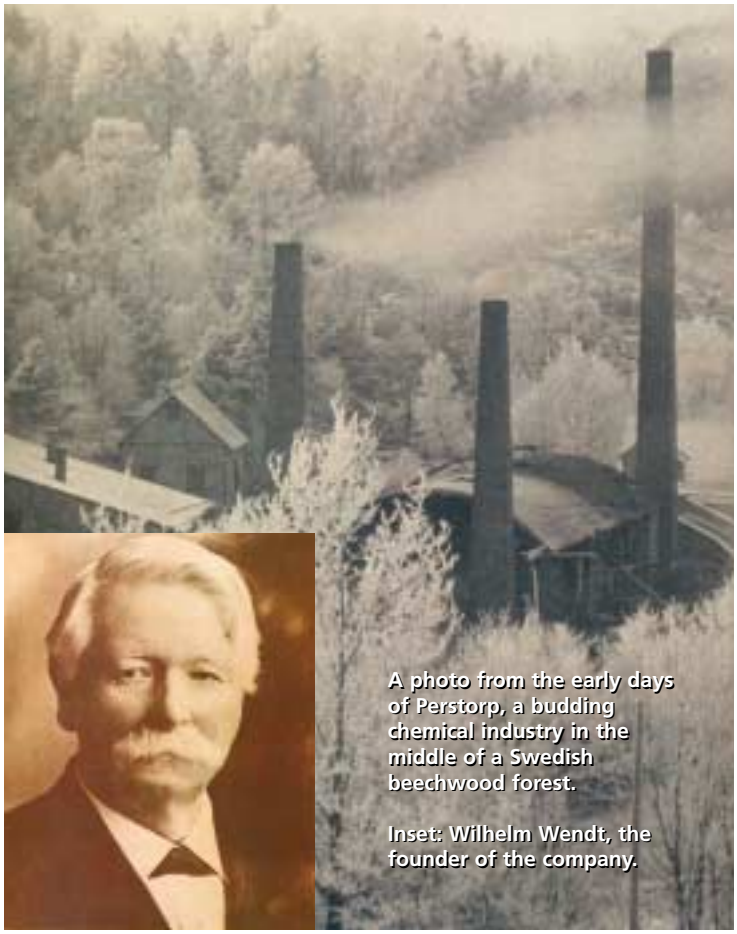
That first plant had two reactors, each containing four rather large metal tubes into which were placed copper rods wound with copper wire. These devices were called "contacts". Today we'd call them catalysts. Not much else is known about the other equipment, except that it was largely made of copper by a clever local coppersmith.

The methanol-air mixture was ignited and burned as an open flame until the copper contacts started glowing, whereupon the flames were extinguished by quickly cutting off the flow of gas. Shortly thereafter, a flow of gas was resumed and the copper contacts were kept glowing by the heat of the exothermic reaction. (The "no smoking" signs at today's plants come to mind…!)

The formaldehyde was absorbed in water and collected in a large copper vessel. Unreacted methanol was distilled out in batches for reuse. The losses were considerable, and a couple of years later, a continuous distillation process was installed.

Work was split into two 12-hour shifts, six days a week. This allowed a production volume of 450 kg/day, i.e. about 150 tons a year. It's reported that a worker would sometimes work a 24-hour shift so that a co-worker could have a day off.

A notation from the Perstorp ledger in 1907 lists the sale of a small quantity of formalin to a nearby leather factory. And thus begins Perstorp's 100-year history of formaldehyde production. The copper process lived on for 15 years.



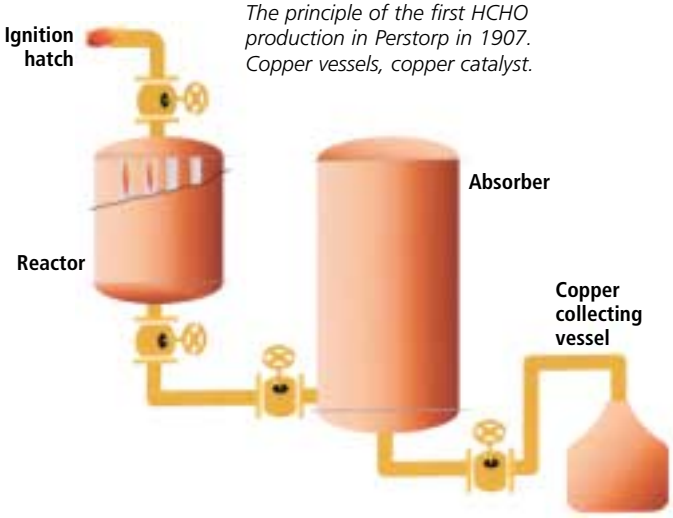
**A photo from the early days of Perstorp, a budding chemical industry in the middle of a Swedish beechwood forest.**

**Inset: Wilhelm Wendt, the founder of the company.**

## The next step

In 1909, Leo Baekeland, a Belgian chemist who had emigrated to the US, invented the first true plastic, a thermoset that came to be known as Bakelite. In 1917, Innanendra Das Gupta, a student from India who had just completed his doctorate in chemistry in Berlin and was hired to develop pharmaceuticals in Perstorp, discovered that he could make a similar thermoset by reacting creosote with formalin, plus some fillers. Perstorp was entering the plastic business – and with it grew the demand for formalin.

To meet the need, a completely new HCHO plant was built in 1921, under the leadership of an engineer named Karl Cederqvist. The plant had many small, parallel-connected reactors (contacts) with a catalyst of silver mesh. (Silver granules were also used.) The




*The principle of the first HCHO production in Perstorp in 1907. Copper vessels, copper catalyst.*

capacity was 3.5-4 TPD, about 1200 TPA, i.e. nearly 10 times bigger than its predecessor.

A second plant was built in 1941, doubling the number of reactors, and by 1946, Perstorp was producing some 6000 TPA. However, the catalyst was highly sensitive to impurities, and since the process uses a surplus of methanol, it works above the explosion limit for methanol/air. This process also contains relatively high quantities of methanol, so an extra distillation step is required. And it probably took more than 500 kg of methanol to make one MT of HCHO. Still, it was the best available technology of its time, and Perstorp used this process for nearly 30 years.

## Time for the oxide process

When Perstorp began producing polyols in the 50s, primarily Penta and TMP, the demand for formalin as a raw material really took off, and the quest for a new, improved process was on.

Reichhold Chemicals, a US company, had a lot in common with Perstorp. Both were family-owned, both had begun producing Penta, both were using the silver process to meet their formalin needs, and both were looking for something better.

But Reichhold had gone a step further, and in 1953 had set up a pilot plant with a new type of catalyst: iron-molybdenum oxide. The new process came to be called Formox® – **form**aldehyde through **ox**idation.

Reichhold, via its VP Pat Ryan, was looking to improve its Penta process and an agreement was reached that it would be mutually beneficial for the two companies to exchange technical information.

After a visit to the Reichhold site in Tacoma, WA, Perstorp's Bengt Wetterling and Sten-Åke Bergstrand, working closely with others, particularly Reichhold's Bob Walker, developed the design for a full-scale Formox plant, to be built in Perstorp. The reactor was twice the size of the pilot reactor, but the absorber was dimensioned to handle four such reactors.

The first start-up, with just the one reactor, took place in August 1959. It was so successful that it was decided to build the other three reactors without delay – and to shut down the silver plant. Even then, the yield from the Formox plant was about 89% (the silver plant had only been giving 84%).

By 1966, Perstorp's capacity was up to 70,000 TPA.

### MeOH sources

By the mid 1920s, wood alcohol was being replaced by synthetic methanol – produced by reacting a mixture of CO and hydrogen. For many years coal was used to produce the synthesis gas, but in the 1960s steam reforming of natural gas began to take over. These processes greatly increased the availability of methanol – a major contributing factor in making formalin more easily available on the market.

## Available to others

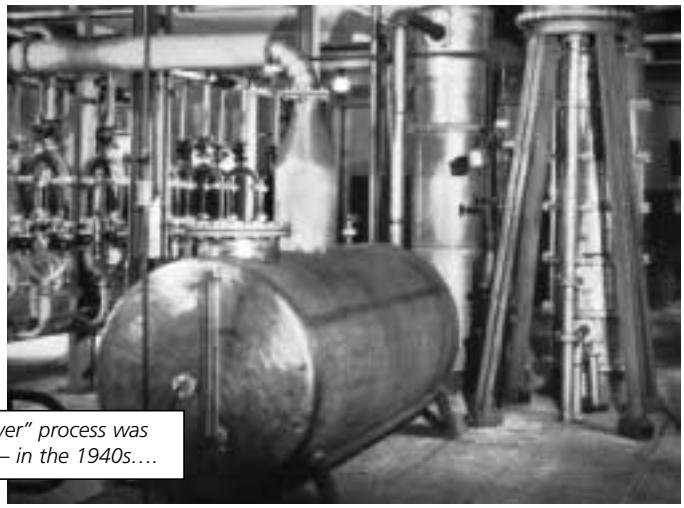
By the 60s, Perstorp was largely dependent on export markets. Since exports often encountered difficulties in the form of tariffs, high freight costs and other restrictions, the company began looking into the idea of overseas production. And about licensing certain technologies to other companies. The focus was on formaldehyde, and Perstorp Formox was born.

Why formaldehyde? One of the main reasons is that formaldehyde must normally produced near to where it is used, since HCHO is invariably stored as formalin, involving huge quantities of water and huge transport costs. It also needs to be heated, so storing huge quantities is not feasible.

Perstorp Formox sold the first technology licenses to companies in Spain, the UK and Chile, and had also undertaken to supply the entire plant, built on the customer's site. Arne Andersson was sent out to oversee the first projects – which took quite a bit longer than expected. This was the 60s, and we didn't have enough experience to know what to expect….

It was at about this time – in the mid-70s – that I began selling licenses for Perstorp Formox, something I continued doing whole-heartedly until my retirement in 2003 (and a bit beyond).

*Perstorp's old "silver" process was good for its time – in the 1940s….*



*That's Max, in the middle of things (and this picture), in his early days with Perstorp*

*Max the pensioner would rather be tending his lovely garden nowadays. Or would he?*

## Increasing support

Initially, a license only entailed the "basic engineering" (drawings, flowsheets, instructions, training etc), and the customer was responsible for his own "detailed engineering" (detail drawings, purchasing of all equipment and actual construction). Over the course of 22 years, some 40 plants were supplied in this manner. Construction was either done by the customer or by a contractor. More than 15 of these plants were built by a Spanish firm, Adaibra, until they went out of business (for other reasons, mind you!) in 1992, and we felt obliged to adopt a new approach.

Perstorp Formox decided to take the big step to supply everything – all drawings, purchasing of all equipment, and site supervision throughout the project. This went hand in hand with Perstorp Formox's growing awareness of the importance of full, long-term support for its customers. At the same time, we also began the work of standardizing plant sizes and designs in order to reduce the number of engineering hours and achieve scale benefits on equipment purchases. Bob Crichton, a formaldehyde consultant who had previously worked with Adaibra, played a big role in this.

The message must have gone home, because over the next seven years, up to Perstorp Formox's 40th anniversary in 1999, another 40 plants were sold, i.e. as many in 7 years as during the first 22. And since 1999, there have been another 27. Plants built with Perstorp Formox technology now account for over 7 million MTPA of capacity in 35 countries, on all continents except Antarctica.

## In closing

Having supplied more than 100 plants has obviously given Perstorp Formox unique experience. Add to this the fact that we've developed and supplied catalysts to even more – including for other oxide processes [Formox is a trademark that now belongs to Perstorp]. And that we have direct experience of the actual production aspects, with five formalin plants "at home". And finally, that we keep on building close and supportive relations with our customers over decades. No wonder I liked my job so much. I wonder if they'll take me back…?

*It came to this: state-of-the-art oxide plants like this one that Perstorp Formox built to supply formaldehyde to DuPont in Holland.*

## Half full?!

There's the old story about the optimist who sees a glass as half full, while the pessimist sees it as half empty. Your friendly editor, who is known by some to tell a story or two, had heard about a further improvement on the optimist and pessimist: the engineer, who sees the glass as being twice the size it needs to be. When I related this story to **Mark Jelpke** of Lucite International at the conference in Bangkok, he immediately took it yet another step, and asked me "Do you know how the Perstorp Formox engineer sees it? The glass offers 100% capacity expansion opportunities!"

# Have plant, will travel


Erland


Gert

You've just signed a contract to purchase a state-of-the-art formaldehyde plant from Perstorp Formox. Now what? The next step is that the purchase becomes a project, and our project team steps in to take you on a journey from the drawing board and into production. Two of our highly experienced team members – Erland Andersson and Gert Svensson – tell about the process, and what it's like to move around all over the world, setting up formaldehyde plants.

### How's your first contact with and/or visit to the customer?

**Erland**: "I normally participate in the contract negotiations and discussions of the technical appendices. If the scope of supply is complicated, we have a kick-off meeting to be sure that we get off to a good start. In our meetings with the customer's team, there are many questions from both sides, but the main thing is to build mutual trust."

**Gert**: "Sometimes our first contact is during the contract-signing phase, when we assist our sales people. Otherwise, we usually introduce ourselves via email. But the first meeting – normally at the customer's site – is an exiting moment for us and I believe also for our customer. There are new people to meet, different cultures for both sides, different languages, finding out how to proceed in a way that meets the customer's expectation etc. Both sides learn a little about each other, which helps assure a smooth and effective project."

### How do you make a schedule for the project?

**Erland:** "We try to leave as little as possible to chance, but still remain flexible and adaptable to special wishes and circumstances. And we put together an experienced team of people responsible for electricals, instruments, each aspect of the project." [See box with Erland's 16 steps].

**Gert**: "The general schedule is normally drafted when the contract is made. The detailed schedule must take several points into consideration, e.g. contract conditions, engineering resources, equipment delivery times etc. When we have all this input, then all parameters can be balanced into a detailed project schedule. And of course we follow the steps and criteria stipulated in our quality system as well, to insure good quality for our customers."

### What are the most common obstacles /problems you face?

**Erland**: "If there are delayed deliveries, or if the customer is in the hands of a powerful contractor."

**Gert**: "All kinds of unforeseen problems can occur, such as late delivery of equipment or communication problems, but our project management team tends to solve them quickly in the best interests of our customers."

### How often do you visit the customer and for how long?

**Erland/Gert:** "During a project, we make 6-8 visits, including engineering meetings, installation and commissioning. The kick-off and engineering meetings are 2-5 days each. Our site representative makes about 4 visits of 2 weeks up to a month, depending on the site situation. And our commissioning team spends 4-6 weeks at the site."

### Are there any difficulties in spending so much time away from home?

**Erland**: "Professionally, no, because everyone knows their tasks before they get there. And of course it's exciting to tackle a new project and meet new people – or old friends, when we build a second or third plant for a client. But there are all the time changes, jet lag, waiting at airports – and being away from the family a lot. And you've got to be prepared to work whenever it's needed – but it's worth it when you make the customer happy! "

**Gert:** "You learn the meaning of the old saying 'There's no place like home'! But in a way, the job is rewarding on both ends: it's fun heading out to help build the world's best formaldehyde plants and it's fun to come home to people who've missed you. Like most things in life that give you valuable experience, there's a lot of hard work involved."

### Are there any difficulties or challenges in meeting new cultures and traditions?

**Erland**: "We've had some intercultural courses, but in my opinion, the main thing is that you're very professional, serious and polite – that you have an open mind and are prepared to respect different ways of doing things."

### Erland's 16 project steps

1. Contract review at Perstorp Formox HQ
2. Purchase of long-lead-time equipment.
3. Plan kick-off meeting internally.
4. Start engineering.
5. Kick-off meeting with customer within a month.
6. Process review meeting with customer within 4 months.
7. Purchasing.
8. Engineering review meeting with customer in Sweden, visit to sub-suppliers.
9. Inspection of vessels and equipment before delivery.
10. Shipping.
11. Open-case inspection (OCI).
12. Site supervision by our specialists
13. Pre-commissioning inspections
14. Commissioning
15. Start-up.
16. Preliminary performance test.

**Gert**: "Yes, it's important to quickly learn how to work with different cultures so the project will run smoothly. We sometimes discover that we have different ways to do things, but in most cases everything is resolved in a good atmosphere."

### What is the most fun and/or rewarding aspect of a project?

**Erland**: "Creative, positive and constructive meetings with the customer! Then, in the end, very nice celebrations and the start of long-term relationships."
**Gert**: "It's working with people from different countries, and working with people in our team, jointly making a successful project. It's also exciting and rewarding to be able to solve problems."

### How do your relations with the customer typically develop during a project?

**Erland**: "I always become very good friends with my customers, so they are more like friends!"
**Gert**: "During a project, you can feel how the understanding, the respect, the cooperation and the knowledge just keep growing. This – and the great plant performance our customers get – is probably why a number of our customers have bought several plants from us."

### How is the team spirit among the people from Perstorp Formox?

**Erland:** "Very good. We often have to work Saturdays and Sundays, many times in pretty remote areas, so it's important to have a very good relationship and also have fun together."
**Gert:** "Enthusiasm and the will to do a professional job is what the Perstorp Formox team is all about. It's a great feeling to work in a team like that! And starting up a new plant is a great thrill – to know that the long efforts have succeeded."

**Do you maintain any contact with the customer after the start-up?**
**Erland:** "Many of my customers are friends I will have contact with as long as I'm working for Perstorp Formox. And since we do so many 'repeat projects' – a new plant for an old customer – it's always easier each time."
**Gert:** "Yes, we can maintain contact for years, even if we're not running any projects, like friends."

**What are the most important qualifications/personality traits for a person working on these projects?**
**Erland:** "The most important qualification is knowing what you're doing and being flexible and polite. Listening to the customer so you can learn, being friendly and sociable – these things are highly appreciated!"
**Gert:** "You need to have good knowledge and experience in how to run international projects. It's good if you can see the possibilities in every situation you face and are flexible and have patience. You have to like to work with people – people from different cultures."

## Projects & start-ups

We have a distinct impression that formaldehyde producers all over the world are recognizing the exceptional performance of Perstorp Formox technology. Read below and you'll understand why….

### New projects

We are pleased to announce the signing of four new projects since the last issue of ***informally speaking***. (The two new plants for China will mean a total of 14 Perstorp Formox plants in that country.)

Please note that Perstorp Formox respects clients' wishes for anonymity, i.e. we endeavor not to publish any information about a client that has not been approved for such purposes by the client in question.

- A project for a new formaldehyde plant for a client in Europe is now underway.
- An FS1 plant, with the possibility to produce HCHO and UFC85 simultaneously, has been sold to a client in the Middle East.
- Contracts have just been signed for two new formaldehyde plants for clients in China. Pending these clients' approval, further information about these projects will appear in the next issue of ***informally speaking***.

### Ongoing projects

Our customers are certainly keeping us busy! In addition to the four new projects mentioned above, we have nine (9!) ongoing projects!

- The project for the FT3 plant for **Yunnan Yuntianhua**, to be located outside Chongqing, is running on schedule and is expected to start up in early 2008.
- The project for **Lucite International** in Singapore concerning the installation of a new formaldehyde plant to support Lucite's new proprietary MMA technology (Alpha technology) is on track. See separate article, page 7.
- The plant for **Faplac S.A.**, the first Perstorp Formox plant in Argentina, is expected to go on stream this autumn.
- The plant for **S.K. Petrochemical** in South Korea is proceeding as planned. The new formaldehyde plant will support SKP's production of BDO.
- **Ningbo Wanhua**, China, will start up the second line of their FT3 plant sometime this autumn.
- The project for **Togliattiazot** in Russia is in the final installation phase and start-up is also expected this autumn.
- The plant for **Kuraray**, Japan is scheduled to go on stream this summer. It will be the first-ever Perstorp Formox plant in Japan.
- Work on the new plant for **Nafta Lendava** in Slovenia – another new country for Perstorp Formox – is underway.
- The formaldehyde plant for the chemical complex for **Xinjiang Markor Chemical Industry** in northwestern China is proceeding as planned.

### Start-ups

Two plants have been started since the last issue of ***informally speaking***:

- The plant for **Nantong Jiangtian Chemical Ltd** in China – the 100th Perstorp Formox plant sold – was successfully started in February.
- The plant for **Shaanxi Sanwei Group**, also in China, also went on stream in February.


*This group of trainees from SK Petrochemical in South Korea arrived in Perstorp in the end of November – just too late for the press deadline for the previous issue of* ***informally speaking****. To make up for the omission, here's a trio of photos from their week in Sweden.*

# Faces & Places


Bengt-Åke


Stig


Allan


Ronny

The only team changes since the last issue of ***informally speaking***: involve our crew of "roving reloaders". **Mats Börjesso**n has retired, as he indicated he would in the spring/summer 2006 issue. He has been replaced by **Stig Hansson**. The crew is headed by **Bengt-Åke Hansson** and the other members are **Allan Larsen** and **Ronny Andersson**. Watch for them in a reactor near you!

## Training

*This group (left) of trainees from **Shanxi Sanwei Group** in China spent some time with us in January, followed by these three guys from **Kuraray** in Japan.*

# Seminar news

The new seminar schedule is now effective, meaning **one (1) conference each year**, with the venue rotating annually between the Americas, Europe and Asia. Since we've just had the Asian conference, the next round will be in the Americas. But please note that *all* of our customers are welcome to attend any or all of these seminars, whether the venue is in your region or not.

The next round, as from now, looks like this:

- **Formaldehyde Americas 2008** – to be held in Toronto on April 21-23. For those of you who like or need to plan ahead, you might want to mark your calendar now. Further information will be forthcoming in the next issue of ***informally speaking***, on our website and directly from us to you.
- **Formaldehyde Europe 2009** – most likely to be held in Helsingborg and Perstorp, Sweden, as is customary, to enable a visit to our own plants in connection with the seminar and so that participants can meet most of the Perstorp Formox team.
- **Formaldehyde Asia 2010** – still a long way off, since we've just had Formaldehyde Asia 2007. But we are known to think long-term….

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


**informally speaking**

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