informally speaking

THE FORMALDEHYDE NEWSLETTER FROM PERSTORP FORMOX spring/summer 2008

Formaldehyde Americas 2008

Terrific time in Toronto

in this issue...

Same team, same theme

Any sports fan who has had his or her heart behind a team for more than a few years knows that players come and go, switch positions and retire. But the team remains the same. Perstorp Formox is a team. I would venture to say that we are quite a bit more like a team than most businesses. The reason I say so is that so many of our customers have told us that that's how they see us – and we're proud of it.

When Mikael Ekblad decided it was time for him to accept a new challenge, I believe that all of us were sad to see him go. And when I was asked to take over as General Manager, my sadness became mingled with all kinds of feelings: excitement, nervousness, pride, amazement – just to name a few.

Fortunately, my long experience in all aspects of the business entitles me to one more feeling: confidence. I am very confident that the Perstorp Formox team will continue to play a world-class game for you, our "fans", our customers. I'm certain that our main theme – technological excellence combined with service-mindedness – will keep on getting stronger, no matter what changes and challenges may lie ahead. We have always striven to be more than just a supplier. We want to go beyond giving you the "usual". In that sense, it's now "business as unusual"!

In this issue you'll find quite a lot of information that we hope will be of interest to producers of formaldehyde, not only about plants and catalysts, but about the external challenges facing all of us in the formaldehyde-related industry. I hope you not only find it interesting, but also useful.

Marie Grönborg
General Manager
Perstorp Formox

Bright days in Toronto

Is it a new design for an absorber? A wheel on a giant toothpick? No, it's the CN Tower in Toronto – one of the world's tallest structures.

When we selected Toronto as the venue for this year's conference – Formaldehyde Americas 2008 – some feared that the icy grip of winter would still be in evidence. Those fears were unfounded. Spring was bursting out everywhere, trees turning green from one day to the next in the (mostly) bright, warm sunshine. And "sunshine" could describe the atmosphere at the conference, with high participation and for the first time ever with representatives from every continent on earth (excluding Antarctica). This year's conference was followed by an opportunity for a half-day refresher training session, in addition to the customary time allotted for those wishing individual discussions with Perstorp Formox. Here's a rundown of what took place.

DAY ONE

Perstorp & Perstorp Formox

Kicking off the proceedings was **Marie Grönborg**, the new General Manager of Perstorp Formox. Marie started with a brief update on the Perstorp Group – a presentation that included a review of the Group's activities and global market coverage, as well as the key message for Perstorp Formox customers: that while Perstorp Formox has formed an integral part of the Perstorp Group for almost 50 years, the business logic is different from other parts of the Group. This is why Perstorp Formox maintains a very high degree of operational independence. At the same time, the Group provides access to captive formaldehyde production units as well as world-class R&D resources (competences & facilities). This enables Perstorp Formox to maintain strong focus on business development and the needs of formaldehyde producers worldwide.

Marie then reviewed the development of Perstorp Formox over nearly 50 years (see the last page under "Next seminars"), and talked about the symbiosis that has emerged along with the experience of having supplied over 100 plants.

"We give our customers technical support. You give us feedback that helps us improve – and give you even better performance," notes Marie. "A key thing here is that we aim to make our customers more successful, so you'll grow and prosper – and come back to us for more, and we are very happy and proud to have many customers that come back to us again and again, both for catalysts, but also for plants! We feel that that's what good business relations are all about!"

Shawn

Talking about the challenges of today, Marie adds: "I firmly believe that our success is thanks to our focus – on designing, developing and operating the process and catalyst to achieve as low investment cost and low DVC as possible, while assuring that safety, environmental impact and trouble-free operation are never compromised. But even more, our success is in our ability to help you to be successful, to provide the support that can help you to improve your operation not only today, but also for many years to come."

Methanex update

Our next speaker was **Shawn Harrington**, making his second appearance at the formaldehyde conferences as a representative of Methanex, the world's largest producer of methanol – *the* raw material for nearly all industrial formaldehyde production. Shawn gave an update on the most recent market trends and developments, noting that emerging energy uses (fuel blending and DME) now account for about one-eighth of global MeOH consumption.

Another significant trend is that China now accounts for over 10% of global MeOH demand, while at the same time having become a net exporter of MeOH, mainly derived from coal. "When the world market prices go up, China exports," claims Shawn. "But overall, the spot price of methanol is seldom below the energy value."

Shawn noted that the recent decline in biofuel could impact MeOH demand. Using corn to produce biofuel has been found to have an adverse effect on the world food situation, so food prices (plus the need for water and fertilizers) are changing public opinion about the alleged blessings of biofuel. This may lead to an increase in demand for MeOH to make DME in order to stretch gasoline – "like mixing in bread crumbs to make more hamburgers out of the same quantity of meat," says Shawn.

Regarding China, Shawn pointed out that while North American demand for MeOH is declining, Chinese demand is rising. He also observed that the main reason for China to use coal to make methanol is because of the high costs of transporting MeOH to meet the growing industrial demands of the interior. "But coal prices are rising in China, so their cheap source is disappearing," claims Shawn.

Finally, Shawn cautioned about expecting MeOH prices to fall. "Current prices are actually below cost on some markets, such as Europe. And the opening of a new methanol plant usually doesn't increase supply over demand, but only keeps pace with it. Moreover, LNG [liquid natural gas] continues to be a big competitor to methanol suppliers for the world's natural gas reserves."

HCHO update

The next speaker was a true veteran in the business – Scotland's own **Bob Crichton**, who announced that Asia now accounts for over 43% of world HCHO capacity (43 million MTPA 37% by year end). "The largest volume growth is China, where installed capacity is now more than 12 million MTPA, but in percentage terms, Russian growth is at the top, with the Middle East close behind."

Capacity utilization is slightly lower now (73%), yet the demand for new plants and upgrades remains at a high level. This is probably due to production costs driving the demand for greater plant efficiency.

Bob estimates that there are some 500 HCHO producers in the world today, with just 30 of them accounting for half the total capacity (see Top 10 table).

The breaks, as always, mean a time for networking, friendly conversation and, oh yes, coffee.

Top 10 HCHO producers by nameplate capacity MTPA 37% (2008)

1	Hexi1on
2	BASF
3	Dynea
4	Kronospan
5	Georgia Pacific
6	Arclin
7	Perstorp
8	Celanese
9	Metafrax
10	Jiantao Chemical

Regarding consumption, Bob claims that wood applications are still in the lead, but have lost ground slightly to chemicals, mainly due to the slowdown in the North American construction market – but not in China.

Rob

"In my last major trend review in 2002, I underestimated the rate at which panel products would penetrate the Chinese market, brought on by the rise in China's GDP," admits Bob. "Needless to say, this resulted in increased HCHO consumption, but as capacity has increased even faster, there is still overcapacity.

"In downstream chemical uses, polyacetal (POM) has made a comeback and is #1 at around 25%, mainly due to expansion in China. POM is followed by polyols, MDI and butanediol."

Bob has revised his HCHO consumption forecast upwards from his 2003 projection and now foresees an average growth rate to 2015 of 4.2% per year, with the bulk in Asia. "But we have a convoluted path ahead," cautions Bob, "with many peaks and troughs…."

FCI update

The last of the conference updates came from FCI (Formaldehyde Council, Inc.), with the presentation given by **Rob Schmidt** of Arclin. Rob, also a member of the FCI board, gave a review of FCI's activities in North America to provide a balanced look at formaldehyde – the balance being between science and emotion.

"The message being sent [by HCHO detractors] is that there is no safe threshold, a view that is simply not in line with science," says Rob, who also noted that the formaldehyde industry is in the unfortunate position of trying to prove a negative.

Those who are out to get formaldehyde – those who stand to benefit from a decline in the use of formaldehyde – include companies involved in soy technology. "They have big pockets and uses scare tactics," claims Rob. "And there's big money in it for lawyers!" [Editor's note: Readers interested in the details of FCI's work to establish a balanced view should visit the FCI website (www.formaldehyde.org) or the homepage of FCI's sister organization in Europe, FormaCare (www.formacare.org).]

New manual

Moving on to topics related to catalyst and plant operation, the next speaker was **Ronnie Ljungbäck**, who reviewed Perstorp Formox's new *Catalyst Operating Manual*, which will be distributed to each and every Perstorp Formox customer with the purchase of the next load. So what's new in the manual, and what's in it for you?

"Well, quite a lot, actually," says Ronnie. "Our old manual had become rather outdated and no longer adequately covered how to operate the catalyst in today's newer, more flexible plants. And it certainly did not describe our High Inlet CAP concept, which has become such a great success in recent years. But it doesn't stop there. The new manual also describes catalyst degradation as well as how to ensure good heat transfer."

In fact, the new manual has everything a manual should!

Lifetime science

The next presentation, by **Johan Holmberg**, took a scientific look at the catalyst, ageing mechanisms and the impact of various parameters on catalyst lifetime. This newsletter will not go into the scientific details, but Johan's conclusions should be mentioned.

"The loss of Mo can be decreased either by decreasing the MeOH inlet concentration or by increasing the oxygen content in the process gas," says Johan. "Note, however, that the economical aspects, desired production capacity, yields and losses, may dictate otherwise. The loss of Mo can also be decreased by operating the load at a low temperature, which is achieved by using a loading plan that has been optimized for the conditions of the particular reactor in question."

Speaking of optimized…

Ronnie Ljungbäck returned to the podium to pick up where Johan left off, talking about optimized catalyst operation. "From my point of view, the catalyst cycle starts when we receive a request from a customer or

In case you're wondering, the attendees didn't only talk – there was some time to eat too!

a potential customer, to offer that customer a catalyst system that will work fine for him or her," notes Ronnie.

"Optimal catalyst operation actually starts at the loading plan design phase," Ronnie emphasizes, "for which we need certain data about your reactor system, product specifications and production schedule. The right balance has to be found between catalyst lifetime and production capacity – criteria that are frequently in conflict with each other."

The next step is the pre-loading phase (preparing the reactor and plant), the actual loading (which must be accurate!) and then the catalyst operation itself, involving various ways and means of controlling temperatures, flows and pressures. Ronnie also pointed out the importance of feedback during operation, as well as during the unloading and recycling of spent catalyst.

The best buy

Next up was **Lars Andersson**, who scrutinized the topic of catalyst lifetime, distinguishing four (!) different definitions:

- the **guaranteed** lifetime – the lifetime that we as catalyst producers are able to guarantee;
- the **economical** lifetime – the point at which the production cost starts to increase too much;
- the **ultimate** lifetime – the longest lifetime that can be obtained with the equipment you have available;
- and the **optimum** lifetime – which is the question Lars focused on.

Lars examined the parameters involved as well as where the real costs are. Changes in catalyst price and/or power costs turn out to have only a very minor effect on the total cost of producing HCHO. "If you would like to minimize your formaldehyde cost, you should concentrate on activities to optimize the yield and to buy methanol at the lowest possible price – provided that you don't get a poor methanol quality that will cause you other problems, of course!" says Lars.

"Many producers already operate in this way, which they can easily do if they have built-in operating flexibility.

Ronnie

Lars

The cost curve is remarkably flat from 20 MT (37%)/kg catalyst and onwards, regardless of variations in methanol, power and catalyst costs. Indeed, it is a proof of the robustness of CAP high inlet loads that they can run with such good results all the way to the range SP25-30, if a somewhat reduced production capacity can be accepted towards the end of the catalyst life.

"But, as always, there is a downside; catalyst in a certain part of the tube can become overheated at the very end of the catalyst lifetime. This can make it very difficult to remove catalyst from the affected section of the tubes, extending the time required to empty and reload the plant and also making it more difficult to recover the molybdenum. And remember that sintered material cannot be recovered.

"So in real life it has more to do with your own circumstances for maintaining your business – your demand for product (how much production capacity you need), your maintenance requirements and even when your people take their vacations!"

A new approach – Tools Я Us!?

The final presentation of the action-packed first day of Formaldehyde Americas 2008 was a review by **Birgitta Marke** of Perstorp Formox's "upgrade toolbox". The toolbox comprises the various offerings for helping HCHO producers to make significant improvements – with only minor investment costs – in four areas:

- productivity
- energy optimization
- plant & yield optimization
- safety & environment

"You may already be familiar with many of the 'tools' from previous seminars, but they need to be seen in a new light, because they involve a really big change in the way Perstorp Formox proposes to operate," states Birgitta.

"As always, our aim is assist you to operate your plants at maximum efficiency – optimum yield, highest productivity and lowest energy consumption. But this doesn't mean that we need to be involved in the design details. Some of you have your own personnel or a local engineering company that knows your plant and local regulations better than we do. You may even be operating a different process!

"To cut a long story short, we have come to the conclusion that you are better served by our expertise in formaldehyde – our specific knowledge regarding all aspects of formaldehyde production and the process engineering aspects of the 'oxide process'. In other words, we are opening the door to supplying you certain basic process engineering packages, or 'tools', to apply at your plant in whatever way you chose!"

On one level, Perstorp Formox offers ideas, recommendations and guidelines for the customer to develop. The next level would involve supplying a

basic process engineering package. A slightly larger engineering scope would involve process engineering and a detailed engineering sample package, basically built on a Perstorp Formox design that could be modified to individual requirements. The "maximum scope" would involve delivery of the upgrading equipment and engineering.

"You could say that another word for our new way of assisting you is 'flexibility'," adds Birgitta. "The scope of our undertaking primarily depends on what you want from us!"

Formaldehyde producers wishing further details on this "toolbox" are welcome to contact Perstorp Formox.

DAY TWO
Plants & pricing

"The key feature of modern plants is flexibility!" After leading off Day 2 with that bold statement, **Bob Crichton** went on to remind the audience that giving HCHO producers the maximum flexibility has been the focus of Perstorp Formox design efforts for some years now. Bob also examined the variables that affect the cost of ownership, e.g. the price of stainless steel and equipment.

Bob

Bob showed how using a few standard sizes with flexible designs as a base has enabled Perstorp Formox to cover an extremely broad range of capacities. So can you still buy a customized plant? Certainly – but, as Bob pointed out, the problem would be the time and the cost.

"The market is very buoyant, to say the least," continues Bob, "and the cost per MT of capacity has not stabilized as we hoped, but has headed north at an alarming rate." Based on past history, Bob expects that further breakthroughs will provide the balance (see his separate article, page 9).

"In the meantime," concludes Bob, "we can be flexible about how and what we sell, as Birgitta said earlier [see above]. Maybe we can sell you a process package – perhaps you can engineer it quicker and buy it cheaper than we can. And the same applies across the range – a flexible approach for a flexible process. In fact, if you can build a plant cheaper, please do – and we'll help with the drawings!"

Hello, myself

The next speaker was the author of this article, **Stan Erisman**, putting in a rare appearance behind the lectern to talk about problems facing the formaldehyde industry in connection with undeserved attacks and negative publicity. Stan (it seems weird to write "Stan" about myself!) started by explaining the unusual word "paraleipsis", which basically means saying something by saying that you're not going to say it, e.g. a sentence that begins with "It goes without saying" and continues with what you've just said you wouldn't say. The rather oblique connection to formaldehyde, according to Stan, is that there are plenty of positive things to communicate about formaldehyde – but they don't go without saying; they need to be said!

"Good communication about formaldehyde should cover both the hazards and the risks, without exaggerating or downplaying either," claims Stan. "We know that formaldehyde is toxic. That is why we take so many safety precautions in connection with production.

"One can really wonder why some people are going to such lengths to disparage formaldehyde? Our daily lives are full of things where the risks are incredibly much greater. As far as I know, nobody's talking about removing electricity from people's homes. Yet it poses a far greater risk. Is it because formaldehyde is an easy target, easy to pick on? And is that because we're not communicating enough about how useful, versatile and important formaldehyde is?"

Stan *Stan*

[Editor's/Stan's/my note: For more on this subject, see the separate article on page 12.]

Catalyst classification

Johan Holmberg then spoke about changes in the MSDS (material safety data sheet) for catalyst, and the possible impact on the return of spent catalyst. "The changes are not due to any changes in the catalyst or its performance, but simply because of the more advanced testing methods we're now using, which have revealed the presence of molybdenum trioxide in the spent material."

Since MoO_3 is classed as an irritating and harmful substance according to current EU norms, one should avoid exposure to dust during unloading, to prevent inhalation. It is expected that MoO_3 will be reclassified in Carcinogenic Category 3 ("Limited evidence of carcinogenic effect") within the European Union. This is an issue that will be decided during the course of the ongoing REACH program.

Johan reminded listeners of the importance of returning spent material, as it helps to dampen the impact of world-market prices by keeping the Mo available as raw material, while also assuring environmentally safe processing.

Perstorp Formox does not foresee any changes in legislation relating to trans-border shipments. "But if you have any questions, or want our help or advice with classification matters, please feel free to contact us!" concludes Johan.

Blasts from the past

In the final presentation of the conference, **Birgitta Marke** dealt with safety issues, citing a couple of historical incidents and what was learned from them. "These seminars were started in the mid-80s due to an increased number of reactor failures taking place, and the purpose was to discuss and understand why they happened.

"Today we also discuss many other issues of importance to HCHO producers, but we retain the strong focus on safety. Telling others about incidents in your plant will be of benefit to them and, even details and plant designs differ, there is usually a lesson for all of us to learn!"

Birgitta noted that most "safety" issues are about damage to equipment, bursting rupture discs, etc, and

do not involve human or environmental safety. "Our focus on safety goes beyond health and environment to include the safety of your investment," concludes Birgitta.

The essence of Birgitta's safety message can be summarized in eight important reminders (see box).

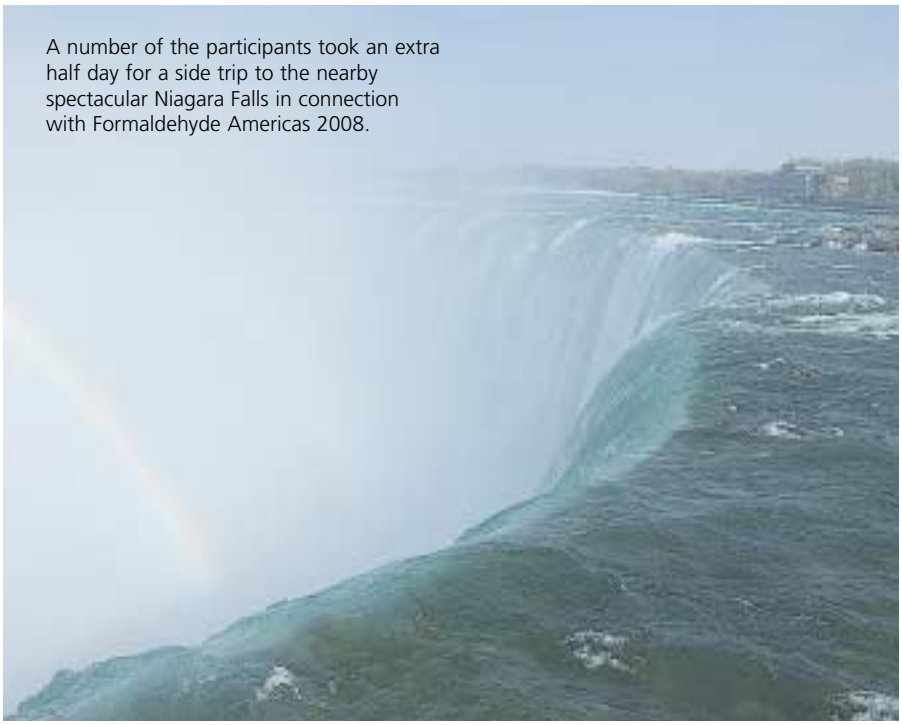
8 important safety reminders

1. Ensure that you have a sufficient HTF level in the reactor.
2. Inspect and clean your demister in the MeOH vaporizer regularly. Consider replacing it if heavily fouled.
3. Regularly test that the MeOH shut-off valve is leak-tight. Otherwise replace the seat.
4. Open the low point drain in the process gas line before the MeOH vaporizer, to drain accumulated liquid.
5. Consider – if not already in place – installing a non-return valve downstream of the recirculation blowers.
6. Regularly send your HTF for analysis by your supplier.
7. Ensure that you don't get HTF into the insulation.
8. Verify that the CO level is low enough and the oxygen high enough before entering process vessels or process areas where the natural ventilation is low.

Open discussion

Birgitta's talk was followed by an open forum on safety issues, including brief presentations by **Pieter Bos** (DuPont), **Henrik Hansson** (Perstorp Polyols), **Dave Pratt** (GEO) and **Scott Dubree** (Hexion), each sharing an incident at their respective plants. Among the other contributors to the discussion were **Dave Patrick** (Georgia-Pacific) and **Leigh Pollard** (Woodchem).

Many expressed their great appreciation for the opportunity to participate in such discussions, and everyone found the entire conference to be very worthwhile. The next chance will be in Sweden in the spring of 2009, when participants will also be invited to help celebrate the 50th anniversary of the world's first oxide plant, built in Perstorp in 1959. Don't miss it!



A number of the participants took an extra half day for a side trip to the nearby spectacular Niagara Falls in connection with Formaldehyde Americas 2008.

Training

In preparation for the start-ups of their respective new plants, a training group from Lucite (left) visited Sweden in April. In February we had a visit from another training group, this time representing a European client whose new plant is nearing completion. As we respect the right of our customers to preserve anonymity, we do not name this client.

Get the most out of your SPENT!


Eva

For years, Perstorp Formox has been offering to buy back spent catalyst from any and all customers. This offer has several clear benefits. One is that it keeps the molybdenum in circulation, i.e. the molybdenum from the spent catalyst can be recovered to make fresh catalyst. You not only receive credit for your molybdenum against your next catalyst purchase, but you help to dampen the effect of today's elevated raw material prices. Another is that you can get your ceramic rings washed and returned to you for about one-tenth of the cost of new rings! A third is that you don't have to worry about handling the waste material – we assure environmentally safe disposal of any material that cannot be reused.

In a perfect world, all of this win-win scenario would flow smoothly, and indeed it usually does. But sometimes there can be problems, so we spoke with **Eva Lindgren** and **Michael Svensson** at our catalyst plant about what kinds of problems might occur and what you as a customer should bear in mind in order to get the full value out of your returned spent catalyst.

What's the most important thing to think about?

"Keep it dry! From the moment you unload until it reaches us! This means unloading into drums and/or big-bags, then covering them immediately. Catalyst that stands unprotected in the rain will turn into big lumps that are not possible to recover – and for which you can't get compensation. It's money down the drain.

"If you are using big-bags, either make sure they can handle rain or that you store them well protected under a roof, well out of reach for rain and other moisture. And remember that snow is just as big a problem as rain.

"I should add that most of our customers are very careful about this, but it never hurts to get a little reminder of how important it is!"

What's the next biggest problem?

"Don't mix your spent molybdenum oxide catalyst with *anything* – including spent ECS catalyst! They must be kept separate. And when I say not with anything, I of course also mean no pens, no gloves, no cigarettes, no screwdrivers etc. We once found a plastic bag with a half-eaten hamburger.

"The basic principle is simple: The material you load into your reactor is what you should send back to us, absolutely nothing else. Again, most of our customers are very good about this, and we seldom have problems, but….

Any other points worth mentioning?

"Yes, there are. If you're using big-bags, see that you tie them securely. Also note that big-bags must have an emptying spout in the bottom. And please do not fill them with more than one ton of material – otherwise we can't lift them.

"If you're sending us back your spent in drums, be sure that the drums are properly secured inside the containers. Once in a great while we get back a container where the drums have shifted around in transport – maybe high seas? – and it's not a pretty sight when we open it! [See photo below].

"But I guess it all boils down to remembering that spent material should be treated like raw material, not waste. It has value for you and for us. We'd like to see you get the most value out of it!"


Mikael Svensson (left) and Daniel Larsson at our catalyst plant


Photo by Daniel Larsson

Another walk down memory lane

by Bob Crichton

Earlier this year I was clearing out one of my desk drawers; clearly not something I do a lot, as the papers that fell out related to one of the first Perstorp Formox plants I was involved with – back in 1979. These papers shocked me; not simply because I had held on to them for nearly 30 years, but because of the contents – and in particular the price paid in those days for such a relatively small plant. The investment cost per metric ton of capacity was in fact much the same as it is today!

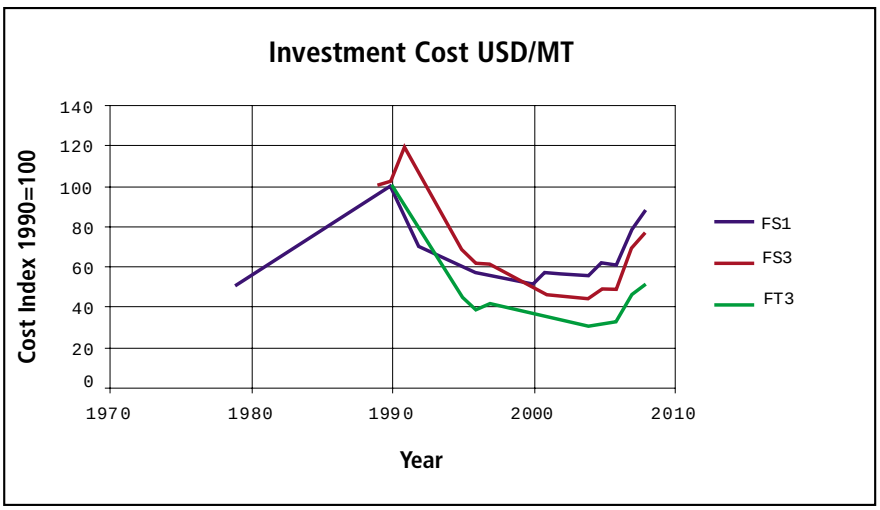
At that time I was working with a contracting company, and though we specialized in small projects, the engineering cost – the software – was a very significant part of the cost. Further, all plants were custom-engineered, so if the client wanted 32,535.5 MTPA, that is what he got. One figure on these dusty pages indicated 12,000 hours for detailed engineering – albeit for a twin-stream plant, fully detailed, including the structural steel. And this excluded the Perstorp Formox process engineering; in those days Perstorp Formox costs were covered by the licence agreement. The problem was that a large plant consumed almost as many hours as a small one, but it was a few years before we faced up to this issue. By then I was working closely with Perstorp Formox and a fabricator in Spain. It soon became clear that to reduce engineering hours, we would need to standardize designs. Further, we needed to standardize components – avoid designing a new reactor for every client. This process started back in 1989 but was not fully implemented until Perstorp Formox started to offer complete plants in 1992. My impression, looking back, was that the standardization process had significantly reduced costs and the fortuitous appearance of the first set of 30-year-old papers provided the incentive to look for evidence to support my instincts.

Finding the data was not easy – and reading it was almost as difficult. In those days, fax machines used thermal paper and the message faded with time. Fortunately there was enough of the message left to be able to extract the costs, and some of these data were used in the Toronto seminar (see earlier in this issue).

The full data set is shown here for two different reactor sizes: the small design (approx 8000 tubes) and the largest size (FS3). Also shown is the twin-stream FT3. These data represent the cost/MT (in US dollars of the day) with 1990 = 100. As you can see, my instincts were correct. Thanks to productivity improvements, both in the process itself and the way we worked, the specific cost – the cost per MT of capacity – fell steeply from the time the "standard" plant concept was fully implemented in 1992. Surprisingly, the larger the plant, the greater was the benefit. And in the ten years from 1995 to 2005, the cost was actually less than in 1979 – 2005 efficiency at 1979 prices! Imagine buying a 2005 Volvo at 1979 prices! And remember these data are in actual dollar terms! Taking into account inflation, the effect would be even more dramatic.

Since the start of the new millennium, however, the cost has not stabilized (as we had hoped), but has increased at an alarming rate – even higher than in the inflation-fuelled early 80s. We are now above the cost in 1980 – though we have yet to reach the peaks seen in 1990/91.

While it is some consolation that we are all in the same inflation-fuelled boat, Perstorp Formox is not complacent, procurement is now on a global basis and the next step is to look again at the fundamentals of the design – perhaps it is time for another leap forward, another productivity gain….



A wonderful week of
Refresher training

For one rainy week in March, Perstorp Formox held a refresher training course in Sweden for participants from companies from seven countries. The course, which was set up in response to a number of customer requests, gave a comprehensive review of just about everything involved in running a formaldehyde plant. Some of the participants were new at the job. Others were veterans who felt a bit rusty. And everyone seemed eager to learn how to do an even better job.

Part of the training took place in the "classroom", reviewing procedures and studying drawings. Another part was "on site" at the formaldehyde plants we have in Perstorp, Sweden. And still another part was for networking – discussing with people from other companies, sharing experiences – and having some fun. Here's what the participants had to say, in their own words:

Eelco de Visser, Du Pont, Netherlands
"A very informative week! I had a lot of time to ask my own questions about specific problems. The best part was being able to interact with others – sharing experiences, solving problems. It was fun and enjoyable!"

Kenneth Isaksson, Casco, Sweden
"It was great for me. I've been working with this for two years now, so I had a lot of new things to learn. Now I understand what they're talking about! And it was good to meet others from other companies and find out about how they do things."

Gary Owen, Synthite, Wales
"I work mostly with maintenance, but now I understand what the whole process is about. To me that's very rewarding. I got to see new developments, and can bring back some new ideas about upgrades. It was also great to meet new people and share experiences – fantastic! That's the way to do it! The staff are fantastic and even the entertainment arrangements were very good!"

Steve Windsor, Synthite, Wales
"I've been operating a formaldehyde plant for 10 years and thought I knew it all, but I've learned so much this week! The trouble-shooting parts were very impressive. It was a nice atmosphere, good people, not too formal. Very well organized!"

Mark Homersley, Synthite, Wales
"With all that I've learned this week, I definitely feel more confident. I've had the time to ask all my questions and have learned a lot about what's behind the scenes. It was also great sharing ideas with others and hearing about their problems – and solutions!"

Chris Hearn, Synthite, Wales
"An excellent week! I've just started at the plant back home, so it was particularly important for me to learn about the start-up and shut-down procedures. The teaching was excellent, and it was interesting to meet the others and get a good understanding of a broader market."

Jean-Pierre Heinis, QAFCO, Qatar
"I've enjoyed the direct connections with Perstorp Formox and other companies. It's given me a lot of valuable information, and we will definitely benefit from this. I've got good answers to all my questions. There's been a good balance between lessons and discussions, and the new information will help us to prevent problems and achieve stable operations. So now we can focus on getting better yield – which is important for everybody!"

Rodrigo Lourenço, Euroresinas, Portugal
"This week has exceeded all my expectations! It covered all of the important issues from my perspective. I got the opportunity to discuss with others, swap experiences and to meet more Perstorp Formox people. There was a well-tailored level of detail and good topics that covered everything. And nice people!
"I strongly recommend this refresher training to all formaldehyde plant production managers!"

Khalid Mohd A Mohd, QAFCO, Qatar
"It was a good course! Good trouble-shooting and problem-solving, good chances to ask questions and communicate with people from other companies, thanks to the dinners and activities. But there wasn't enough time for shopping! Seriously, I really appreciated all of the arrangements, and the activities have made a very good break from the lessons!"

Vyas Nath Tripathi, QAFCO, Qatar
"Very good. I've got better information about our plant and how to solve problems. What I've leaned will help the performance of our plant. And the arrangements were excellent."

Sandarina Amaral, Euroresinas, Portugal
"It was quite a good week for me. I've been listening and learning, and I can definitely take back what I've learned to 'real life'. I feel more confident in my work now, and can put into practice what I've learned. It was good to meet people from other companies too. Even though we're not all very trained in English, we can communicate. There's been a good balance between learning and activities, and the Perstorp Formox people have been very welcoming and explain things well."

Mario Agüero, Perstorp S.A., Chile
"It was a very good week and I've learned a lot that I can use back home. It's been great to meet other people and get answers to my questions. A good atmosphere!"

Vitold Mishtal, spokesman for a six-man delegation from Metafrax, Russia
"We liked everything! It's very clear that Perstorp Formox takes training seriously and has prepared well. We also liked meeting people from other companies, so we could discuss thing both with Perstorp Formox and from other companies around the world, and learn how others do things. We feel more confident now, so this has been very useful. Perstorp Formox is about the only supplier we know who does this kind of training. We got to ask our questions here, but of course we can always ask Perstorp Formox – we have close cooperation. And we always get good answers!"

If there are people at your company who might be interested in refresher training, please inform your Perstorp Formox representative. When we get enough to make a course, we'll set one up!

Online
CO measurement
by Birgitta Marke

Using an IR (infrared) analyzer to measure the carbon monoxide content in your recycle gas is an easy way to find out more about what's going on in your reactor – and whether you should increase or decrease the reactor temperature. Could you benefit from having such an instrument? Yes, especially if you have a single-line plant, and even more so if your plant produces UFC (urea formaldehyde concentrate).

Why single-line plants? Because the CO content is best measured in the recycle gas line, and in a single-line plant, you are only measuring the CO from one reactor, so you get a clear and accurate picture. In a multi-reactor plant you would be measuring the combined CO content from all reactors. Although it would still be useful as guidance, you wouldn't get the current conditions for each of the reactors. You would then need a GC (gas chromatograph) to measure the individual losses from each reactor system, but the cost would be considerably higher – both the investment and the operational cost.

Why UFC plants? Well, basically because the CO content would be a hands-on measurement. Measuring the methanol in the UFC product (the conventional method) is not a good indication of the reactor conditions because the level does not change very much, regardless of the methanol loss over the reactor. The methanol content in the condensate varies more, but is still not as good an indicator as the methanol in formaldehyde product.

Another advantage of an IR analyzer is that the signal can be connected to the DCS so that the CO content can be monitored online from the control room. You can trend it on the DCS screen and follow it live. The instrument can also measure CO_2 concentration, which can be good for determining when to recatalyze, since the CO_2 content generally increases rapidly at the end of the catalyst run.

Last but not least, the IR analyzer can be combined with a paramagnetic oxygen analyzer at a very low additional cost. You can thus kill three birds with one stone – you get CO, CO_2 and oxygen measurement all with one instrument. This is worth remembering for those of you who need to replace your oxygen analyzer!

For further details, or to place your order, simply contact your Perstorp Formox representative.

P.S. I would like to take this opportunity to thank all of our customers and contacts over the many years I have been with Perstorp Formox. I've decided to try my hand at something else in a new field now, but I really have mixed feelings about leaving such a fantastic team and so many wonderful people out there in the wide world of formaldehyde. Wish me luck, as I wish you. Perhaps we'll meet again some day!

Birgitta

It makes one wonder...

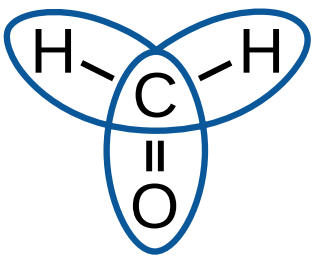
An essay by Stan Erisman, editor

More than 30 years ago, when I was looking at a display of cards with humorous messages, one in particular stuck out at me from the rest: "My mind is made up – don't confuse me with facts." At first it sounded very funny, but the more I thought of it, the more sad-but-true it seemed. I don't believe I've ever heard a better formulation of what scientific thinking is not.

The fundamental principle of science is total open-mindedness, looking at all the evidence, challenging one's own hypotheses, trying to find new information that will require revisions of old "truths". But this does not mean that all scientists act scientifically! Perhaps this is why I reacted so strongly to a recent article by Elaine Burridge in the trade journal *ICIS Chemical Business*, in which she quotes an IARC spokesman:

> "Indeed, a 2007 study by the University of Pittsburgh concluded that the excess mortality rate from nasopharyngeal cancer [NPC] at the plant may have been caused by other sources and not exposure to formaldehyde.
>
> "'It is expected that the industry will cast doubts, but scientifically, I do not find it legitimate,' comments Dr. Nicolas Gaudin, chief of communications at the IARC. Gaudin's view…is that the 'debate is closed' and adds that he has 'never seen a group one classification reversed.'"

This clear paraphrase of "My mind is made up – don't confuse with facts" is all the more frightening coming from someone representing an organization whose "scientific" decisions can have such a huge and potentially devastating impact on an entire industry. It makes one wonder what's going on behind the scenes! Who is bad-mouthing formaldehyde and why? Who stands to benefit? Certainly not the general public!



Easy target?

On one hand, you could say that formaldehyde is an easy target. Hey, the stuff's toxic! But chlorine gas is toxic too, and nobody's banning salt (in which half of the atoms are chlorine). Nobody's suggesting getting rid of all the electricity in people's homes, despite the many fatalities each year from electrocution or electrical fires. Ban water? Why not, people drown in it, so you can't prove that it's safe. Ban motor vehicles? Huge number of fatalities there! Why not just ban everything? Then there would be no more causes of death – except we'd have to ban ourselves as well. (There was a recent study purporting to show that the amount of formaldehyde in the air we exhale is greater that some of the new proposed limit values, which might mean that we would no longer be allowed to exhale. That would pretty much do the trick of banning ourselves!)

The reclassification of formaldehyde might be understandable if it there had been irrefutable evidence to warrant it. That, however, does not seem to be the case.

Proving negatives

Instead, the formaldehyde industry has been placed in the nearly impossible position of trying to prove negatives. Somebody comes up with the brilliant idea that formaldehyde causes NPC. The formaldehyde industry has to spend tons of money to prove how very unlikely that is. So they switch to leukemia. Again, the industry has to spend a lot to prove that there is not a connection. What about ALS? Surely formaldehyde must be horrible in some way?!

My own theory is that the mentioning of the word "formaldehyde" can demonstrably be said to have a toxic effect on the ability of some people to think rationally or to report truth.

Dirty tricks

There are plenty of dirty tricks used by unscrupulous people to influence others. Consider this example. If you claim that a product is "syzthkol-free", you create the impression that whatever "syzthkol" is, it must be bad, and that the product in question is the better for not having any "syzthkol" in it. That is what is happening with formaldehyde. Most people outside our business don't understand formaldehyde very well, so when products are labeled "formaldehyde-free", the general public assumes that's good, isn't it?

Obliging people to prove negatives is also a dirty trick. Telling people that substitutes are better – without telling them they may be more dangerous, more expensive and more environmentally hazardous, and that there may not even be any substitutes – is another dirty trick. And getting people to believe that you can ban one of the most useful chemical building blocks known to man, a chemical that occurs naturally in all living things, and that banning it won't have a hugely destructive impact on their economy and way of life is one of the dirtiest tricks of all.

Call to action

It's time for everyone in the formaldehyde-related industry to blow the whistle on dirty tricks and ignorance. We can do this by responsible actions to inform the public and our lawmakers of the tremendous value and benefits of formaldehyde. We can do this by supporting the scientific and communications efforts of the two sister organizations that represent these interests: FormaCare (in Europe) and FCI (in North America). You can join either of these two no matter where in the world you are located.

Join now! FormaCare (www.formacare.org) and FCI (www.formaldehyde.org) need your support. First get more facts – **then** make up your mind!!

The financial IMPACT

Report on a FormaCare-sponsored study

Ron

FormaCare's Detlev Clajus and Lars-Erik Johansson in the cockpit of the Concorde

Last year, FormaCare commissioned a study on the financial impact of discontinuing formaldehyde production in Europe. Led by **Ron Whitfield** of Global Insight (USA) Inc, the study demonstrated that the cost to society would be staggering. The results were presented at a press conference in Weybridge, England in January. The press conference was held onboard a Concorde airliner! (OK, it was on the ground.)

Global Insight's research focused on the contributions of the formaldehyde-based industry to the economies of the EU and Norway. It noted that such contributions occur in four main areas where HCHO is used as a chemical building block: the construction industry, the motor vehicle industry, the aircraft industry and in healthcare applications.

Posing the question "What would be the costs to the consumers if they were forced to switch to substitute products that are not based on formaldehyde?", the study took a hard look at the consumer benefits. Also taken into consideration were the direct economic contributions of the industries involved in producing and using formaldehyde, in terms of employment and investments.

Astounding results

The findings of Global Insight's research were simply astounding. Formaldehyde contributes some €330 billion (about half a trillion dollars) to the economy. And that's just in the EU (and Norway). Over 1.7 million jobs would be directly affected, as more than 20,000 plants in the EU alone are dependent on formaldehyde. And European consumers would have to pay some €30 billion (about $45 billion) more for products made from substitutes.

The question was raised at the press conference whether all of those 1.7 million jobs would really be lost, or whether people would not simply go to work on other things? Ron claimed that many jobs would indeed be lost outright.

You could have a scenario like this. Formaldehyde could no longer be produced in Europe. Products containing HCHO would be banned – even if they didn't emit any, i.e. if the HCHO used in the manufacturing process had completely reacted into other substances. But such products could be imported. So jobs would be lost locally. In the event of an EU-wide ban, for example, jobs would be lost within the EU, and the trade deficit would soar.

Also astounding is the number of applications of formaldehyde used (safely!) by consumers in everyday life in so many areas: in the home, in cars, in planes etc. Another question arose at the press conference about whether substitutes would be an improvement?

Ron emphatically pointed out that in almost every case, using a substitute for formaldehyde would mean a higher price and lower quality – and that for many products there are simply no substitutes to be found!

What it means

Another question arose about environmental impact. Since HCHO is so reactive, it breaks down very quickly and has no long-term environmental impact at all. The impact of possible substitutes, however, is not always known, but would certainly not be less than nothing. (Although readers of ***informally speaking*** don't have the opportunity to go back in time and attend the press conference like your editor did, you can get access to Ron's report via the FormaCare website.) Would any society on earth really want to shoot itself in the foot by banning one of its most useful building blocks?

10 facts worth pointing out about formaldehyde

- The human body produces formaldehyde. It is essential for metabolism.
- It is not exposure that is hazardous, but concentration.
- Formaldehyde provides its own warning before hazardous levels are reached.
- Regardless of the hazard level (the theoretical danger), the risk level (the practical danger) is very low.
- Formaldehyde must always be treated with the greatest caution and care.
- The global formaldehyde industry has an outstanding track record of safety.
- Formaldehyde is a simple, natural molecule that is one of the most useful chemical building blocks known to man.
- Products made through substitution are almost always more costly and of much lower quality.
- Formaldehyde is not hazardous to the environment. The impact of possible substitutes, however, is not known.
- Formaldehyde offers numerous benefits to society – and even to human health.

Modeling

– a key to optimized loading plans

by Johan Holmberg

The key to loading plan design and development is to understand how to make meaningful calculations on data. In most cases these calculations are too complex to do manually or using a calculator, so it is necessary to use software. For a simulation tool to be useful, it must be able to rather exactly predict the outcome in full scale. That's why it's important to create a model that perfectly describes a full-scale reactor under actual reaction conditions. In other words, the problem must be well-defined, i.e. all conditions and constraints must be known.

The software we're using is called Catlab, which is specially designed for our conditions and requirements. But even though simulation programs are valuable tools, using them properly requires a great deal of experience.

What is a model?

A model is a way to describe the full scale, i.e. it's not an image but rather a description or prediction of the full scale. There are two basic types of models – empirical and mathematical – either of which can be simple or complex. They consist of one or many equations, used either individually or in combination.

A simple model may be useful for making an estimate, to which you add a safety margin, but the usefulness of such models is limited by their very limited range and poor correlation to the mechanisms involved. When a high degree of constraints are present, mathematical models are preferred, based on various degrees of assumptions and simplifications. Also for such models, a simple one is often only valid within a limited range.

For more complex tasks, e.g. obtaining a loading plan, an estimate is not good enough, since adding a safety margin is not possible in order to achieve optimal performance. In such cases, more accurate and sophisticated models must be used.

Most of the models we are using involve advanced equations that have proven to be valid in experiments. For obvious reasons it is important to create a model that will be valid for the entire span of reactor systems and conditions. Generally speaking, we have found that the greater the number of equations, the more complex the model is – and the higher the quality of the results.

Nice & easy

In doing simulations (compared to making pilot-tests), you can test a great number of loading plans every time you are going to design a loading plan. The simulation software used is based on a huge number of experiments made in the past, which is why the results are associated with a very low degree of experimental error. Other advantages are that you don't have to wait long for an answer when optimizing a loading plan, and you can very quickly and easily make reliable predictions regarding the loading heights on a centimeter scale.

Software design

Three major issues have to be taken into consideration when designing the model: the heat transfer, the mass transfer and the reaction. Choosing the appropriate methods and equations is often the key to the accuracy of the simulation results, i.e. creating a model is a matter of taking the appropriate equations and obtaining all constants present.

The reactions and reaction rates (including the constants) must be stated. The latter mostly depend on temperature and surface coverage, which in turn depends on the partial pressures of the elements present, adsorption and desorption phenomena. That, however, is usually the easy part – compared to defining the heat and mass transfer mechanisms.

The mass transfer can be separated into two categories: the gas flow outside and the diffusion inside the catalytic material. The greatest challenge is to create a model that is valid not only for the great span of reactor types, catalyst types, temperatures, flows and partial pressures present, since very small differences might have a great impact not only on the flow distribution but also on the temperature profiles. Since the reactions taking place are highly exothermic, great effort has to be made to create robust models for the heat transfer. Basically, heat is generated inside the catalyst rings and is transferred via convection, conduction or radiation to the HTF medium (oil

Projects & start-ups

This column seems to grow with every issue. This time we have no fewer than 18 projects to report on. But who's complaining?!

New projects

- **Duratex S.A.** has signed up for a formaldehyde and resin plant to be installed in Sao Paulo state, Brazil.
- **Foresa**, located in Caldas de Reis, Spain, will be adding an ECS to one of their existing plants.
- **Qafco** will increase capacity with a new FS1 UFC plant for their site in Mesaieed, Qatar.
- We have recently agreed terms for the licensing of our technology, together with a basic engineering package, for a new plant to be constructed for **Injaz Projects** in Saudi Arabia. This will be our second licensed plant in Al Jubail and will represent a considerable increase in the installed capacity in the Gulf region using the Perstorp Formox process.

Ongoing projects

- Work on a new FS3 plant for a client in Europe is nearing completion and is expected to be started during this summer.
- The new plant for **Lucite International** in Singapore is approaching mechanical completion, with commissioning expected late this summer. The trainees were in Sweden in April (see photo, page 7).
- The project for **Karbodyn** (the joint venture between **Metafrax** and **Dynea**) is due for the start of installation this summer.
- The new FS2.5 plant for **Shaanxi BDO** in Weinan, China is now in the shipping phase.

or salt solution), mostly via the gas but also directly due to rings being in direct contact with each other and the tube wall.

It is then of utmost importance to continuously review and update the equations and constants, to match the latest findings and expertise. This means constantly experimenting in order to be able to verify and fine-tune the postulated mechanisms. The latest edition of the simulation software we are using has, of course, the latest updated set of equations and constants.

Accuracy essential

The outcome of the simulations should be expected yield, losses, pressure drops and temperature profiles. Taking into consideration the importance of correct loading plans, the accuracy must be very high. As the inlet concentration of methanol, pressure and flow rates are increasing, an even higher degree of accuracy is needed. Basically, the greater the demand for obtaining fully optimized solutions, the greater is the need for experience when interpreting and designing simulations. This experience must include taking a loading plan from simulation to full scale, while being aware of the complications and possibilities present.

Our long experience and many hours of pilot and full-scale testing have enabled us to develop a fine-tuned model. Please contact your Perstorp Formox representative for an update on how we have designed and on how we continuously monitor your loading plans.

- Also running on schedule is the FS2.5 plant for **Yunnan Yunwei** in Zhanyi, China.
- The project for **Formosa Plastics** of Taiwan is on schedule, now having entered the procurement phase.
- Construction of the plant for **Nafta Petrochem** in Lendava, Slovenia, was officially launched with a "Groundstone Ceremony" in May (see pictures).
- A major project for another European licensee, previously announced, is running on schedule.

Start-ups

In the last issue of ***informally speaking***, we mentioned three projects that were expected to go on stream at the time of publication. We would like to confirm that these three did indeed start on schedule:

- **Ningbo Wanhua** started in November in China.
- **Togliattiazot** also started in November, in Russia.
- **Alto Paraná** (which was formerly called Faplac) went on stream in mid-December in Argentina.

And this year we have three start-ups to report so far:

- **SK Petrochemical** in South Korea started in February.
- The big dual plant for **Xinjiang Markor** went on stream in China in late March.
- The FT3 plant for **Yunnan Yuntianhua** is expected to start at about the time this issue of ***informally speaking*** is distributed, in June.

Far left: The Groundstone is unveiled by Slovenia's Finance Minister Andrej Vizjak and Nafta President Mirko Horvat.
Middle: Local kids plant a tree on the site to symbolize the eco-friendly feature of the process.
Right: Lars Andersson and Erik Timander flank Perstorp Formox's rep in Slovenia, Bojan Zadnik.

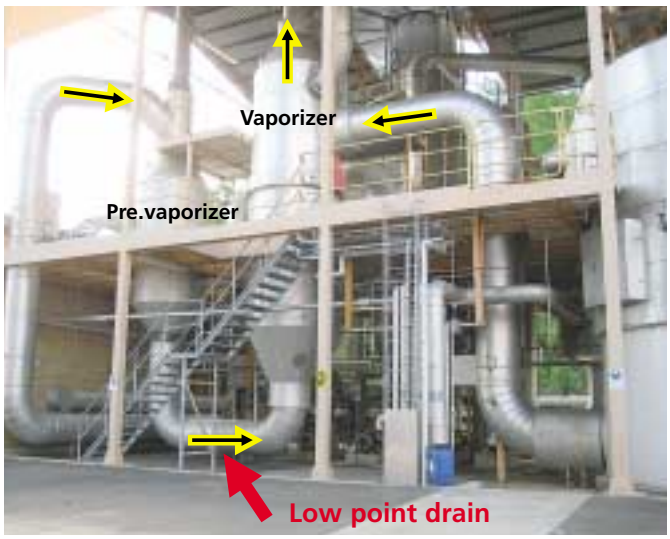
Check your MeOH valves

by Anna Wemby Björk

Methanol is, like many other alcohols, toxic and highly flammable. There is also a risk of an explosion, depending on the methanol/air ratio. All the vessels in a Perstorp Formox plant that involve any risk of explosion are equipped with rupture discs and are designed to withstand the higher pressure of an explosion. The safety system will immediately shut down the plant before it enters into an unsafe operating area.

However, when a formaldehyde plant trips or is shut down, there is a risk that methanol is accumulated in the low points if the blowers have not been running long enough at shut-down to completely blow out the system. It is therefore our recommendation that all low point drains in the plant after introducing methanol up to the reactor should be open after a blower trip or shutdown. This check should be added to your shut-down procedure. Consequently, the start-up procedure should be updated to include that the low-point drains must be closed before the blowers/fans are started.

At each shutdown it is also important to check that the methanol safety valve (after the methanol control valve) closes completely and that no methanol can leak through it into the process.



We thus have the following recommendations to you:

- Add to your shut-down procedures that all low point drains in the plant (from the point where methanol is introduced and all the way to the reactor) should be open after a blower trip or a shutdown.
- Add to the start-up procedure that all low-point drains in the plant must be closed before the blowers/fans are started.
- Add the methanol safety valve to your maintenance program. It should be tested for leakage or other damage at least once per year (for example at every catalyst change).

Faces & Places

The biggest news in our team is at the top: **Marie Grönborg** has taken over from **Mikael Ekblad** as General Manager of Perstorp Formox. Mikael has moved on to a position within operations management for the Perstorp Group. Good luck, Mikael!

Other changes since the last issue of ***informally speaking***:

- **Eva-Lena Ekblad** (no relation to Mikael) and **Michel Bellais** have joined our team of process engineers. Eva-Lena has a degree in chemical engineering from the Lund Institute of Technology and has previously worked for Prikon, a consultant company in the field of environment and safety. Michel has a Ph.D. in chemical engineering from the Royal Institute of Technology, Stockholm. He comes from a position as an R&D engineer within the Perstorp Group.
- **Jennifer Wu** is the new commercial manager for our operations in Beijing.
- **Ronny Lindström** has become a full-fledged member of the Perstorp Formox team, but is not exactly new. An instrumentation engineer, Ronny has been helping us as a consultant on numerous projects for over 15 years.
- **Andreas Blomqvist**, **Jonny Hult** and **Anna Nilsson** have all moved on to jobs at ABB, Alfa-Laval and AAK, respectively. We wish them all the best for the future!

Marie takes the helm!

Eva-Lena

Michel

Jennifer

Ronny

Seminar news

The next round of formaldehyde conferences hosted by Perstorp Formox is planned as follows:

- **Formaldehyde Europe 2009** – This special conference will be held in Sweden next spring. Why "special"? Because in addition to the usual full program, we will also use the occasion to celebrate the 50th anniversary of the start-up of world's first plant built with oxide technology, also making it the 50th birthday of Perstorp Formox. We hope you'll be able to celebrate with us!
- **Formaldehyde Asia 2010** – The exact time and venue have not yet been decided, but it is likely to be in the early part of the year and somewhere in South East Asia. Information will be announced in this box and in a future issue of ***informally speaking.***
- **Formaldehyde Americas 2011** – We just finished a great conference in Toronto (see pages 1-7) in late April, so those of you who like to plan far ahead can expect something somewhere around that time again in 2011. We'll be in touch!

Also refer to our website (www.formaldehyde.com) for further details!

informally speaking

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

Perstorp Formox
SE-284 80 Perstorp, Sweden
Phone: +46 435 38 000
Fax: +46 435 388 90
E-mail: formox@perstorp.com

Editor: Stan Erisman
Publisher: Marie Grönborg

Perstorp Formox

Layout: Gösta Mårtensson
Printer: Perstorps Tryckeri