A formaldehyde magazine from Formox

# INFORMALLY SPEAKING

autumn/winter 2012



## Formaldehyde, Formox and the wood industry

# Adjusting to the **"new normal"**

As I am writing this, I am again reminded of the harsh reality facing the Eurozone and the ripple effects this is having on the rest of the world. The various measures taken by governments in the affected economies to improve the fiscal debt situation are taking their toll on consumer spending, and are likely to do so for a significant period of time. After a decent first half of the year, business activity has decreased in the autumn, and the chemical industry again has to accept that the return to pre-crisis levels is still far away. Uncertainty about the development of the Chinese economy is still looming, despite the massive infrastructure package announced by the government in September.

But chemical companies have already adjusted to this "new normal" and bright spots can be found when looking ahead. A recent survey by KPMG on the outlook of the chemical industry* indicates that the macroeconomic environment is more of a worry for executives this year than last, and companies are to a somewhat lesser degree expecting revenues to rise next year in comparison with earlier polls. Despite this, nearly two thirds of all executives plan to increase capital spending over the next year. For the second year in a row, Asian executives were most bullish about capital spending with 81 percent expecting an increase.

We believe that this also is valid for the Formaldehyde industry. 2012 has continued to be a strong year when it comes to formaldehyde capacity expansion, and we are thankful that customers continue to see Formox as a preferred supplier when expanding capacity as well as for catalyst reloading, as was clearly shown in this year´s customer satisfactions survey.

### Thank you Marie

After many years within Formox, Marie Grönborg has decided to move on to new challenges within the Perstorp group. As a consequence, I have been asked to step in as General Manager, gradually taking over her responsibilities during the autumn. I would like to personally thank Marie for her significant contributions towards the success of Formox and I wish her all the best in her new endeavors.

Formox was recently announced winner of the "Innovative Energy Use Award 2012" awarded by Cheminnovations Advisory Committee and the Chemical Engineering Editors for the implementation of the turbocharger concept in formaldehyde plants. This innovation is attracting a lot of interest from both old and new customers and is a good example of how we continue to improver the Formox process.

I would also like to take the opportunity to inform you about the upcoming conference Formaldehyde Asia 2013. Formaldehyde Europe 2012 was a success and I have high hopes that the next conference will provide you with process/technology eye-openers and ample networking opportunities. The venue this time is Thailand.

Best wishes for the holiday season and see you in Thailand in March 2013!

*KPMG's 2012 Chemical Industry Pulse Survey, October 2012

Mårten Olausson
*General Manager*
*Formox AB*

## CONTENT



## Formaldehyde Asia 2013

Next year´s Formaldehyde conference will be held in Bangkok, Thailand on March 11-14. The conference will start with a welcome reception on the evening of March 11th followed by the first day with a common agenda for all participants. On the second day we will offer two options for the participants, one with more in-depth technical discussions and one with a more general agenda. On the last and third day the agenda will focus on practical plant operation.

We'll be sending out invitations soon. Should you need more information beforehand, please contact your Formox representative.

# Formox put **focus on Turkey** - the fastest growing market in the OECD

In June Formox hosted a one-day conference in Istanbul for our customers and prospective customers in Turkey.

Participants at the conference represented the following companies: BAKS, Çamsan, Kastamonu Entegre, MKS Marmara, Polisan and Yildiz Sunta. Formox was represented by Lars-Olle, Lars, Ronnie and Fredrik. Our agent in Turkey, Intra, was represented by Yusuf Bahar and Hasan Gökman

Almost all formaldehyde in Turkey is produced by the oxide process where Formox supplies more than half of the catalyst demand. Turkey represents a market with potential for significant growth in the wood segment. The conference was very well received by all participants and most of the Turkish formaldehyde producers were present. The venue was the Suadiye Hotel on the Asian side of Istanbul.

The focus was on presenting and discussing the Formox product portfolio and the benefits offered with Formox's unique technology, catalyst and technical support package. Areas such as formaldehyde and methanol market updates and formaldehyde in society were also covered. Other areas of great interest were energy optimization where Formox presented the new and unique turbocharger application that enables cutting production energy cost by 35%.

The Turkish formaldehyde market is dominated by the wood sector and today Turkey is one of the most expansive countries for board manufacturing. The two main players, Kastamonu Entegre and Yildiz Entegre, are both on the European top ten list regarding manufacturing capacity.

Housing and construction are two vital drivers in Turkey's fast-growing economy

## Strong Turkish Economy

The Turkish economy has performed outstandingly well with a stable growth rate over the last decade and the main engines have been the housing and construction sectors, both experiencing better than 16% growth over the last year. The Turkish economy seems to be stable against economic turbulence that may come from outside, a strong banking system and a low budget deficit.

Besides the young and growing population, the remarkable growth within the housing and construction sectors depends certainly on a variety of reasons. The large earthquake at the end of the nineties as well as structural reforms, hastened by Turkey's EU accession process, have contributed strongly to delays in addressing demand. Over the last five years, however, a strong effort has been made to meet demand.

While many economies have been unable to recover from the recent global financial recession, the Turkish economy expanded by 9.2 percent in 2010, and 8.5 percent in 2011, thus standing out as the fastest growing economy in Europe, and one of the fastest growing economies in the world.

Strong improvements within a short period of time have registered Turkey on the world economic scale as an exceptional emerging economy, the 16th largest economy in the world, and the 5th largest economy among the countries in the European zone.

BY

*Lars-Olle Andersson*
*Business Manager*
*Formox AB*

# Formaldehyde, Formox and

Regular readers will know that the wood industry consumes around half of all formaldehyde - so in this issue we shall take a closer look at the composite panel industry and speculate about its future.

## Why Composite Panels?

A good question; why grind, chip or slice wood only to stick it back together again? The answer is to make the best use of available resources; by this means even waste wood can be used to make large panels, moreover with predictable properties. It is not an exaggeration to say that without the availability of structurally reliable panels the modern furniture industry would simply not have happened.

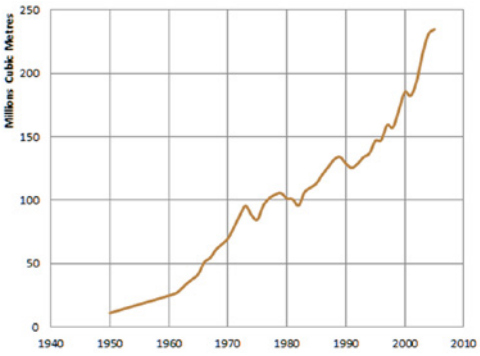
The ancient Egyptians were first; veneers of imported "exotic" timbers were used to cover poorer quality indigenous material. But it was not until the early 20th century that veneers were assembled one on top of the other to form rigid sheets – a material that came to be known as plywood. This "new" product, however, used a similar protein based adhesive to that used in Egypt. This all changed in the 30s when urea formaldehyde (UF) adhesives entered the market. These not only improved plywood properties, they hastened the development of other panels, notably particleboard whose advance had been curtailed by lack of a suitable binder. Continued improvement in resin systems and pressing techniques led to waferboard (the precursor of OSB) and MDF. And OSB is a particularly interesting material in the context of the question posed in the paragraph heading; by orientating flakes of wood from a fast growing "weed" species (aspen) it was possible to create a strong structural panel competitive with plywood.

But synthetic binders did not become fully competitive until first coal and then oil and gas based urea and methanol became available. UF and its derivatives went on to dominate the wood adhesives market. As there is no commercially viable alternative, this situation is likely to continue for the foreseeable future.

## Growth of the Industry

Panel production (Fig 1) increased from 11 million cubic metres in 1950 to 230 million today. Initially growth was slow - the construction and furniture industries tend to be conservative when it comes to adopting new methods or new materials. In addition early products had a "utility" image and met with some consumer resistance. Quality issues did not help and the bad publicity generated by formaldehyde health issues is still with us over 40 years later.

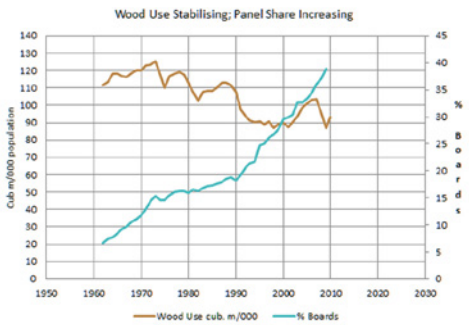
**Fig 1. Development of Board Production**




The industry took off in the mid 60s and after a quieter phase in the 80s, boomed in the 90s. A shortage of quality timber forced substitution and market penetration increased; eventually even traditional industries came to accept that panel products offered more reliable performance – at lower cost.

Originally growth was driven by substitution (Fig 2); falling per capita wood use (due to competition from other materials) was more than compensated by a switch from "real" wood to panels; the share of wood represented by panels increased. Around 1990 market penetration (% boards) accelerated sharply - above the substitution trend. By the mid 90s wood use had stabilized.

**Fig 2. Development of Board Production**




The reason why was touched upon in an earlier article, namely that in many regions of the world, wood is not a traditional material. There is very little wood to replace; panels are driving wood consumption. So much so that in the medium term global wood consumption may even start to rise. In such regions growth is fuelled by a rise in living standards; the market for consumer goods in general (and panel products in particular) is expanding.

## What types of panel will be in demand?

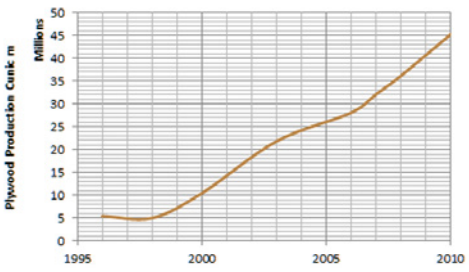
Generally speaking structural panels (plywood and OSB) compete with each other, as do particleboard and MDF. And the current distribution of panel capacity (in volume terms) between these two groups is as shown in Table 1.

| Table 1 | | % of region | |
|---|---|---|---|
| **REGION** | % of total | MDF+PB | Ply+OSB |
| Africa | 1.2 | 78 | 22 |
| Asia | 47.8 | 47 | 53 |
| Australasia | 1.0 | 83 | 17 |
| Europe | 22.8 | 86 | 14 |
| Middle East | 0.7 | 90 | 10 |
| North America | 15.1 | 27 | 73 |
| Russia | 4.8 | 79 | 21 |
| South America | 6.6 | 76 | 24 |
| World Average | | 57 | 43 |

Plywood dominates the structural category and most of this capacity is in Asia and North America. In the latter it reflects the extensive use of structural wood in house building. S.E.Asia also had access to large old growth trees and as plywood is relatively easy to make and transport, a large export industry developed. But environmental pressure reduced the availability of old growth material. In North America OSB provided a solution but in Indonesia plywood production fell dramatically. This has been compensated in recent years by the almost exponential rise in plywood production in China (Fig 3); exports from China have increased to match. Low labour costs may explain the rise - plywood production can be labour intensive; however, plywood is relatively wasteful of a high value natural resource; production depends on

# the WOOD industry

**Fig 3. Plywood Production in China**




imports of increasingly expensive wood. This is unlikely to be sustainable in the longer term; it is more than likely that plywood will diminish in importance.

The relative percentages of MDF and particleboard are also different in different regions (Table 2). At first sight this is strange as these materials are used in much the same way around the world. Australasia's predisposition towards MDF is explainable as much is exported and the North American and European/Russian bias towards particleboard is historical and changing. However, Asia, and particularly China's, partiality towards MDF is unusual. Laminate flooring may be part of the explanation but given that the downstream product mix in the longer term is unlikely to be much different from say South America, investment in particleboard would seem to be overdue.

Table 2:
Relative Proportions of MDF and PB

| REGION | MDF% | PB% |
|---|---|---|
| Africa | 10.3 | 89.7 |
| Asia | 63.0 | 37.0 |
| Australasia | 58.3 | 41.7 |
| Europe | 27.9 | 72.1 |
| Middle East | 41.3 | 58.7 |
| North America | 28.2 | 71.8 |
| Russia | 26.1 | 73.9 |
| South America | 42.7 | 57.3 |

## Where will the wood come from?

In North America the paper industry was a big player – diversifying an available resource into other products. With few exceptions, the product was raw boards; it was left to the downstream industry to add value. In Europe the industry originated in areas with forestry traditions and access to a wood resource. The successful companies were those that forward integrated – for example, offering surfaces rather than simply the substrate board. In the rest of the world it was generally the European model that was adopted and access to a forest resource was paramount – plantation wood in South America, Australasia and indigenous forests (and waste rubber wood) in South East Asia. And if future demand is to be met by local production, rather than imports, access to a forest resource will be the key.

## In conclusion

Though there is still scope for moderate substitution growth in Europe and North America (as and when the economy improves), panel demand in regions such as Asia, South America and Russia will continue to grow at a much faster rate. But in Asia, unlike the other regions, there is, as yet, insufficient wood resources to meet likely future demand. Japan, Korea and India, particularly the last two, may see some expansion in production but demand will increasingly be met by imports of panels and/or finished products. And Japanese and Korean companies have already invested in regions with available resources. China is much more uncertain; production capacity keeps increasing even though there is a shortage of indigenous wood. And with costs rising, how long will it be economic for countries to export wood to China only to re-import as products? Especially so given that modern board plants and indeed furniture assembly lines are much less labour intensive than a typical plywood plant. In time there may come a tipping point where low labour costs are insufficient to overcome the high raw material cost. As regards formaldehyde's role; as yet there is no commercially viable alternative but its future in the wood market will increasingly depend on the resin industry's ability to deliver adhesive systems able to meet tighter emission standards.

### The Perstorp group

The association with the board industry goes back a long way; the group manufactured resins and licensed both resin and formaldehyde technology in the very early days of the industry. Laminate flooring was introduced by Perstorp in the 80s – a product that in its many emulations has gone on to consume over 10% of the world's MDF and consume approaching 7% of all formaldehyde used in the wood industry. And much of the formaldehyde used by the wood industry is manufactured using Formox technology – plants and/or catalysts. In fact Formox has supplied fully integrated formaldehyde and resin plants to some of the largest board producers in the world.

BY

*Bob Crichton*
*Formaldehyde Specialist*
*R.S Chrichton & Associates*

# Change at the helm as Marie and Formox move forward

After leading Formox to, and well into, a very expansive period, Marie Grönborg is now moving on to new challenges at Perstorp. Mårten Olausson, who began his career at Perstorp 19 years ago, is taking over the reins and is excited about the opportunity to lead Formox forward.

Marie Grönborg has been with Formox for 18 years, the last five as General Manager. Having performed nearly every leadership role, she is now taking the next step in her career, just a stone's throw away. Since late summer, Marie has been sharing the helm with new General Manager Mårten Olausson. Mårten officially joined Formox on September 1st and has since taken over more and more of Marie's operational responsibilities.

Of her long stint at Formox, Marie says, "It has been a truly enjoyable time for me, working in a challenging but growing environment and working closely with the entire Formox team and our customers, and the business has developed very positively."

## From engineer to GM to new challenges

Marie began her career at Formox in 1994, direct from her studies at Chalmers Technical University and Imperial College. As a newly graduated process engineer, her initial duties were in the field of designing and commissioning formaldehyde plants. She has since held several leadership positions at Formox, including as head of process engineers, catalyst sales, technical support and plant sales, prior to being named General Manager at the beginning of 2008.

Now Marie is taking the experience she has gained during nearly two decades at Formox, to her new position as Region Head Western Europe and Business Unit Manager for Perstorp's Performance Additives (Feed and Food). "I feel like it is now time for me to take on some new challenges, and I am very glad to have the opportunity to be able to do that at Perstorp."

## Pleased about choice of successor

As far as the future of Formox goes, Marie says she is quite confident that the business will continue to develop favorably under the leadership of Mårten Olausson.

"Mårten has a very long and wide-ranging experience working within several areas at Perstorp," says Marie. "His ability to work over a broad scope, in combination with his enthusiasm for his work and for dealing with customers, make him very well suited to take over and drive the business forward."

## Well travelled

Mårten Olausson began working at Perstorp one year earlier than Marie started out at Formox. "I like to joke that I began my career at the resins factory here in Perstorp and after 19 years have moved all of hundred meters down the street," says Mårten with a chuckle.

A closer look at his career, however, shows he is much more travelled than so. Not only has Mårten worked abroad for several years, but he has also gained experience in many departments along the way including production, technology, IT, marketing, sales and supply chain. His latest position prior to coming to Formox was in Warrington, UK, where he served as manager for Perstorp's Business Unit Caprolactones.

## Staying the course

Mårten says that following Formox's record sales in 2011, everyone at the company has plenty to concentrate on both now and in the future.

"With all the orders we received last year a lot of projects are underway and will be coming to fruition over the next couple of years," he says.

"All the same, it is important that we not lose focus on our work with continuous improvements of plants and catalyst, or the ability to meet the growing demand of catalyst. Hence I expect to keep busy in the months ahead, and am really looking forward to taking on these challenges together with the Formox team and to meet as many of our customers as possible."

Mårten Olausson
New General Manager at Formox

**Born**
1967 in Gothenburg, Sweden

**Education**
MSc in Chemical Engineering as well as MBA

**Resides in**
Helsingborg

**Family**
Wife Annelie and three children, Hannes 13, Disa 9, and Siri 8

**Recreation**
Working on the house, spending time with the family, travelling, winetasting and physical exercise such as swimming, working out in the gym and fervently supporting HIF, the home soccer team.

# Pressure vessels – dealing with pressure is Arsopi's specialty

They're perhaps the most impressive structures you'll see at any Formox plant – mammoth-sized tanks towering up to 35 meters above the ground. From the drawing board to production, delivery, installation and startup, these vessels travel a long and carefully executed journey.

Arsopi S.A. in northern Portugal is one of Formox's trusted suppliers. Founded in 1942, the company has been exporting equipment to the chemical and petrochemical sectors for over 50 years, reaching 95 countries across the globe from New Caledonia in the South Pacific, to northern Canada. We asked Luís Valente, Industrial Sales Manager at Arsopi, to share with us how they meet the demanding challenges of designing, manufacturing and testing pressure vessels at their facility in Vale de Cambra:

Mr. Valente: At the start of every project all our departments meet to participate in the verification of the order and to choose a Project Coordinator. From then on, each department will contribute with its own special expertise. The Technical Department performs all necessary calculations according to the code to be used, and produces the blueprints, materials list and welding specifications. Purchasing procures the necessary materials from pre-approved suppliers. Production plans and executes the manufacture according to specifications. And Quality inspects all works from received materials to final tests, and fills in all data books.

How do you secure quality throughout each step of the process?
Mr. Valente: It starts very early, even before we have received the order. Already at the inquiry phase, our Quality Department is asked to verify the feasibility of the requested tests. Most times they will recommend additional or alternative tests for proving and ensuring the intended product quality. Later, during the design phase, they compile an 'Inspection and Examination Plan', or 'ITP', which the client is requested to review and approve, or suggest amendments.

The ITP details all the inspection and test activities to be performed during the various manufacturing stages. And all documents issued for the project are also submitted for approval by a third party entity – Authorized Inspection Agency for ASME vessels, or Notified Body for vessels according to the European Directive 97/23/CE – to ensure conformity to applicable standards, codes, laws or other regulations.

How do you handle the risks involved?
Mr. Valente: We have a thorough process to ensure that risk management recommendations are properly addressed during design, construction and start-up activities. We also make sure that all materials comply with relevant pressure equipment standards and client specifications, and are suitable to the operating conditions, and we identify them with a project code to ensure complete traceability of each part of the vessel to the original raw material.

During fabrication, all welding activities are executed by qualified personnel and according to WPS and PQR developed internally and third party certified. Quality Control staff performs all planned examinations, some witnessed by the client or third party inspectors. Our Non Destructive Examiners are certified according ASNT SNT-TC-1A and EN473, and perform the tests that ensure welds and other activities have been executed following correct procedures and are free from defects that could impair performance. Leak tests with helium are normally performed to ensure tightness, mainly on tubular reactors or heat exchangers to verify the quality of tube to tubesheet welds.

What does final approval involve?
Mr. Valente: At the final stage of fabrication, the vessel is submitted to a resistance test, normally a hydraulic pressure test, to verify that it is strong enough for the purpose it has been designed. This is normally witnessed by the third party entity and usually a representative of the client is also present.

A 'Manufacturer Data Book', or 'MDB', containing all documents related to vessel design and manufacture is compiled and presented to the third party for review. Upon acceptance, the vessel is marked, either ASME U or CE mark, depending on the case. The MDB is part of the documentation supplied to the client.

And your experience with Formox projects?
Mr. Valente: Our long-term collaboration with Formox is right in line with our objective of working closely with the most demanding companies in the world and helping them deliver high quality, safe and reliable equipment to their customers.

Following tubing (17,400 tubes), the tubes are adjusted for welding.

Two Main Reactors (about 56.5 tons each) loaded for transport to Leixões harbor. Final destination: Germany.

# Formox organization **in Perstorp**

**Finance & Admin Team | Project Team | Marketing, Sales & Technical Support Team**
**Technology Team | Catalyst Production Team | Engineering Team**
**Process Engineering Team**

**Finance & Admin Team**
From left:
Lotta Ekedahl
Sandra Karp
Mårten Olausson (General Manager), Mariette Walter
Monica Cronström

Not present:
Jan Lundborg (Manager)


**Project Team**
Back row: Monica Marntell, Helen Lundström, Henrik Berggren, Martin Bengtsson.

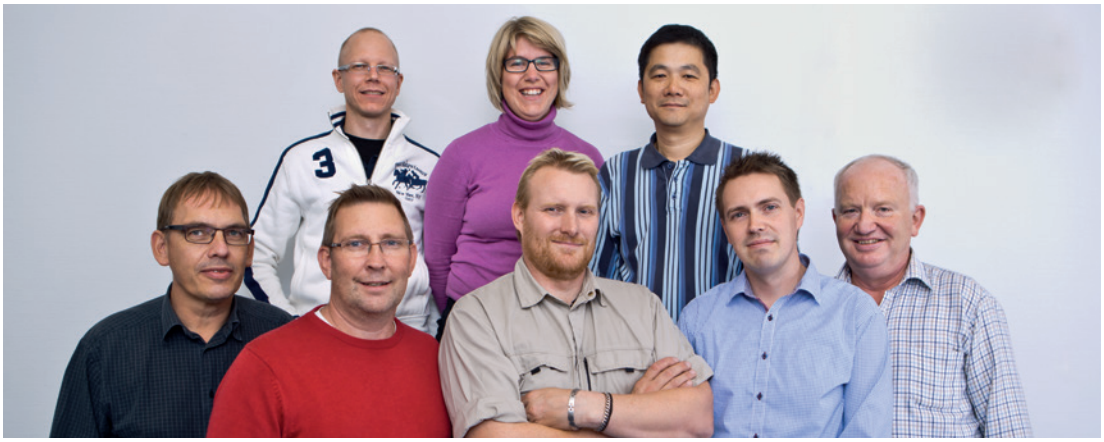
Front row: Gert Svensson, Lars Jennergren, Erland Andersson, Roger Welin, Nilspetter Sandén.

Not present:
Jonas Lindborg (Manager), Karsten Wilken, Maria Yngvesson, Ola Seger, Tommy Johnsson.

**Marketing, Sales & Technical Support Team**
Back row: Lucia Bengtsson, Åsa Hallberg, Lars Andersson, Anne Rundström-Eliasson.

Front row: Lars-Olle Andersson (Manager), Anders Malmborg, Ronnie Ljungbäck, Andreas Magnusson, Philippe Thevenin.

Not present:
Fredrik Rietz, Paul Walter.



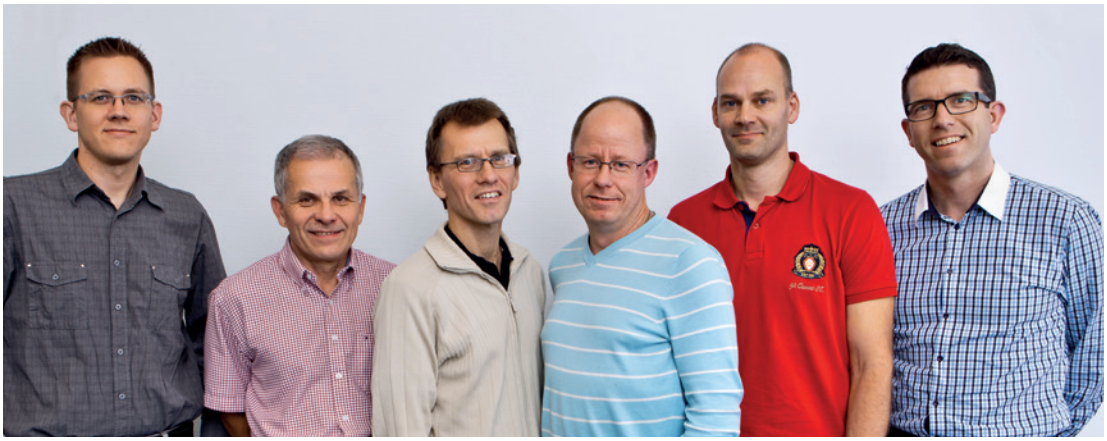
**Technology Team**
Back row: Johan Holmberg, Camilla Eklund, Kim Wong

Front row: Ola Erlandsson (Manager), Lars Schuler, Peter Haack, Robert Häggblad, Bengt-Arne Hagsten.

Not present:
Neil Cruise, Hillevi Arvidsson.

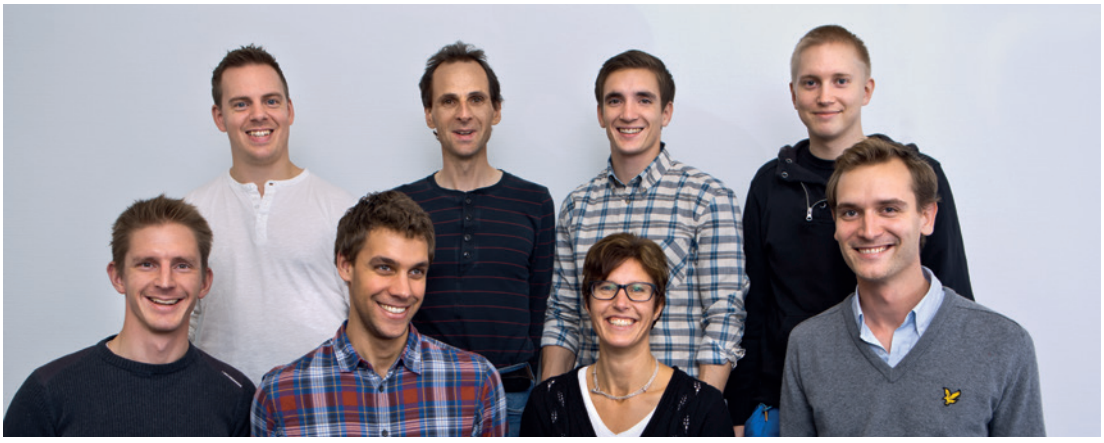
**Catalyst Production Team**
From left: Eva Lindgren (Manager), Peter Harrysson, Anette Björk.

Not present:
Michael Svensson, Peter Nemeth and the plant staff.



**Engineering Team**
From left: Christian Luckmann, Ingvar Linderberth, Sten Schmidt, Ronny Lindsjö, Håkan Svärd, Stefan Wedman (Manager).

Not present:
Christoffer Olsson, Lars Hansen, Lorentz Rensfelt, Mats Kellgren, Ronny Lindström.



**Process Engineering Team**
Back row: Christian Andersson, Mikael Wernersson, Mikael Edmundsson, Kai Jauhiainen.

Front row: Henrik Hansson, Viktor Björk, Anna Wemby Björk (Manager), Tomas Nelander.

Not present:
Daniella Cheng, Eva-Lena Ekblad, Martina Skantz, Simon Smrtnik.


# Formaldehyde exposure

Formaldehyde is quite a hazardous substance and therefore one should try to avoid being exposed to it. There are also regulations regarding exposure limits, which are usually divided in two groups: one long term exposure limit and one short term, or peak level, exposure limit. The long term limit is calculated as a weekly average and is therefore lower than the peak level. The peak level is the maximum exposure limit, which should not be exceeded even for a short time period.

In Sweden, these exposure limits have recently been lowered. The weekly average exposure limit has been lowered from 0.5 to 0.3 ppm, and the peak level exposure limit has been lowered from 1.0 to 0.5 ppm. The trends for exposure limits in general, no matter the location, are ever decreasing. So, the exposure limits for formaldehyde will likely be decreased elsewhere also, if they have not been already.

The detection limit for smelling or sensing formaldehyde is, for most people, somewhere between 0.2 and 1 ppm. That means that whenever formaldehyde can be smelled, the levels are probably too high.

## Personal staff and raising awareness

To protect personnel at the site in Perstorp, Perstorp is planning to purchase personal gas detectors for people entering areas where there is a risk for exposure to formaldehyde. Gas detectors selective towards formaldehyde are difficult to find. In a formaldehyde plant, however, there are generally no other chemicals, so a gas detector that detects organic compounds is sufficient.

A personal gas detector that emits an alarm when the levels are exceeded will guarantee that high formaldehyde levels are noted. Once the levels have been noted, appropriate actions can be taken. That could mean sealing leakages, wearing protective equipment or changing the routines for certain tasks. The alarms will be much more difficult to discard than an odor that can be perceived very differently depending on the person. Furthermore, the gas detectors will hopefully help to raise awareness of the potential dangers involved when working with chemicals.

## Multi-purpose gas detector

The gas detector model being considered for site Perstorp is the Dräger X-am 5000. It can measure up to four different gases at the same time. That means it can measure oxygen, carbon monoxide and formaldehyde simultaneously. This makes the detector very versatile since it can also be used for checking oxygen levels when entering confined spaces such as the reactor or absorption towers. The same type of analyzer is also used by Formox commissioning teams during all commissioning.

If you are uncertain about any safety aspects regarding formaldehyde you can always look in the MSDS. There you can find information regarding levels of exposure, actions in case of exposure or accidentals release, and also tips regarding storage and handling.

BY

*Viktor Björk*
*Process Engineer*
*Formox AB*

# New cause of deflagration found!

A deflagration in a formaldehyde plant can occur when the oxygen concentration is above 13 vol%, the methanol inlet concentration is above 6.5 vol%, and there is a spark. Experience has now also shown that an undetected fire inside the system can cause a deflagration even outside these limits.

Formox plants are designed to immediately shut down in case of a major methanol or formaldehyde fire based on temperature measurements. If the plant is operating outside normal conditions, a small local fire can occur, caused by contaminants in the reactor or the vaporizer.

Formox has earlier experienced deflagrations caused by HTF (Heat Transfer Fluid) fire in the reactor due to tube leakage. We have also seen deflagrations caused by fire in the pall rings placed in the top of the vaporizer. In these cases, fires were caused by impurities entering with the methanol or from a leaking prevaporizer.

## Background and investigation

During start-up of a newly commissioned Formox plant, we experienced yet another cause for a deflagration - the presence of a fire not caused by the above examples!

Formox personnel were on site and investigations started directly after the incident. Since the oxygen level was below 13 vol% and the methanol inlet concentration was below 6.5 vol%, the process conditions were outside the deflagration area.

The plant was cooled down in order to make an ocular inspection of the reactor and the vaporizer. Some wooden pieces were found in the bottom of the reactor. These were most likely left in the reactor following the loading of the catalyst, and they may even have been inside the pipe between the reactor and the vaporizer.

So how could these cause a deflagration? The explanation is that the wood pieces left in the bottom of the reactor began to smolder due to the heat in the system and the air flow from the blowers (wood may start to smolder already at about 200 °C). This combined with a slightly higher oxygen concentration during a short period of time started the deflagration.

## Protection and learnings

All fires in the plant should be avoided, which is why a Formox plant has temperature transmitters to detect major fires. The temperature transmitters are connected to the blower trip (in older designs this is called the SS-A interlock) that, when activated, will shut off the recirculation and pressurization blowers. When the blowers are shut off, the methanol feed will automatically also shut off. When no oxygen is fed to the system, the fire will stop.

Burnt piece of wooden pieces in the bottom of the reactor found after the deflagration.

Nonetheless, it is still critical that the system is clean prior to start-up regarding both the reactor and the pall rings in the vaporizer. All tube leaks should be fixed as soon as they are found.

Therefore, we once again urgently appeal to customers to do a careful check of the reactor after reloading. Even a small piece of wood left in the reactor has now been proven to be able to cause a deflagration, with down time and replacement of rupture discs as consequences.

BY

*Anna Wemby Björk*
*Manager Process Engineers*
*Formox AB*

# Mo update

The price of molybdenum (Mo) has been very stable since the previous edition of informally speaking. At the end of last year, the price hovered around 14 USD/lb and later peaked at just below 15 towards the end of February. Since then the price has slowly but gradually decreased, dropping below 13 in July and 12 in August, and then remaining around 11-12 until early October. As reported in the previous edition, various analysts expected the price to stay at this level, or within 12-17 USD/lb, for quite a long time now, and this has not changed. It is believed that the present level of about 12 USD/lb will be a baseline level, since this is the cost estimated for molybdenum mining in only molybdenum mined mines in China.

Of course sudden increases in demand due to market changes (incentives to buy new cars, or infrastructure projects such as in the previous crisis in 2008-2009) or import-export restrictions could push the price over the 20 USD/lb level. A new usage for molybdenum could also lead to a change in demand. One new area of usage was recently discovered in the electronics area - making ultra-thin electronic components. But this is still in the research phase and it should take a few years before being commercialized - if ever.

The majority, or some 80-85% (depending on the source) of the molybdenum mined and produced each year, is used in steel and alloy production. Usage in chemicals (mainly lubricants and paints, but also e.g. catalysts for the oil and gas industry) accounts for the remaining ~15%. The molybdenum used to produce our catalyst represents a very small part of this chemicals usage - but it is a big deal to us of course!

Regardless of possible market changes due to new usages or government driven incentive measures, you can rely on Formox to maintain reasonably stable net prices thanks to your efforts to return spent catalyst, and also to our efficient catalyst recycling system!

BY

*Ronnie Ljungbäck*
*Product Manager Catalysts*
*Formox AB*

# Methanol Supply and Demand

The summer of 2012 can be thought of as a period where methanol markets kept their heads above water despite a gloomy economic and geopolitical outlook. As the Eurozone and its currency struggle through the continuation of unresolved debt issues in that region, the China engine decelerates, and Iranian sanctions continue to impact not only methanol supply, but geopolitical stability, there is still much to be of concern. Yet, despite all of this near term concern, global methanol markets remain poised for continued annual of growth over the next five years, led by China, a country which continues to value methanol for energy applications.

This assertion comes after completion of the latest quarterly update of the MMSA global supply and demand balances and price forecast, which are available to MMSA clients at www.methanolmsa.com utilizing their login credentials (referred to as the "4Q12 update"). The chart below highlights the latest outlook for global supply and demand over the study forecast period.

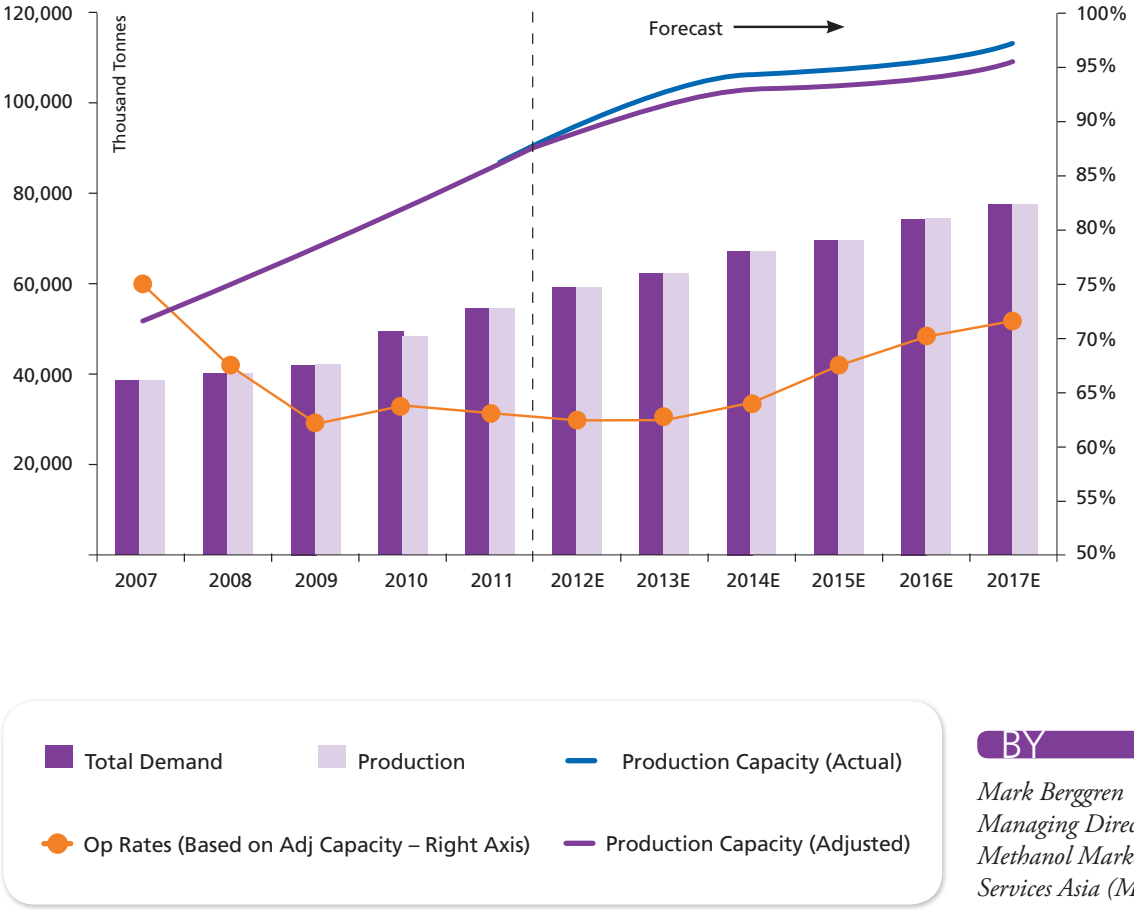
Global methanol demand is forecast at 59.4 million metric tons for 2012. By 2017, this estimate climbs to 78.1 million metric tons, an additional 18.7 million metric tons of methanol demand, with Asia providing the engine for this growth. This growth will issue mostly from increased methanol to olefins (MTO) and methanol-gasoline blend activity in China, where economics of each application are expected to remain favorable, and application is less hindered than in developed economies. Additionally, strong demand growth in MTBE in China and elsewhere in Asia continues, as that region of the world takes a different environmental approach than the United States.

It remains clear that, despite a "cooling" economy, methanol use in energy substitution continues to accelerate in China.

While the storm in the industry has been rough, calmer waters have been reached, and the methanol markets continue to stay above water.

Thoughts, comments, or criticisms on this article can be sent to **services@methanolmsa.com**

## Methanol Supply and Demand – World 4Q12 update




BY

*Mark Berggren*
*Managing Director*
*Methanol Market*
*Services Asia (MMSA)*

# Formox "Innovative Energy Use Award" Winner!

Formox constantly focus on energy saving solutions. The implementation of the turbocharger concept in formaldehyde plants has resulted in winning the "Innovative Energy Use Award" announced by the ChemInnovations Advisory Committee and the Chemical Engineering Editors. There were eight award categories in total, including "Best Plant Improvement Award", "Early Adopter Award" and "Unit Operation Award", and companies such as BASF, Dow and UOP were some of the other winners. The winning finalists were announced at the Awards Banquet at the Marriot Convention Center in New Orleans on November 13th 2012, where Formox was represented by Ola Erlandsson and Andreas Magnusson.

Formox began developing the turbocharger concept in 2005. A patent application was submitted in 2006 and approved in 2008. Formox has been working closely with MAN Diesel & Turbo since 2007 for implementing a "real" turbocharger in our plant range. The first plant was successfully started in 2011 at Egger's UFC plant in Radauti, Romania.

For more information about the turbocharger concept, please see the 2012 Spring/Summer issue of informally speaking.


# Customer Center
## – a gold mine for information seekers

Did you know there is a section on our website www.formox.com called the Formox Customer Center? We normally refer to it as simply 'Customer Center', or 'CC'. If you don't know about it, I recommend that you check it out as soon as you have finished reading this issue of Informally Speaking! Customer Center is a tool we have created and provide to all our catalyst customers. Regardless of whether you operate a Formox plant or another oxide technology plant, if you are using our KH catalyst you can get access to the tool. Information specific to Formox plants, however, is only accessible for those operating a plant of our design.

### What is it?

First and foremost, the Customer Center serves as an information bank open 24/7 to catalyst customers. We live in a globalized world where Formox catalysts are in use on all continents where there are formaldehyde plants in operation.

Questions and information requests can come at any time from China, USA, Germany, Russia, Brazil or New Zealand, to name just a few. Of course, person to person interaction is normally more comprehensive, but as we are not physically present on all continents there are times when it is not possible to reach us (we also have to sleep now and then!).

If you are in a hurry, perhaps due to an emergency shut down in the middle of the night, and need technical information or recommendations regarding catalyst or plant operation, or maybe some advice about maintenance & troubleshooting, you can find a lot of information by logging into the Customer Center. I like to describe it as a gold mine for information seekers.

### … and more

Here you can also find a lot of information on raw materials related to the formaldehyde process. You can easily search for such information in the database at your own convenience and when you have the time. You can also find information and methods for product and raw material analysis, such as methanol concentration in the formaldehyde, formaldehyde content in gas samples and many more.

### Digging in the archives

In addition, your purchase statistics for KH- or PPt/PPd-catalyst can be found in the Customer Center. We started this service already 2001, so if you have used our catalyst for some time and have many reactors, the list can be rather long. There is also a list showing the status of the spent catalyst and ceramic rings you have returned to Formox. Here you see the same information you get in your spent reports, but also have a good overview for all your spent transactions.

### How to get started

It's easy to get started. Just contact your Formox representative and you will receive all the information you need to apply for your personal account and password. You can also read about the procedure at www.formox.com

### What's next?

This question is one that I would like to ask to you. That is, what would you like to see in the Customer Center in the future? We realize the potential for this tool is huge, which is why we would like to develop it further. Modern IT enables functionality that was not possible when we first released the tool many years ago. So, if you have any good ideas, please let us know. As the Customer Center exists for your benefit, we believe you have a lot to contribute to make it even more valuable to you. Discuss with your Formox representative or contact me directly.

BY

*Lars Andersson*
*Plant & Catalyst Sales Manager*
*Formox AB*

# Common problems
## in a Formox plant – and how to avoid them

Formox has a large number of customers all over the world to which we are constantly providing support for different catalyst and plant issues. Feedback related to more severe problems with the plant is recorded in a database, and the purpose of this article is to highlight two of the most common problems. Recommendations are also given on how to avoid these problems and, consequently, to minimize the amount of unplanned stops and production losses in your plant.

### HTF condenser - tube rupture

A Formox plant could be in operation for many years with insufficient treated boiler feed water (BFW) without any noticeable problems. However, when problems do occur, such as a tube rupture in the HTF condenser, the damage could be too severe to salvage the tube bundle in the vessel and the effects could cause large downtime in the plant.

The HTF condenser produces steam from the BFW on the shell side by condensing the hot HTF vapor on the tube side. A tube rupture in the HTF condenser will lead to BFW entering the tube side of condenser. A minor tube rupture can often be spotted by excessive amounts of vapor coming from the HTF tank vent or a slightly higher temperature in the top dome of the condenser.

Poor welding could, of course, be the reason for the problem, but also the quality of the BFW. If the make-up water does not meet the quality standard set by the steam system, there may be problems with scaling and corrosion in the condenser's tube bundle on the shell side.

The usage of correct demineralized water with low quantities of ionized mineral salts is an important factor in the BFW treatment. If the levels are too high, the amount of blow-down needs to be increased. If not, there will be an accumulation of non-volatile salts and minerals, which can cause deposits and scaling inside the vessel.

If the pH of the BFW is too low, problems with corrosion can occur, which could also lead to tube rupture. The pH should be controlled by dosing alkaline agents such as sodium hydroxide into to the water. Furthermore, dissolved gases in the boiler feed water, especially $O_2$ and $CO_2$, could also cause corrosion. Make sure that the water is properly deaerated or use oxygen scavengers to remove gases.

To avoid tube rupture caused by bad BFW quality:

- Add make-up water according to specification, sample and adjust blow-down accordingly
- Inspect vessel and clean the tube bundle on shell side if necessary
- Contact your local BFW specialist for further information

A tube from a condenser with corrosion and scaling problems. A small hole can be spotted in the center of the picture.

### Leaking methanol valve

Some of our customers experience problems with leakage in the methanol control valve. This is a serious problem that, in a worst-case scenario, could have devastating consequences if not handled in the correct way.

First of all we have to stress the fact that the purpose of the methanol control valve is to regulate the amount of methanol that is introduced to the process gas system. A control valve should never be trusted as a shut off valve, especially after some time of operation when the disc in the valve gets worn out.

If the valve leaks during shut down, methanol will accumulate at a low point in the process gas system that, if not drained before start up, creates a risk of deflagration.

To avoid the problems a leaking methanol valve can cause:

- Always close a manual isolation valve in the methanol line during shut down
- Before start up, open the low point drain in the process gas pipe where methanol could be accumulated
- Regularly test the control and shut off valve function with water during shut down to confirm proper tightness

If you experience these types of issues or any other problems in your plant, please do not hesitate to contact your Formox representative for further assistance.

BY

*Tomas Nelander*
*Process Engineer*
*Formox AB*

# Perceived low yield?

The formaldehyde yield is one of the most important parameters when it comes to calculating the economical performance of the plant. You will always want the yield to be high, but it is important to remember that there are things that can make it appear lower than what it actually is.

It is always recommended to keep track of the yield throughout the entire lifetime of the catalyst. This makes it possible to act on slipping performance and to maintain economical production.

The yield is typically calculated from the mass flows of methanol and formaldehyde in the plant.

$$\text{Yield} = \frac{FA * FAconc * 32}{MeOH * 30}$$

FA = Formaldehyde flow, kg/h
MeOH = Methanol flow, kg/h
FAconc = formaldehyde concentration, %
32 = Molecular weight methanol, g/mol
30 = Molecular weight Formaldehyde, g/mol
A typical example from a Formox formaldehyde plant could be:

$$\text{Yield} = \frac{5640 * 37.0 * 32}{2400 * 30} = 92.7\ \%$$

## Instrument accuracy

The yield calculation is based on the instrument readings. All instruments have a built-in accuracy and the better the instrument, the lower the fault will be. Formox generally provides coriolis meters for the mass flows. This type has a very high accuracy and is easy to use. The lab analysis of the formaldehyde concentration also has an inherent accuracy. We can calculate the effect on the perceived yield if we assume the same operating conditions as in the example above and a fault of 0.10%.

$$\text{Perceived yield} = \frac{0.999 * 5640 * 0.999 * 37.0 * 32}{1.001 * 2400 * 30} = 92.4\ \%$$

This means that the plant can operate with a good yield of 92.7% and the instruments will only show us 92.4%. In this example, all the instruments are working well and we are unlucky only in the fact that all faults are working in the same direction. The effect can, of course, be much larger if other types of instruments or analysis are used.

## Instrument misreading

The instruments can also give wrong readings if they are not well maintained. The coriolis flow meters are generally very robust and reliable. It is typically only the zeroing of the instrument that can go wrong. A small fault in the zero value can, however, have a large effect. A zero offset of only 20 kg/h on one of the flow meters will have a large impact on the perceived yield.

$$\text{Perceived yield} = \frac{5640 * 37.0 * 32}{(2400+20) * 30} = 91.9\ \%$$

The plant is still operating with 92.7% yield and is still producing the same amount of formaldehyde, but the perceived yield is only 91.9% and the methanol flow meter will show 2420 kg/h.

## Methanol concentration

A Formox plant can handle some water in the methanol without affecting the performance of the reactor. It is very important to know the methanol concentration if we want to calculate the correct yield. A water content of 1.5 % will have a dramatic effect on the perceived yield.

$$\text{Perceived yield} = \frac{5640 * 37.0 * 32}{(2400/0.985) * 30} = 91.3\ \%$$

The extra water will show itself as a larger methanol flow if the plant is operated at the same capacity and with the 92.7% real yield.

## Conclusion

The perceived yield can be lower compared with the actual yield due to a number of reasons. It is generally very difficult to prove the exact yield. Many times it is better to calculate the yield and use the numbers to detect changes.

BY

*Ola Erlandsson*
*Manager Technology*
*Formox AB*

# Formox launches
## Performance Package

In the spring/summer 2009 issue of informally speaking we wrote about how the DCS (distributed control system) can be used to monitor and control the process. Now Formox is launching Performance Package, a new tool to be included with the DCS for new plants, that can also easily be installed in older plants upon customer request.

Plant operation is governed by several process constraints such as production volume, product quality, operating economy, etc. These can usually be fulfilled by altering the various process parameters operating the plant in several ways. Hence, it is of great interest to find the most optimal process conditions for minimizing DVC (direct variable costs) and operating the plant as efficiently as possible.

### Monitoring and control of plant performance

The Performance Package enables process management to predict at an early stage when plant operation will become less effective and when to think about reloading the reactor. The actual cost for a plant in operation is continuously estimated and displayed on screen using set prices for methanol and electrical power, taking into consideration the specific value of steam. It also facilitates troubleshooting, as process anomalies can be tracked more easily to help identify the root cause of the process problem. By viewing changes in Performance Package parameters on screen as they happen, plant operators can take immediate and corrective actions to optimize plant performance.

The DCS parameters displayed on screen that facilitate direct and fast process control are yield, power consumption, steam production, specific production, loss of carbon monoxide, loss of methanol, loss of DME and DVC. Hence, plant operation can be optimized in terms of product quality, energy use and costs, enabling long-term savings and high sustainability.

For best results, process management needs to actively work with the Performance Package as part of their daily routine. Laboratory data regarding concentration of formaldehyde and methanol in product as well as the humidity of air, are parameters that need to be regularly updated to correct inline measurements. This will ensure reliable and accurate process data.

### Large savings even for existing plants

DCS systems in existing plants can be upgraded with the Performance Package, which is being launched for DCS software Delta V versions 9.3 or later. If you are using other software, our instrumentation department can assist with programming the DCS to implement Performance Package algorithms on the specific system being used.

In older plants, some additional instrumentation is needed to monitor power consumption. A power meter must be installed on the motor control cabinet to measure power output to pumps and heaters. On the frequency drives of blowers, the current output has to be converted into power output. This is easily done!

Installing the Performance Package represents great potential for increasing savings. So please do not hesitate to ask your Formox representative for further advice and assistance. We will gladly help you to upgrade your DCS to include the Performance Package!

BY

*Simon Smrtnik*
*Process Engineer*
*Formox AB*

# Contaminated methanol

Whether or not to use methanol streams that contain contaminants is a question that many Formox customers face. On the one hand, it might significantly cut methanol costs. On the other hand, it could have a negative impact on production, the product and the catalyst. Formox's advice on this matter is to consult with us, and we shall do our best to help you!

## What to consider

Contaminated methanol-rich streams typically originate in up- and downstream processes. Examples are upstream crude methanol and downstream production of Polyoxymethylene (POM), Butanediol (BDO) and Methyl Methacrylate (MMA). Contaminated methanol might also be offered as a market product to producers of formaldehyde. Regardless of how and where this occurs, however, the important thing is to know what is present in these streams and how will it affect the production of formaldehyde and downstream processes. Although the Formox process, in comparison with the alternative, is a robust process for producing formaldehyde, several potential risks must nonetheless be properly considered before using contaminated methanol:

- Main reactor considerations (impact on catalyst, degree of conversion, formation of by-products, reaction rates)
- Absorber considerations (foam formation, impact on the absorption of formaldehyde and methanol)
- ECS considerations (impact on catalyst, degree of conversion, temperature increase over the bed)
- Product considerations (product contamination)
- EHS considerations

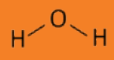
## Improved process economy

One might therefore ask, 'If the contaminated methanol streams may cause problems, why bother to use them?' One very good reason is process economics. Besides the fact that cheaper raw material can be utilized, it may also be possible to produce considerably more formaldehyde per methanol unit added, as several of the compounds commonly found in these streams strongly contribute to the production of formaldehyde (see info box to the left). Thus, not only may it be possible to use cheaper methanol, but also less. As methanol makes up more than 90% of the production costs for producing formaldehyde, using contaminated methanol consequently makes a lot of sense from an economical point of view.

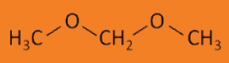
## Formox can help

The info box to the left lists some of the components frequently found in contaminated methanol. In response to requests from the market, Formox has performed studies on these and many other components. Based on lab- and pilot scale testing, Formox can design tailor made experiments in order to address the issues listed above. So, if you have any requests regarding this matter, please do not hesitate to contact your Formox representative to discuss how we can help.

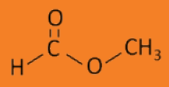
## Compounds frequently seen in contaminated methanol

**Water** 

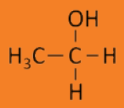
Water is definitely the most common "contaminant" in recovered methanol and less purified methanol. Since water has a negative impact on the catalyst activity it is important to know the concentration, or at least be able to predict it rather accurately, when designing the loading plan. When calculating the loading plan, Formox normally only takes into account the water content derived from the recycled gas and the fresh air. If you plan to operate your plant with a water-rich methanol feed, please inform your Formox representative and you will receive a catalyst loading plan designed for, and better suited to, your conditions.

**Methylal** 

Methylal is a well-known reaction intermediate in the Formox process, occurring in the upper part of the reactor tubes where the conversion of methanol is low. Here, the majority of the Methylal will end up as formaldehyde. However, since the early reaction sequences of the overall reaction mechanism are endothermic, it is necessary to make adjustments in the loading plan if the concentration of methylal becomes significant. In order to compensate for the cooling effect, there will be a need to adjust the blending of the mix or to change catalyst in the uppermost part of the reactor.

**Methyl formate** 

Methyl formate is a by-product of the Formox process. Formation is favored by a high concentration of methanol, and tends to decompose rather easily. Consequently, concentration is rather low at the reactor outlet. From this two-carbon compound a maximum of one formaldehyde molecule is expected to be formed. The rest will end up as carbon monoxide resulting in a higher concentration of CO entering the ECS, which will affect the temperature increase over the catalytic bed.

**Ethanol** 

In the Formox process ethanol can be oxidized to acetaldehyde over the iron molybdate-based catalyst. Besides this component, the highly toxic three-carbon aldehyde, acrolein, can also be formed when acetaldehyde reacts with formaldehyde. As a result, Formox recommends all customers to avoid having significant concentrations of ethanol in the feedstock. For further details, please contact your Formox representative.

**Benzene** 

Benzene will pass through the main reactor without being converted at all. Due to the high vapor pressure of benzene, only trace amounts will be absorbed in the absorption tower. Consequently, all benzene feed to the reactor will enter the ECS where it will be converted.

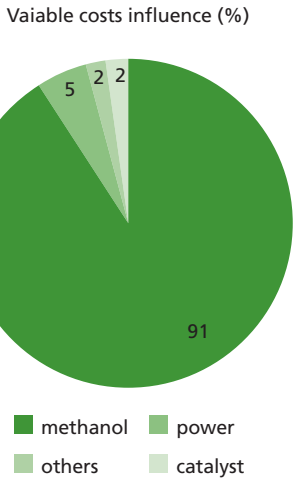
BY

*Robert Häggblad*
*R & D Associate*
*Formox AB*

# Gas Chromatograph
## – why you need it to gain control of your plant

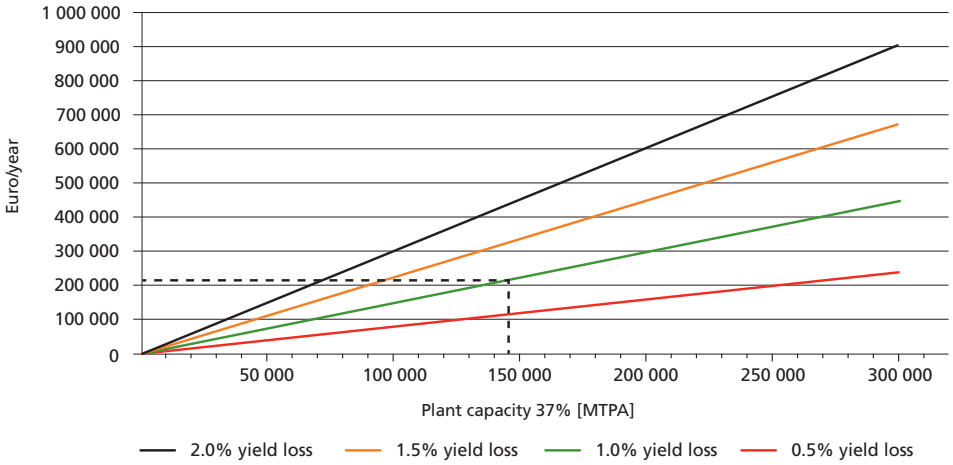
One of Formox's most important missions toward our customers, besides providing catalysts and plants for formaldehyde production, is to provide good technical support. This support should help you as a customer to get the best performance from your plant. The plant must, of course, be able to produce formaldehyde in a safe and reliable way, but at the same time at the lowest possible cost.

The most important factor to consider when studying the cost for producing formaldehyde is, by far, the methanol. The raw materials that mainly contribute to your direct variable cost (DVC) are methanol, the power and the catalyst. The methanol alone contributes to about 91% of the DVC, thus making it extremely important to maintain good control over your methanol use.




### The cost of 1%

To put this in another perspective, we can take a look at how much money a yield loss of 1%, for example, will correspond to at a certain production capacity. If we take a Formox FS3 plant as an example, we know the yearly production capacity is about 145,000 MTPA 37% formaldehyde. The plant manager maintains good control over the plant and the plant yield is measured regularly. Process adjustments are based on the information the yield measurements are giving. So everything is fine then. Or is it?
Unfortunately it turns out that the obtained yield is incorrect. Either it's not based on reliable data, or perhaps some important data is missing. In this particular case the correct yield turns out to be 1% lower than what a correctly optimized plant can perform. Now take a look at the chart in the next column. It




turns out that this unoptimized plant condition, which results in an unnecessary, 1% yield loss, costs more than 200,000 EUR per year. That is almost 1.5 EUR per ton of produced formaldehyde. I'm sure we can agree that there must be many better places we can put this money than in the pockets of the methanol supplier.

### How can you obtain your correct yield?

So clearly we must keep methanol consumption under control, and we can do that by obtaining the correct yield. In other words, we must know how much of the methanol that we put into the plant is coming out as formaldehyde.

In principle, to calculate this yield we have a number of parameters we must make known. These are the carbon monoxide loss ($CO_{loss}$), the dimethyl ether loss ($DME_{loss}$) and the methanol loss ($MeOH_{loss}$). The methanol loss consists of two parts; one part is the loss we get in the product and the other loss is in the gas going to the ECS (incinerator) or stack (if there is no ECS installed). When we know the losses, we can calculate the yield according to this formula:

Yield HCHO = 100 – $CO_{loss}$ – $DME_{loss}$ - $MeOH_{loss}$, prod. - $MeOH_{loss}$, ECS

I'm sure many of you are now thinking, 'Well this is nothing new, we have been doing this for a long time and we know our yield.'
If you always get consistent, repeatable and realistic values you are probably right. But is this really the case …. honestly?

Let us begin with the product, the formaldehyde. You get the produced amount from the flow meter together with the product concentration. The only way to get a reliable flow measurement is to use a coriolis type mass flow meter. The concentration you get from titration. It's important to understand that measurements and analysis are not always exact and true. There is always a degree of uncertainty in the numbers achieved, and it is good practice to estimate the deviation.
To minimize these errors it is better to derive the formaldehyde from the gas measurements you perform (by GC or InfraRed, IR). If you have the losses of MeOH, CO and DME, you will get the formaldehyde indirectly.

The methanol in the product must be analyzed using a GC to achieve sufficient accuracy. Analysis by mass density methods should only be considered as a quick indicative method, giving a relative value.

### How gas analysis helps

Then we have the process gas. From the gas analysis we get the CO and DME losses. The DME loss is necessary for calculating the yield correctly, but usually is less important for optimizing the plant's performance. Thus, using a GC, the process gas should normally be sampled after the recycle blowers since there is a low concentration of formaldehyde and also relatively small amounts of condensable gases, e.g. water. An alternative for getting the $CO_{loss}$ is to use a dedicated CO meter. To take the sample after the oxygen analyzers is then even better, since the gas is then not only clean, but also dry. It can be a portable one, or an on-line instrument like the one installed as standard in our latest plant range.

If your plant has twin, parallel or dual reactors, a process gas sample must also be taken and analyzed after each reactor to obtain the individual reactor yield. It should be noted that the process gas in such cases contains a consider-

ably high concentration of formaldehyde and water, making the sampling more difficult.

So, now you have the values you need to be able to calculate the yield. Perhaps the data do not match up and you can't get a realistic answer. Well in that case, it is time to search for errors. Calibration of flow meters and instruments is, of course, essential, but also check your working methods carefully.
It can be a good idea to send samples to another laboratory to countercheck your own values. Challenge the data; do not take a value for a fact until you've gotten it validated.

### Increased technical support

By now, everyone reading this article knows that it is not always easy to gain control and to get values you can trust and use for optimizing your plant. We know this, and as always we try to help you as much as we can.
So, to bring you even better technical support, especially in this very important matter (remember the 200,000 EUR savings in the example above!) we can now help you sort out your plant performance by sending a performance audit team to your plant. Perhaps you are unable to perform these measurements yourselves, or you feel it would be a good idea to let someone else question your own measurements, analysis, data and calculations. Either way, we are now committed to offering this service to our customers. If you are interested and would like assistance to sort out your optimization procedures, please contact your Formox representative for more details including price information.

## Conclusions

**Optimization requires information that is:**
- Complete
- Clear
- Correct

**Type of analysis needed:**
- Flow analysis with good accuracy
- Product analysis
- Gas analysis

Errors can be, and usually are, expensive. Errors can, and must be, identified and corrected.

BY

*Lars Andersson*
*Plant & Catalyst Sales Manager*
*Formox AB*

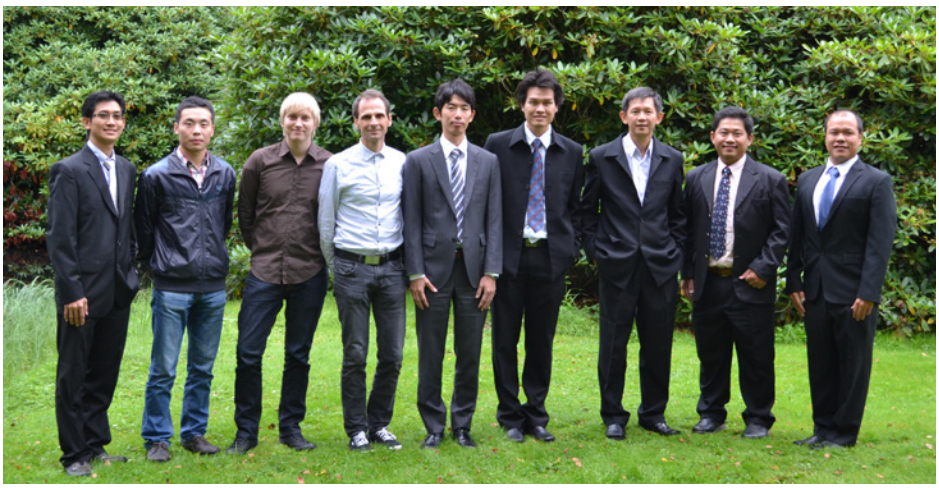
# Projects & start-ups

### New projects

- We have signed an agreement for a new FT3 plant to be supplied to a client in China.
- An agreement for a new FT3 plant has been signed with Yantai Wanhua Polyurethane Co. Ltd., China.
- An agreement for an FT3 plant to be located in Asia has been signed, and the engineering phase has started.

### Ongoing projects

- The FS2 UFC project for Campact UK (a subsidiary of Egger) has begun the engineering phase.
- The FS3 plant for ISP Marl GmbH (an affiliate of Ashland Inc.), Germany, is in the engineering phase.
- The project involving a new FS1 UFC plant to a client in the Middle East is in the engineering phase.
- The FT2 plant to be supplied in the Middle East is near the end of the engineering phase.
- The engineering phase of the new UFC plant being supplied to an existing customer in the Middle East is complete.
- Works on two Formox plants (FS3 + FT3) for Polyplastics Asia Pacific Sdn. Bhd., Malaysia, is in the shipping phase.
- The second FS3 plant for Henan Coal & Chemical Industry Fine-Chemical Co., Ltd., Hebi, China, is in the shipping phase.



Customers on training in Perstorp

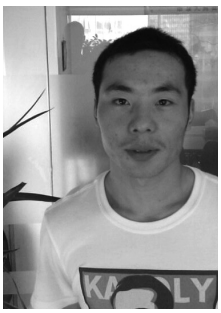
- The project involving two FT3 plants for Chongqing Changfeng Chemical Industry Co., Ltd, Chongqing, China, is in the shipping phase.
- The FT3 plant for Shaanxi BDO Chemical Industry Co., Ltd., China, is in the construction phase. This will be their second Formox plant.
- The project involving an FS3 plant to be located in Asia, is in the construction phase.
- Works on the FS3 plant for Tangshan Zhonghao Chemical Co.,Ltd., China, is in the construction phase.

### Start-ups

- The expansion involving a second reactor line in an FT3 for Ningbo Wanhua Polyurethanes Co., Ltd, China, was successfully started in July. This is their second FT3 plant at this site.
- The project involving an FT3 plant for Xinjiang Markor Chemical Industry Co., Ltd. in Korla, China, was successfully started in November. This is their second Formox plant at this site.

# new...

**Anette Björk**
Operations Manager
catalyst plant



**Dong Pengwi**
**Technical Support Engineer, (Beijing office)**

**Chai Songyu**
**Junior Adm, (Beijing office)**

**Mikael Wernersson**
**Process Engineer**

**Henrik Berggren**
Project Manager

**Martin Bengtsson**
Project Manager

**Roger Welin**
Supervisor catalyst plant

**Mårten Olausson**
General Manager

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## Seasonal Greetings

All of us at Formox take this opportunity to wish all of you customers, suppliers and readers of informally speaking a joyful holiday season and a peaceful and successful 2013.

We continue our tradition of a donation to The Swedish chapter of "Hand in Hand", whose objective is "to eliminate poverty through enterprise creation and an integrated development approach". Read more on their web site handinhand.nu.

A formaldehyde magazine from Formox

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

Editor: Monica Cronström
Contributing writer: Charles Hodgdon, Bob Crichton
Publisher: Mårten Olausson
Layout: Anna Carlsson
Printing: AM-tryck, Hässleholm, Sweden
Publication: 2 times per year
Cover image: MAN Turbocharger

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